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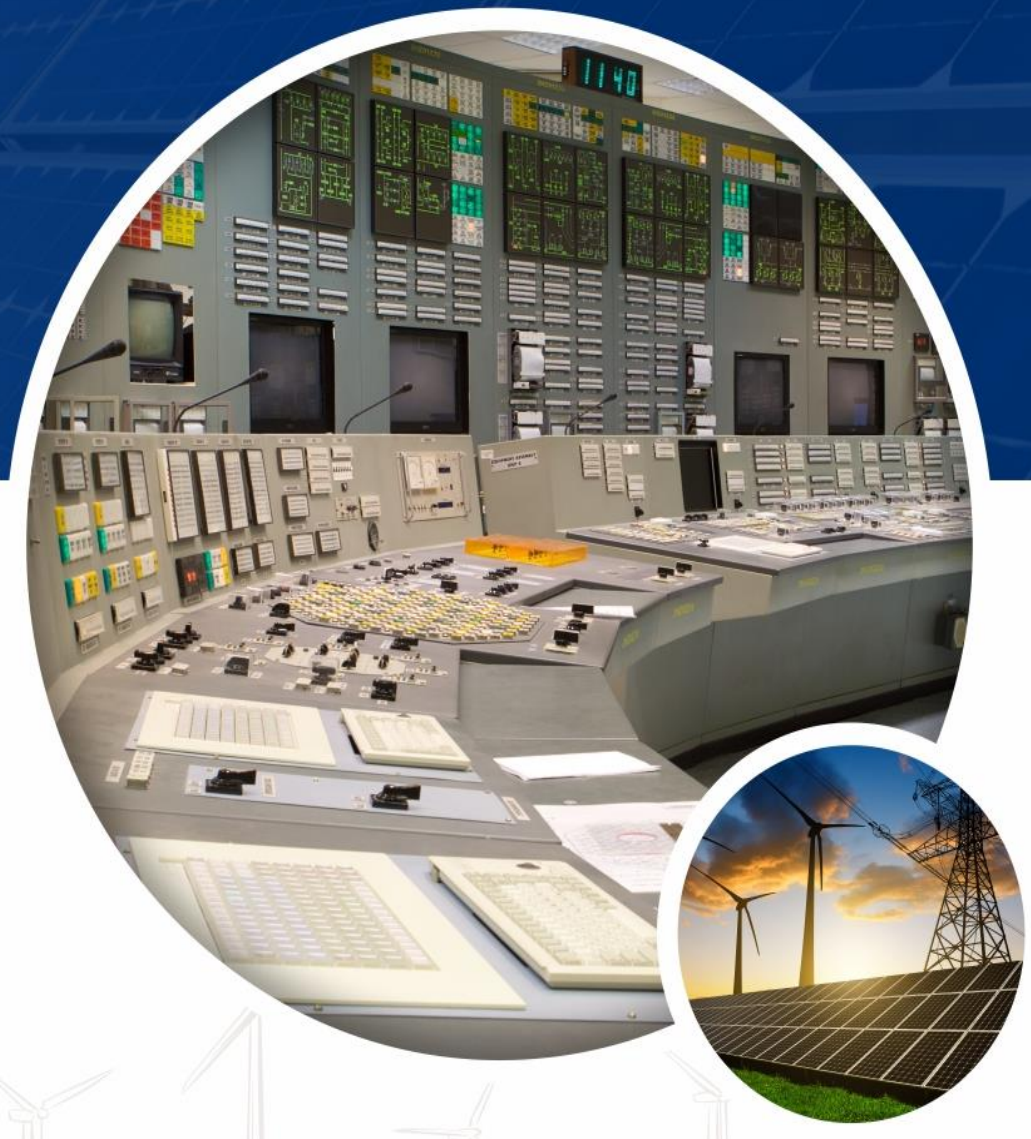
DISCOM RENEWABLE ENERGY PROCUREMENT OPTIMIZATION & SMART ESTIMATION SOFTWARE TOOL (DISCOM REPOSE)

USER MANUAL



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GLOSSARY

TERMS		
S.NO	TERMS	DEFINITION
1.	ANN	ANNs are a form of artificial intelligence, which attempts to mimic the function of real neurons found in the human brain. As opposed to the traditional statistical methods such as regression, which need prior knowledge about the nature of the relationships between the data, ANNs are self-adaptive methods that learn from data, and only few a priori assumptions about data are needed.
2.	Annual Demand Profile	**HISTORICAL ANNUAL DEMAND PROFILE** for past years is the basis for arriving at the future load profile. The hourly data from the load profile is considered for computation of load factor for each discom.
3.	ARIMA	ARIMA is a popular and widely used statistical method for time series forecasting. This acronym is descriptive, capturing the key aspects of the model itself. Briefly, they are: i. AR (Auto regression) - A model that uses the dependent relationship between an observation and some number of lagged observations ii. I (Integrated)- The use of differencing of raw observations (e.g. subtracting an observation from an observation at the previous time step) in order to make the time series stationary iii. MA (Moving Average)- A model that uses the dependency between an observation and a residual error from a moving average model applied to lagged observations.
4.	CAGR	CAGR is a specific term for the geometric progression ration that provides a constant growth rate over the time period. This method dampens the effect of volatility of periodic changes that can render arithmetic means irrelevant. It is a useful measure of growth over multiple time periods. The following equation corresponds to CAGR method- Y = {(Current value/Base value)[1/(no of years-1)]}-1 Where, Y denotes the CAGR.
5.	Captive Power Plants (CPP)	**CAPTIVE POWER PLANTS (CPPS)** are those huge power plants established as part of huge industries or commercial facilities that generate power. They can fall

		into any category or the power generators. Consumption of power from these sources is on the rise in the recent times. The percentage of CPP based power consumption also impacts the demand forecasted.
6.	Category	**CATEGORY** refers to the various consumer types that are identified and associated with a distribution licensee. Each of these consumer types is associated with independent and dependent variables that are grouped and mapped to it.
7.	Dashboard	**DASHBOARD** is technically defined a tool used by the users to track/access their routine works, reports, activities and communications within the application. It also gives the user access to one's profile.
8.	Demand Profile	This refers to the demand profile of each of the DISCOMs.
9.	Distributed Energy Resources (DERs)	**DISTRIBUTED ENERGY RESOURCES (DERS)** are electricity generating units (typically 3 kW to 50 MW) within the distribution system or close by to the consumer. The rapid rise in the number of such units and the energy consumed from these units impact the demand forecasting.
10.	Drivers	**DRIVERS** are the factors that impact the rise and fall in the demand experienced by the DISCOMs. Based on the values derived from these drivers, the quantum of energy generated, distributed and purchased may alter from time to time. The list of common drivers dealt in the application are the following: Open Access (OA), Captive Power Plant(CPP), Distributed Energy Resources (DERs) and Electric Vehicles (EV)
11.	ECONOMETRIC ANALYSIS	An econometric forecast determines energy demand by considering the influence of independent variables such as population, income, economic growth, cost, industrial & commercial activity and also other socio economic variables. Econometric models are estimate equations that relate electricity demand to external factors. An important aspect to solve in econometric method is the selection of the correct independent variables.
12.	Electric Vehicles(EV)	EV stands for Electric Vehicles (EVs). The stark rise in the number of EVs impact the demand experienced by the generators and DISCOMs. The penetration of EVs shall hugely affect the demand forecast of the DISCOMs.
13.	Energy sales	**HISTORICAL ENERGY SALES DATA** for each consumer category is required for determining the future energy sales for the categories. This variable acts as the

		dependent variable being forecasted by the application. Based on the forecasted energy sales for each category, the total DISCOM demand and thus the State demand can be evaluated.
14.	Integrated Resource Mapping (IRM)	**INTEGRATED RESOURCE MAPPING** is a futuristic approach that considers both supply side and demand side management while planning for the power generation and supply in the recent times. Ideally this results in generating a public planning process to evaluate the optimal mix of utility resources and options.
15.	LDFC	Long term Demand Forecasting
16.	Licensee	The software shall allow the user to model one or more **Distribution Licensees** of a State. The distribution licensee could be a state distribution utility, a private DISCOM or a franchisee. The data necessary for each DISCOM are discussed in the below subsections.
17.	Load Factor	**LOAD FACTOR** is also a key aspect for forecasting the peak demand. Based on the historical annual energy consumption and peak demand, the load factor shall be computed for each historical year. The load factor for future years can be projected based on the historical trend.
18.	MDFC	Medium term Demand Forecasting
19.	TAB BAR	**TAB BAR** is part of the module interface which gives access to all TAB items in the application. This application has demand, system config and user as the TAB items on the TAB BAR.
20.	Open access (OA)	**OPEN ACCESS (OA)** allows the consumers to purchaser power for lesser prices in the market as compared to consumption through the DISCOMs. The percentage of power purchased from other sources for a competitive price other than DISCOMs should be considered for predicting the demand forecast as there seems to be a rise in the OA factor annually. While considering the generation plan, OA factor amounts to a significant difference in the final power to be generated.
21.	Operations	An **OPERATION** is defined as the combination of access rights + actions based on role. Each user is assigned to operations based on the role in the application.
22.	Per Capita Energy Consumption	It is another important parameter which is required for forecasting demand. The energy demand is a direct function of population and total energy consumption.

		Typically, statistical departments will calculate the Per capita energy consumption for future years by the following formula: $PCE = \frac{Estimate\ of\ total\ energy\ consumption\ during\ th}{Estimated\ mid-year\ population\ of\ that\ ye}$
23.	PEUM	End Use is a Bottom-Up approach that directly estimates energy consumption by using extensive information on end use by end users, such as appliances, the customer use, their age, sizes of houses, and so on. These models are based on the principle that electricity demand is derived from customer's demand for light, cooling, heating, refrigeration, irrigation etc. This method is highly data intensive, which is challenging in a developing country like India. It is especially challenging to establish a robust link between a macroscopic scenario and the dependent variable. Partial End-Use Method is a combination of time series analysis and end-use method. The time series method shall be used to project growth indicators which shall then be used for forecasting electricity demand. The consumption of power is assumed to be a measure of the indigenous requirements. The future demand is not projected directly out of past demand data but from the power utilized in end products, which is measured through growth indicators.
24.	Policies	**GOVERNMENT OF INDIA (GOI**) and **MINISTRY OF POWER (MOP)** keep updating the policies on electricity generation to distribution.
25.	Power Trading Optimization(PTO)	The results of execution of the medium and long term demand forecasting gives a consolidated view on the demand to be incident for a specific duration. If a deficit in generation is predicted, it is met by purchasing power from other resources.
26.	Roles	The roles defined for users who use the application. It is mandatory for all users to have a role configured for them.
27.	Seasonal trends	Every consumer category sees seasonal fluctuations. Weather changes influence products and services that consumers want. At residential level, use of AC or heater may vary with season. Similarly, at industrial level, production of some products could vary with season. This implies, impact of season could be different for different categories. User shall be allowed to configure

		seasons at monthly levels. As indicated, seasons could be categorized broadly as summer, winter and monsoon or into further subcategories.
28.	T&D LOSSES	**TRANSMISSION & DISTRIBUTION Losses** is one of the factors that affect the demand. A reduction in total T&D losses reduces the total demand.
29.	TREND	Trend Analysis is a deterministic extrapolation technique that involves fitting trend curves to basic historical data adjusted to reflect the growth trend itself. With a trend cove, the forecast is obtained by evaluating the trend curve function at the desired future point. In trend analysis, the following standard analytical functions are used in trend curve fitting. ● Straight line: $Y = a + bx$ ● Parabola: $Y = a + bx + cx^2$ ● S Curve: $Y = a + bx + cx^2 + dx^3$ ● Exponential: $Y = ce^{dx}$ ● Gompertz: $Y = ln^{-1}(a+ ce^{dx})$ Wherein, x is the independent variable, a,b,c and d are constant coefficients used for trending and Y is the dependent (forecasted) variable. Curve fitting technique is used wherein by the method of least squares the coefficients "a", "b", "c" and "d" of a function are computed.
30.	User	The list of people and their details are configured using this module. A user can be an operations specialist, administrator, field engineer and so on. Every user can be either a domain user or an external user to the application. Each user is provided with a user name and a password (Exception: domain user, as they login using their windows password.)
31.	Variables	The software allows you to configure a list of variables that impact demand forecasted using the methods. The variables are classified into Dependent and Independent variables considering many factors grouped under the following: historic energy sales, econometric variables, weather conditions, demographic variables, demand factors and so on. The user has the freedom to choose and configure the variables necessary for the demand forecasting.

32.	Crew Constant	Crew constant refers the number of crews in active state at the hydro-plant units while it participates in resource mapping.
33.	Domain User	The term refers to the users who work in the utility and can use their respective system credentials (windows username/password) to login to the software.
34.	Non-Domain User	The non-utility members who need to work on the software can create a username and password exclusively to access and work in the software.
35.	Contracts	The power purchase agreements that a utility makes with any power generator for either a hourly based agreement or days to months or years agreements are called contracts.
36.	Exchange	The short-term contracts are called exchange in the software.
37.	Procurement	The long-term contracts are called procurement in the software.
38.	MILP	Mixed Integer Linear Programming method used in Resource Mapping and Power Purchase Optimization modules in the software.
39.	RPO	Renewables Procurement Obligations
40.	Cost Characteristics	It defines the collection of various costs incurred that are classified as cost coordinates, cost coefficients, fuel cost, heat rate and heat rate coefficients, and fixed and variable cost values.
41.	Fuel contracts	The fuel contracts specify the details of cost associated with the purchase and transport of fuel for the plants.
42.	Emission Library	It lists out all the possible emission characteristics that the plant have.
43.	Generation Portfolio	The plant-wise generation profiles of all types of plants are grouped as libraries for each category of plant types.
44.	Energy Exchange	The energy exchange procured in MUs is added as an input for the short-term exchange module.
45.	Exchange Rate	The energy exchange rates observed in the historical data of the power exchanges are used to predict the future rates of the exchange that might be procured by the utilities to meet the demand.
46.	State-owned	The state-owned generators information is provided to distinguish when a few units of the plants participate in

		contracts or as a resource in the generators mix considered in resource mapping.
47.	IPP	Independent Power Producers are the non-state-owned power generators who generate power and share it with utilities via contracts or participate in the generation planned by utilities. These IPP storage units have different charging and discharging cycles in a given day as they accommodate more RE sources. These are modeled in the software as they participate in power procurement module as contract units.
48.	Grid Dependent	A few battery storage RE contracts are called Grid Dependent based on the discharging characteristics of the storage systems. They only exhibit energy discharging characteristics and they are modeled for a time period as contracts in the software.

A. DISCOM REPOSE SOFTWARE TOOL

1. ABOUT DISCOM REPOSE SOFTWARE TOOL

DISCOM Renewable Energy Procurement Optimization and Smart Estimation (REPOSE) is a sophisticated, interactive, robust and dynamic software with a comprehensive set of advanced and scientific demand forecast methods, integrated resource mapping models and power procurement optimization technology built into three modules. This software helps distribution companies (DISCOMs) forecast demand, establish resource plans and optimize future procurement costs. DISCOM REPOSE provides utilities with hourly, weekly and yearly visualizations of demand and resource adequacy (type, amount and time) over a 15-year horizon.

This software lets DISCOMs study a variety of scenarios to optimize their power procurement plans with a generation mix from available resources, future contracts and renewable energy maximization, while considering renewable energy's uncertainty and variability. DISCOM REPOSE provides insights into how DISCOMs can reduce their overall generation cost, provides granular projections of demand and generation adequacy, and helps to increase renewable energy penetration.

2. HOW TO USE DISCOM REPOSE SOFTWARE TOOL

The DISCOM REPOSE is designed to provide step-by-step guidance on how to perform end to end Demand Forecasting, Integrated Resource Mapping and Power Procurement Optimization using the modules in the software. The Demand Forecast module shall discuss the input parameters, additional parameters, configuration of Business As Usual (BAU) scenario, and the impact of drivers on the BAU scenario, and probabilistic analysis of the results obtained for BAU and complete analysis of results. The IRM module shall discuss the input parameters, how to create scenarios, how to edit the parameters to suit the study, executing the scenario, and analyzing the results.

The demand results obtained from the demand forecasting scenario are taken as input for IRM and PPO studies. The IRM studies provides the results and analysis for demand obtained by considering only the existing power plants whereas the PPO module will help us to preform studies by considering the contract plants, and other procurement options by taking same demand as input.

DEMAND FORECASTING

Demand forecasting is of great importance for the management of power systems. Long-term forecasts of the electricity demand (both energy & peak load) are needed for capacity planning and maintenance scheduling while the Medium-term demand forecasts (both energy & peak load) are required for power system planning or adequacy analysis.

The development of an accurate, fast and robust demand forecasting methodology is of importance to both the electric utility and its customers. More generally, the error in predicting electricity demand has significant cost implications for companies operating in competitive power markets.

Globally, the demand forecasting is a key aspect of Integrated Resource Mapping. It is forecasted for a long/medium-term horizon, typically for 10 years. More sophisticated tools and advanced methods are used for forecasting the demand. It considers several existing and proposed drivers to assess the annual energy consumption and the peak demand for future years. Further, the hourly load profile is also estimated for future years in medium-term analysis.

MEDIUM TERM DEMAND FORECASTING: It is used to estimate yearly energy demand for duration of 1-3 years considering seasonal and economic developments that impact the energy consumption during those years. In our case, it reads the input data provided by the user and internally uses the historical data for computing the forecasting. The results are saved in a specific database for future usage. It is good to have at least 1- 3 years of historical data for medium forecasting to predict a better demand.

LONG TERM DEMAND FORECASTING: The long-term demand forecasting is used to predict demand for a longer duration such as more than 10 years. It considers the input data provided by the user and internally uses the historical data for performing the forecasting. Then the results are saved in database for future usage. It is ideal to have at least 5- 10 years of historical data while performing long-term demand forecasting as that enables you to generate near-realistic demand forecast.

INTEGRATED RESOURCE MAPPING

Resource Mapping is one of the prime beneficial planning activities of any DISCOM, as it focuses on creating energy generation plans that are low-cost, low-risk, and with outcomes that minimize the environmental and societal impacts. Energy efficiency and Demand-Side Management are the key concepts, or the desired results expected out of using the IRM module.

There are two challenges faced in such a planning. The under-estimation of the demand forecasted shall lead to a lack of energy supply resulting in blackouts and brownouts. Whereas, the over-estimation of demand may lead to surplus energy or establishing generation plants that are fueled and not matured to assist in supplying the expected demand. In either of the cases, the cost involved in investment and operations of such plants can be detrimental to the utility as inability to match the generation at optimal cost with demand forecasted may lead to a major setback in the economic growth of the country. To eradicate such disasters, appropriate planning is a must.

An efficient planning process considers a complete range of investments in the power sector to meet the new age electricity demand by including newer energy sources while keeping in mind the transmission, distribution and also demand side management measures such as energy efficiency and an optimized operational cost.

An ideal IRM plan integrates the environmental, socio-economic, strategic policy changes in the country, regulatory compliances constraints, and other general costs and benefits to serve the power

needs at lower costs across the country. The planning is carried out for the long- and medium-term-time horizons and hence could be easily integrated with an existing demand forecast reports generated.

POWER PROCUREMENT OPTIMIZATION

Power Procurement Optimization is the ability to provide the best possible energy mix, meeting the high renewable portfolio by including all variables while considering power procurement from power purchase contracts. This optimization is vital to assess whether the electricity supply will be able to remain secure and available when needed, while ensuring least cost procurements. It facilitates the planning process of new energy supply facilities and contracts to deliver energy while avoiding overinvestments.

From the Gap Analysis report submitted earlier, it is observed that power procurement plan will be developed by the Distribution Company (DISCOM) and approved by the commission typically for a period of about 5 years. In addition to the projected demand and foreseen generation, the renewable purchase obligations (RPOs) targets are also considered in the development of the procurement plan.

Matching the available generation with total energy consumption does not guarantee adequate resource mapping. Power procurement optimization is necessary to identify the least cost contracts to economically meet the deficits. Considering this, the project team proposes the development of a sophisticated software package for resource mapping that aims at optimizing the power procurement.

The objective of this procurement optimization module is to provide Strategy Support, which will include all types of contracts and assessment of market conditions and risks for a forecast horizon up to 10 years. The procurement optimization module will provide the following features:

The log in page of DISCOM-REPOSE software looks as shown in Figure 1.

1. Optimization of internal generation mix, considering the availability of contracts in the system
2. Optimization of available long- and medium-term power purchase contracts
3. Maximization of renewables in the grid while considering technical constraints and economic optimization of conventional generation and power purchase contracts
4. Planning for procurement considering the uncertainty from renewables
5. Optimization through advanced Mixed Integer Linear Programming (MILP) techniques

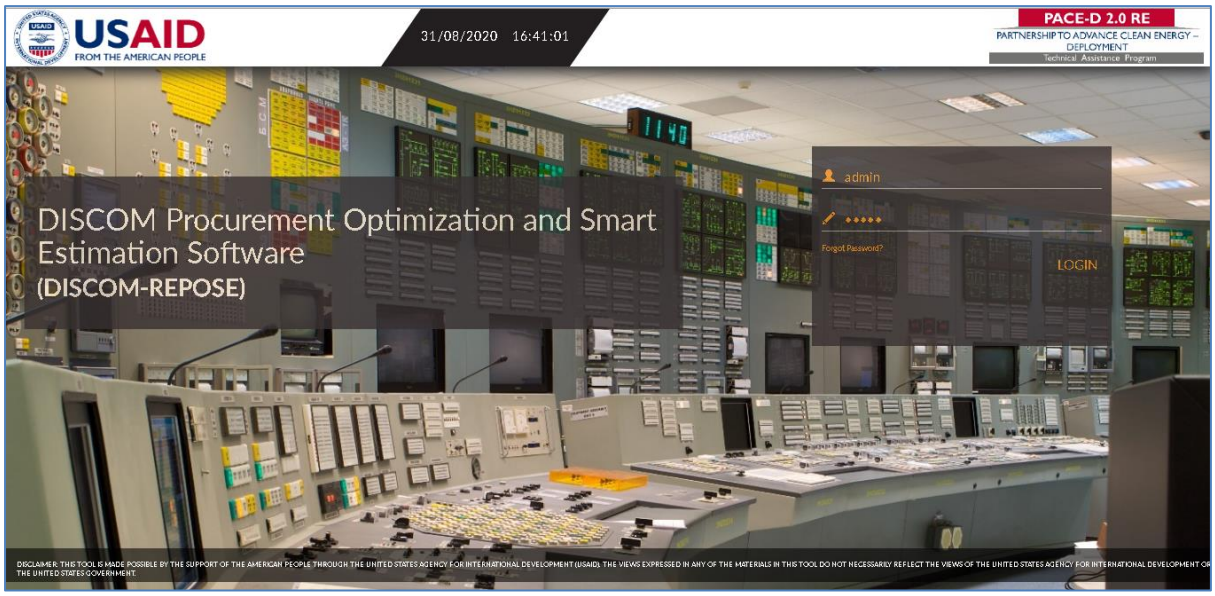


Figure 1. Login Screen of DISCOM-REPOSE Software

2.1 MODULE I: DEMAND FORECASTING

2.1.1 Introduction

Demand forecasting is the first component in DISCOM-REPOSE software using which we can perform long term demand forecasting (LDFC) and medium-term demand forecasting (MDFC).

Once you login to the software, you will see the page as shown in Figure 2.

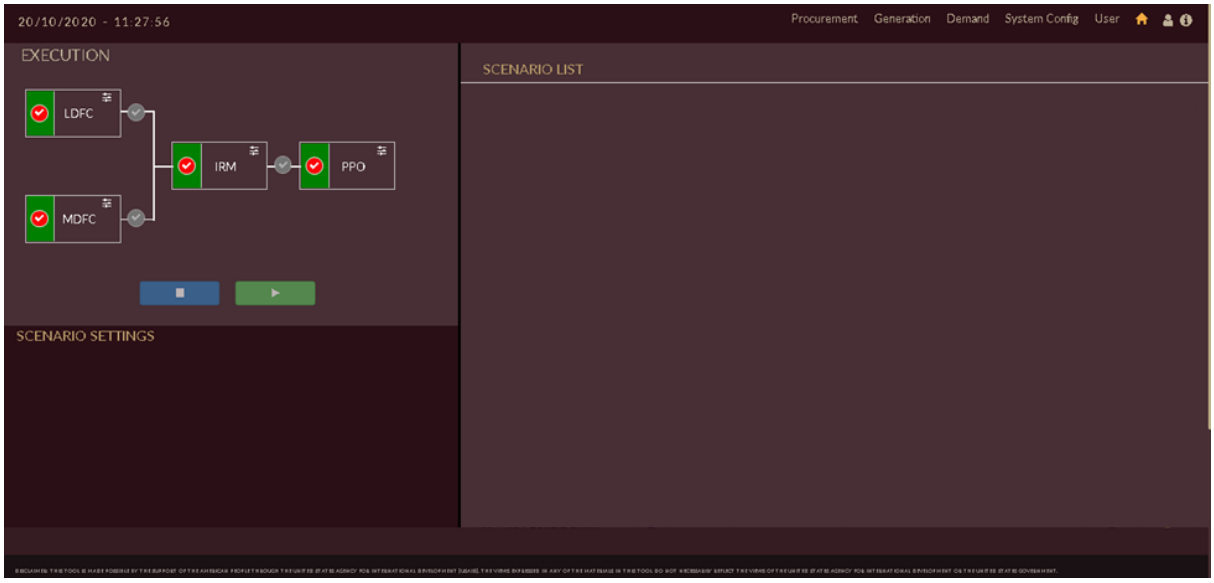


Figure 2. DISCOM – REPOSE Home page

Let us see the input parameters required, how to model the database, and how to obtain the results in following sections.

Note: We have considered Assam state's database as an example in this document.

2.1.2 Input Parameters

For performing demand forecast studies, we have to collect a certain set of data that will be considered as input for the studies.

Inputs to be considered are the following

- Categories (Consumers) of respective DISCOM/State
- Historical & Forecasted Econometric variables related to the selected categories
- Historical energy sales of each category

Let us consider two sample categories of Assam shown in Table 1 and discuss how to upload and execute the demand forecast studies.

Table 1. Sample Categories and Econometric Variables		
SL. NO.	**CATEGORIES**	**ECONOMETRIC VARIABLES**
1	HT-1 HT Domestic 25kVA (20 KW) and above	Per capita income - Constant
		Gross Domestic Product - Constant
		Installations
		Specific energy
		Average Temperature
		Average Humidity
2	LT-1 Jeevan dhara 0.5kW and 1kWh/day	Population
		Gross Domestic Product - Constant
		Average Temperature
		Average Humidity

Table 2 shows the annual input data required for performing Long term demand forecast (LDFC) studies.

Table 2. Sample Annual Data		
YEAR	**HT-1 HT DOMESTIC (Energy Sales in MU)**	**GROSS DOMESTIC PRODUCT – CONSTANT (in Lakhs)**
2009	30.760	6403256
2010	29.054	6979387
-	-	-
-	-	-
2018	31.000	20114394
2019	22.100	21286959
-	-	-
-	-	-
2040	-	69960641

Table 3 shows the Seasonal input data required for performing medium term demand forecast (MDFC) studies.

Table 3. Sample Seasonal Data		
YEAR	**HT-1 HT DOMESTIC (Energy Sales in MU)**	**GROSS DOMESTIC PRODUCT – CONSTANT (in Lakhs)**
2014-April	2.74	15550359
2014-May	2.93	15648178
2014-June	3.59	15745997
-	-	-
-	-	-
2019-February	1.54	21183681
2019-March	1.31	21286959
-	-	-
-	-	-
2024-March	-	28258363

Table 4 shows the Annual input data for policy named 'LED-PENETRATION' impacting on HT-1 HT DOMESTIC CATEGORY.

Table 4. Sample Policy Data Impacting HT-1 HT Domestic Category	
YEAR	**LED PENETRATION**
2020	-1.186
2021	-2.372
-	-
-	-
2040	-18.976

1. Login to the software and click on the **Demand** tab, the Demand tab appears as shown in Figure 3.

   Three options appear on page under which the user has to upload the input data and they are the following:

   i. Variables
   ii. Category

iii. Licensee

2. You have to enter the variables and variables data under **Variable** tab.
3. The list of categories for respective DISCOM/State is to be entered under **Category** tab.
4. The historical energy sales and other licensee data of each category have to be entered under **Licensee** tab.

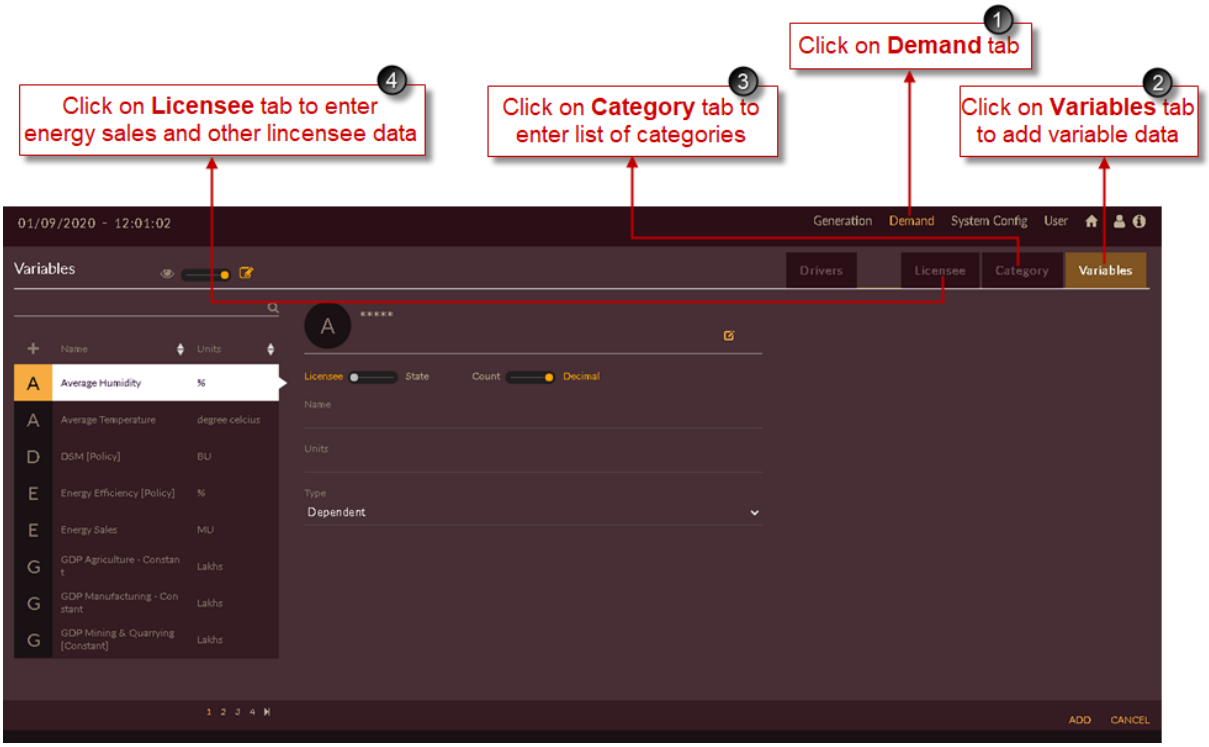


Figure 3. Demand Forecast Home Page

2.1.2.1 VARIABLES

This section guides you to configure **DEMAND Forecast** variables. Demand forecasting is crucial while creating the operational plan for optimized resource scheduling and generation. There are many variables that affect/impact demand forecast.

Note:

- All Econometric/Independent variables will be kept as Licensee/State variables and are of independent type.
- One default variable known as Energy Sales to be created which should be a Licensee and Dependent type as shown in Figure 4.

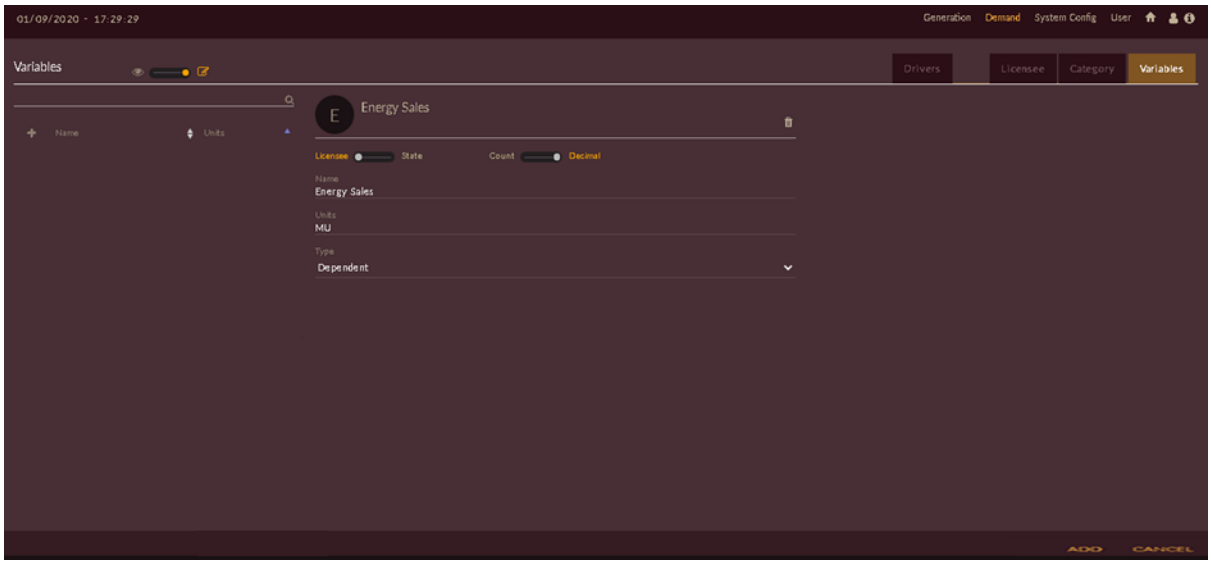


Figure 4. Energy Sales as Dependent Variable

The variables thus identified can be configured using the variable functionality in the software.

STEPS TO ADD VARIABLE

1. Login to the software and access **Demand** tab. The **Demand** tab appears.
2. Click on the **Variable** tab. The **Variable** tab appears.

   After you click on Variable tab the software page looks like as shown in Figure 5.

3. Click on the  **Add Variable** icon. An empty record appears.
4. Use the slider **Licensee or State** and **Count or Decimal** to choose between the appropriate values.
5. Enter the name of the variable in the **Name** field.
6. Enter the unit in the **Units** field.
7. Select the variable type from **Type** drop-down.

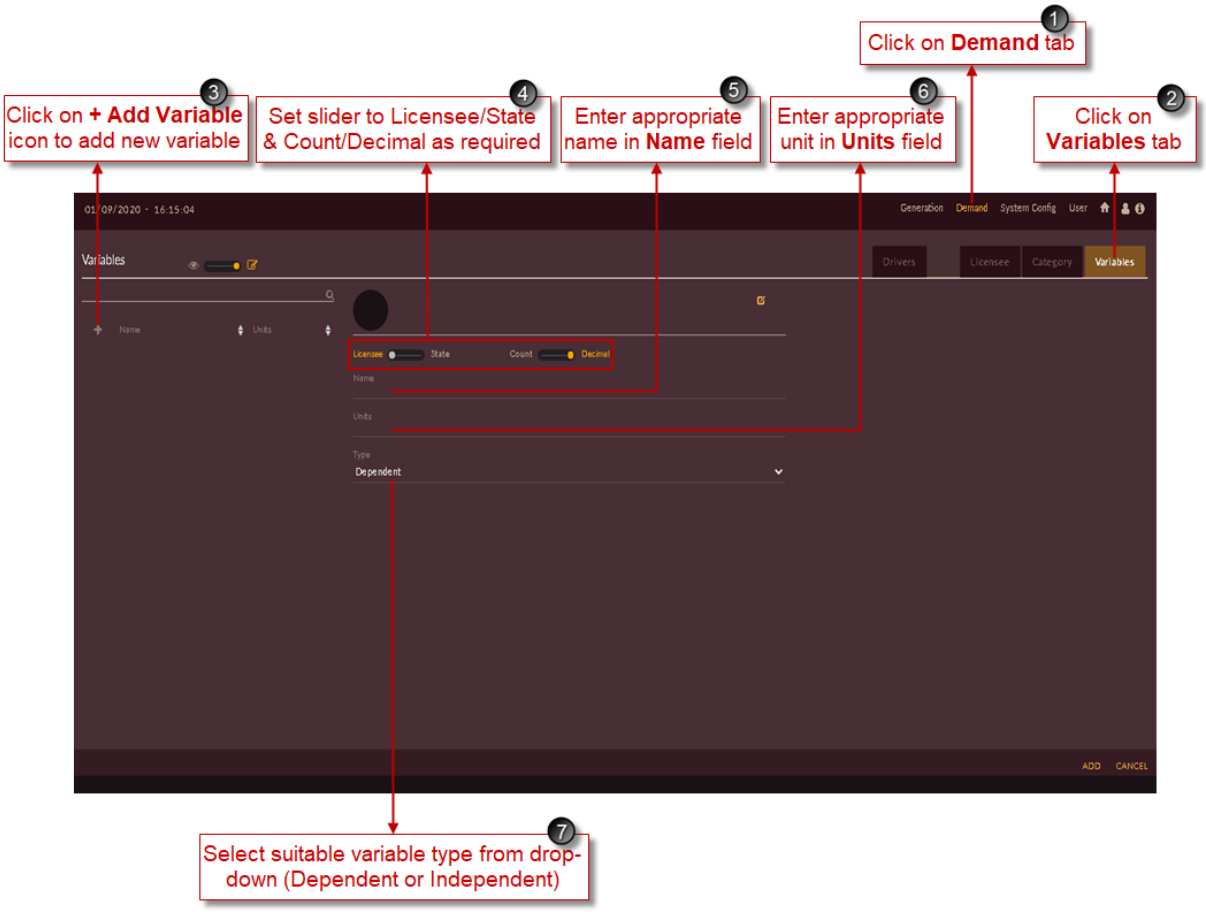


Figure 5. Page to Enter Variable Data

You have to enter the variable details as shown in Figure 6

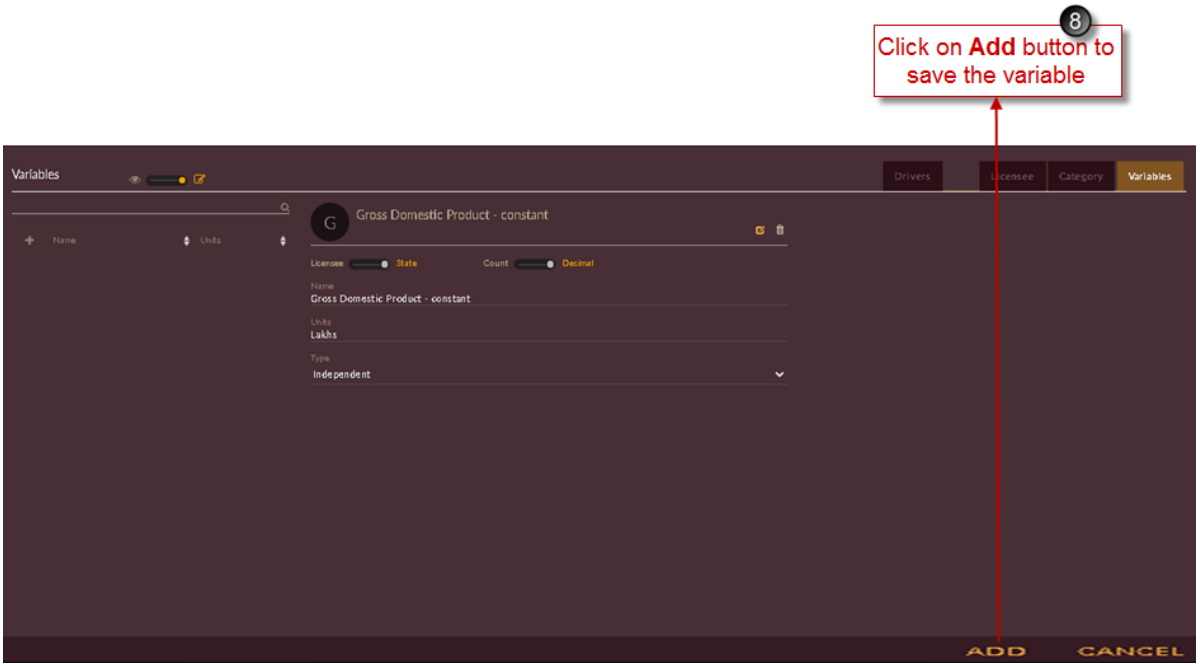
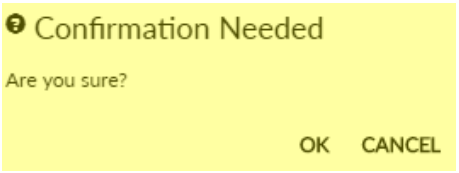


Figure 6. Variable Name

8. Click on the **ADD** ADD button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

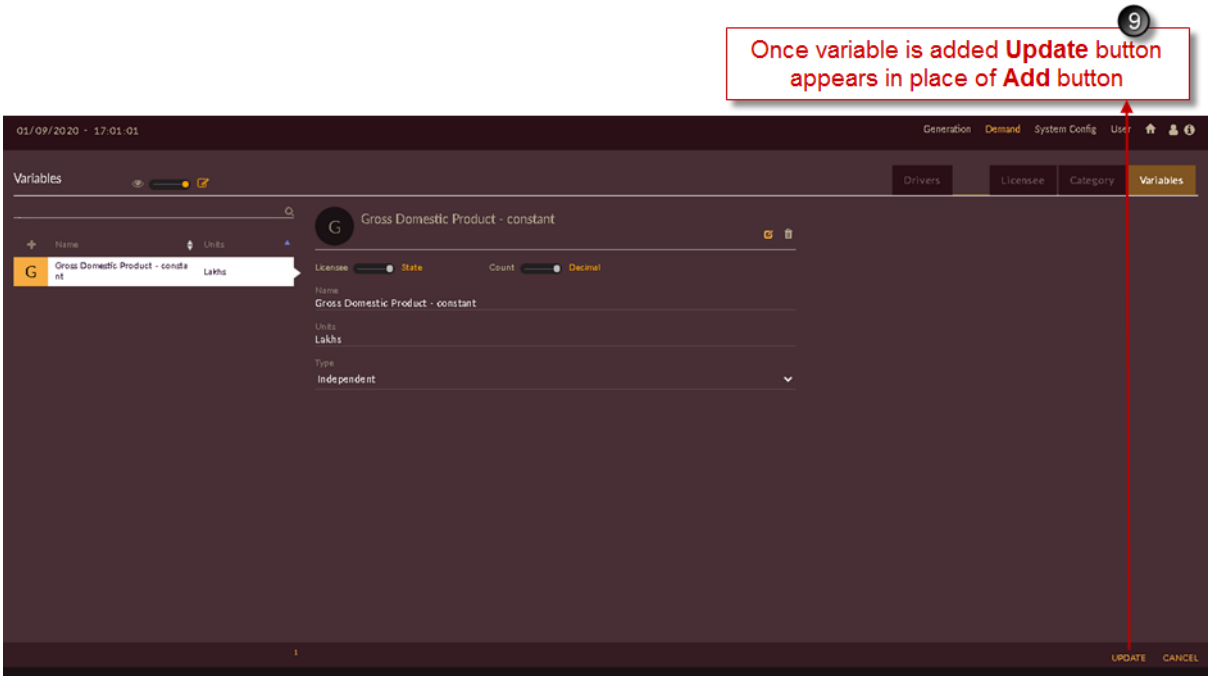


Figure 7. Updated Variable Page

9. You will see the successfully added variables list on left of screen. ADD ADD button is changed with UPDATE UPDATE button where you can click to update the changes made in variable data as shown in Figure 7.

STEPS TO UPLOAD VARIABLE DATA

In the above steps, it is shown that how to create the variable list, now let us see how to add/insert data into the variables.

1. Select the variable for which you need to upload the data (say Gross Domestic Product), then click on **Upload State Data** icon which is shown in Figure 8.

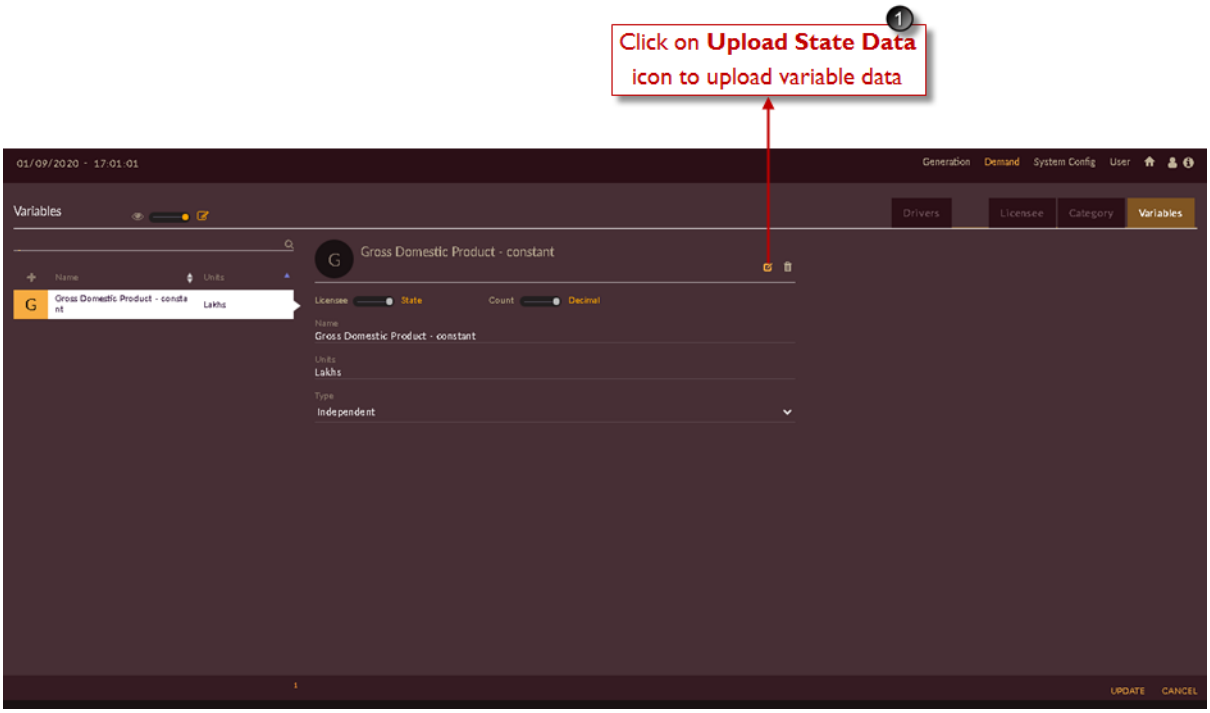


Figure 8. Upload State Data Icon

2. The following page appears as shown in Figure 9.

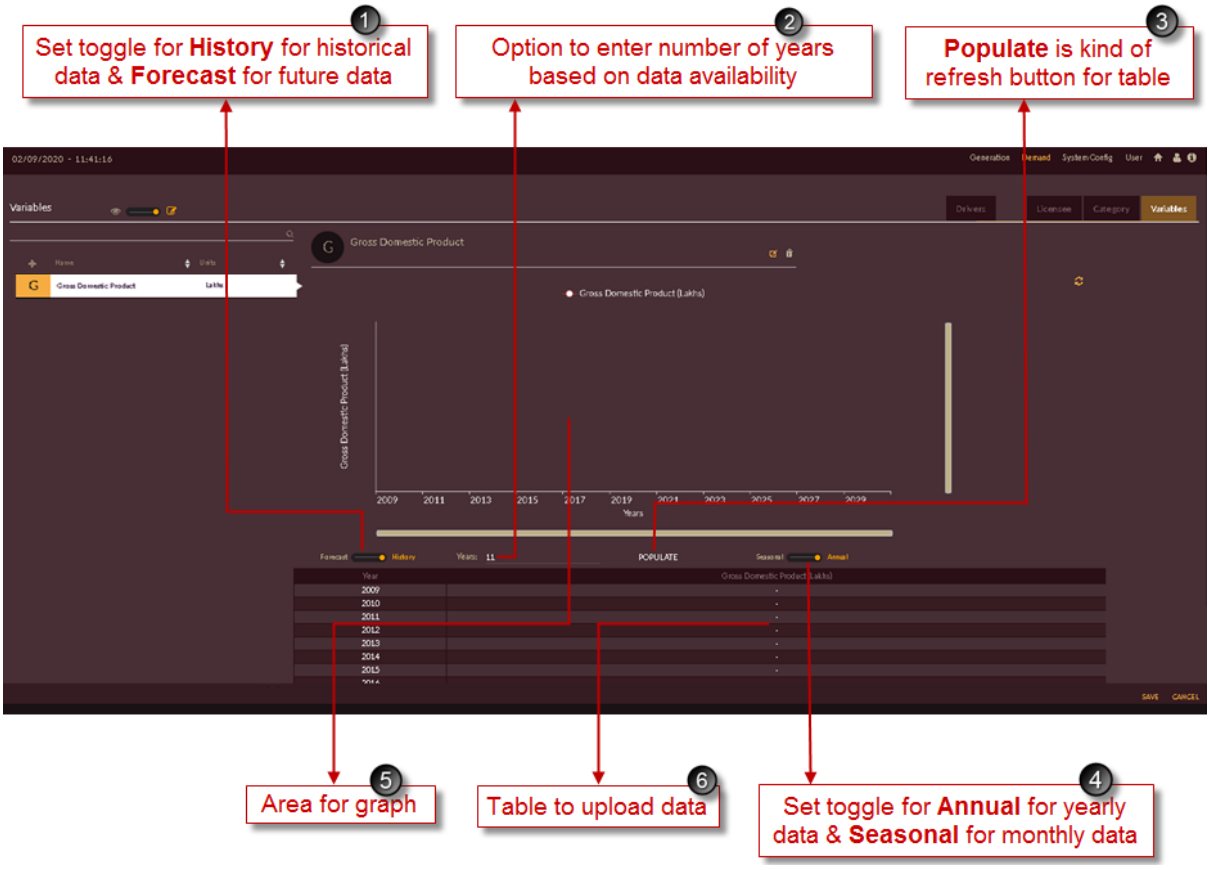


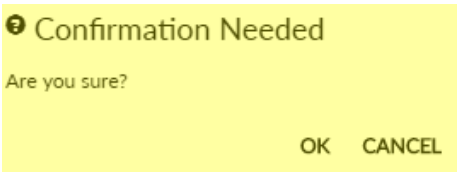
Figure 9. Introduction on Variable Data Page

3. Refer Table 2 for annual econometric variable data and Table 3 for seasonal econometric variable data of 'Gross Domestic Product'.
4. Figure 10 shows uploading of historical annual data for variable 'Gross Domestic Product'.
    a) Toggle the icon to **HISTORY** tab 

    b) Toggle the icon to **ANNUAL** tab 

, then upload the data available for historical years of Gross Domestic Product (Table 2).
    c) Click on **SAVE** button 

. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears. Click on **CANCEL** to discard the task.

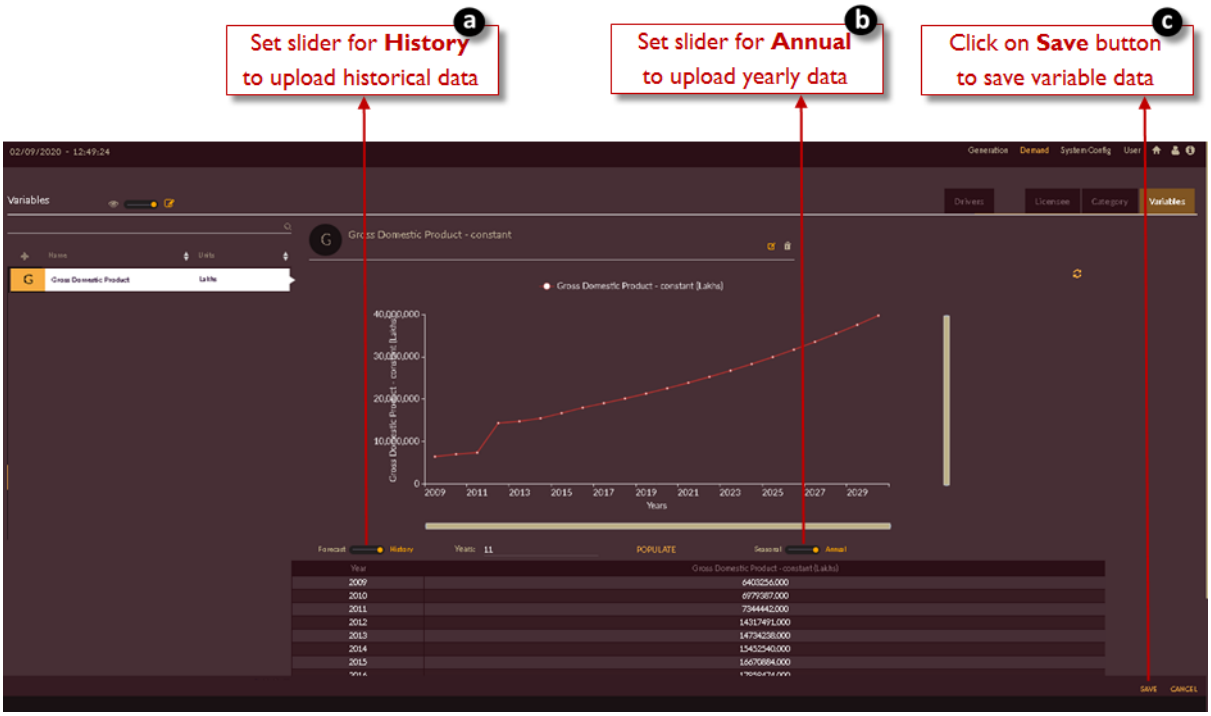


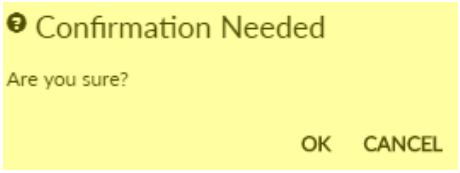
Figure 10. Annual History Data of Variable

5. Figure 11 shows uploading of future annual data for variable 'Gross Domestic Product'.
    d) Toggle the icon to **FORECAST** tab 

    e) Toggle the icon to **ANNUAL** tab 

, then upload the data available for future years of Gross Domestic Product (Table 2).

f) Click on **SAVE** button SAVE. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears. Click on **CANCEL** to discard the task.

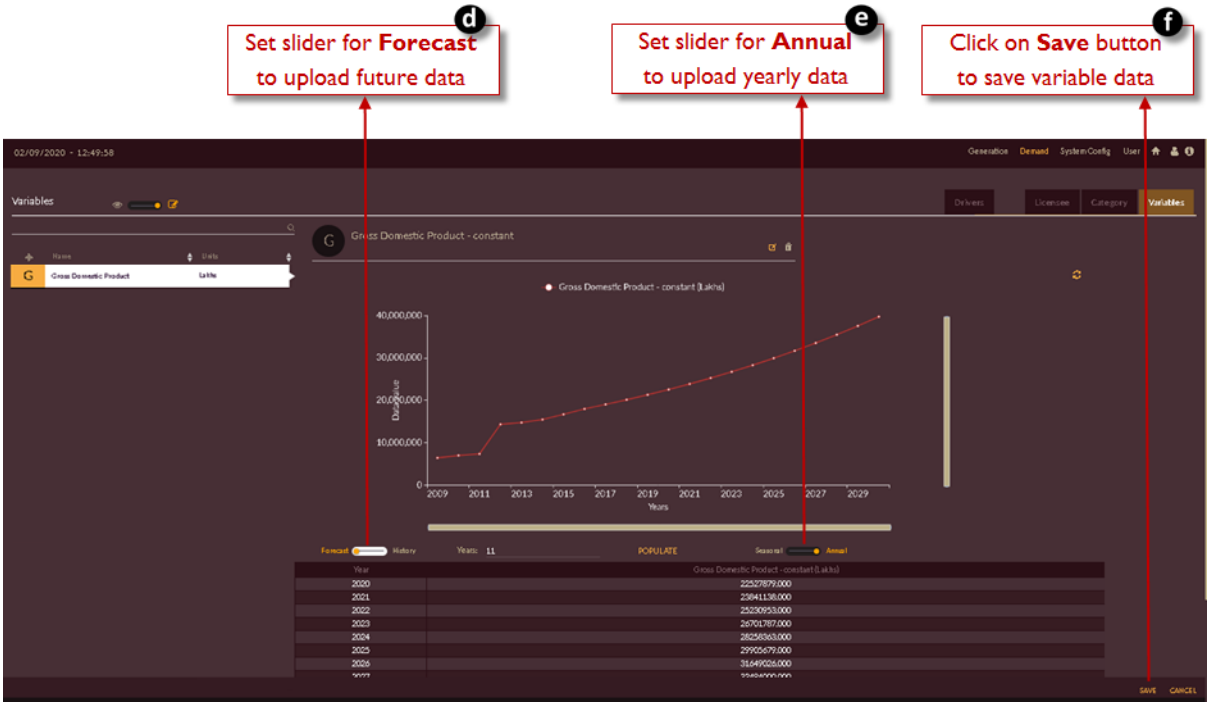


Figure 11. Annual Forecast Data of Variable

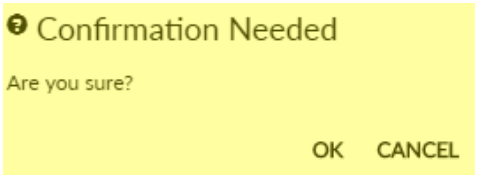
6. Figure 12 shows uploading of historical seasonal data for variable 'Gross Domestic Product'.

g) Toggle the icon to **HISTORY** tab 

h) Toggle the icon to **SEASONAL** 

tab, then upload the data available for historical months of Gross Domestic Product (Table 3).

i) Click on **SAVE** button SAVE. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears. Click on **CANCEL** to discard the task.

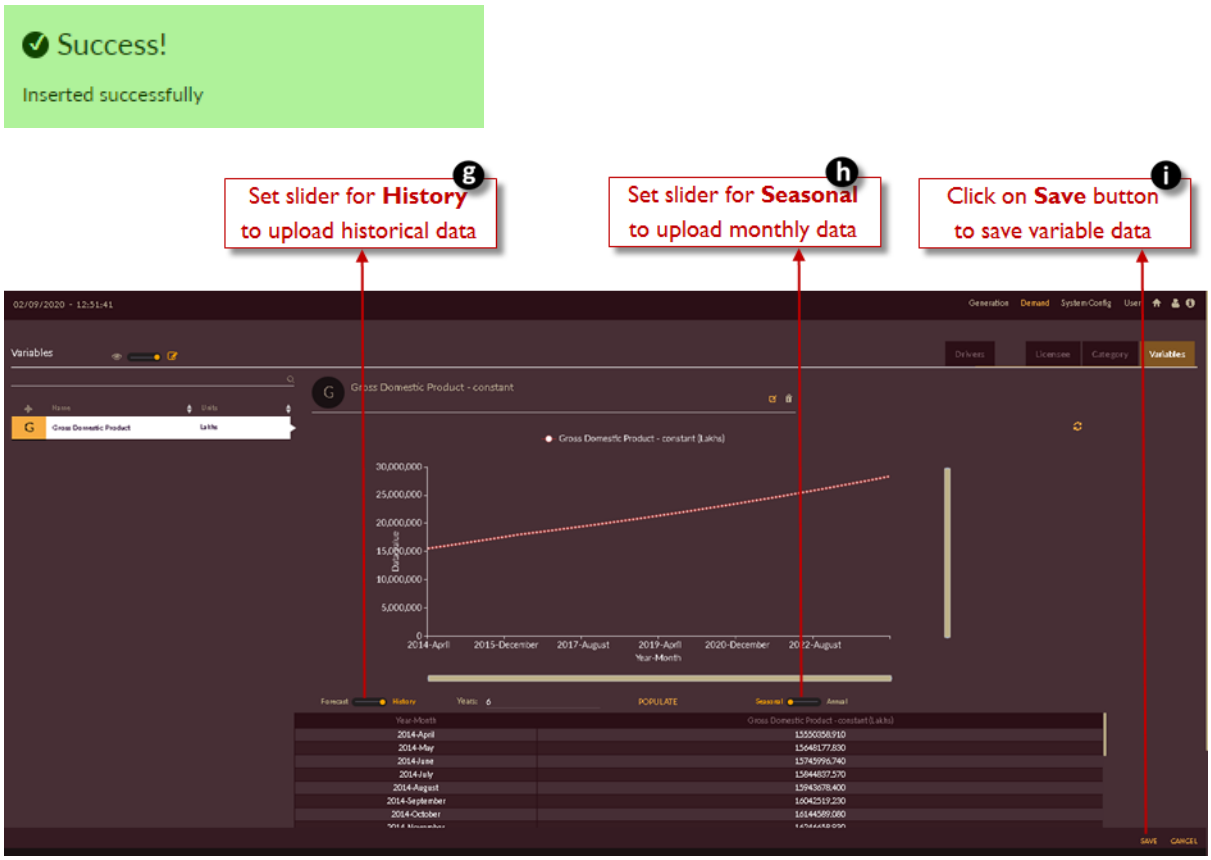


Figure 12. Seasonal History Data of Variable

7. Figure 13 shows uploading of future seasonal data for variable 'Gross Domestic Product'.

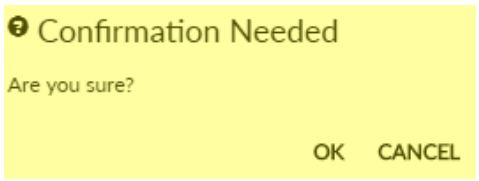
   j) Toggle the icon to **FORECAST** tab 

   k) Toggle the icon to **SEASONAL** tab 

, then upload the data available for future months of Gross Domestic Product (Table 3).

   l) Click on SAVE button 

. The "Are you sure?" confirmation pop-up appears.



   Click on **OK**. The "Inserted successfully" message appears. Click on **CANCEL** to discard the task.

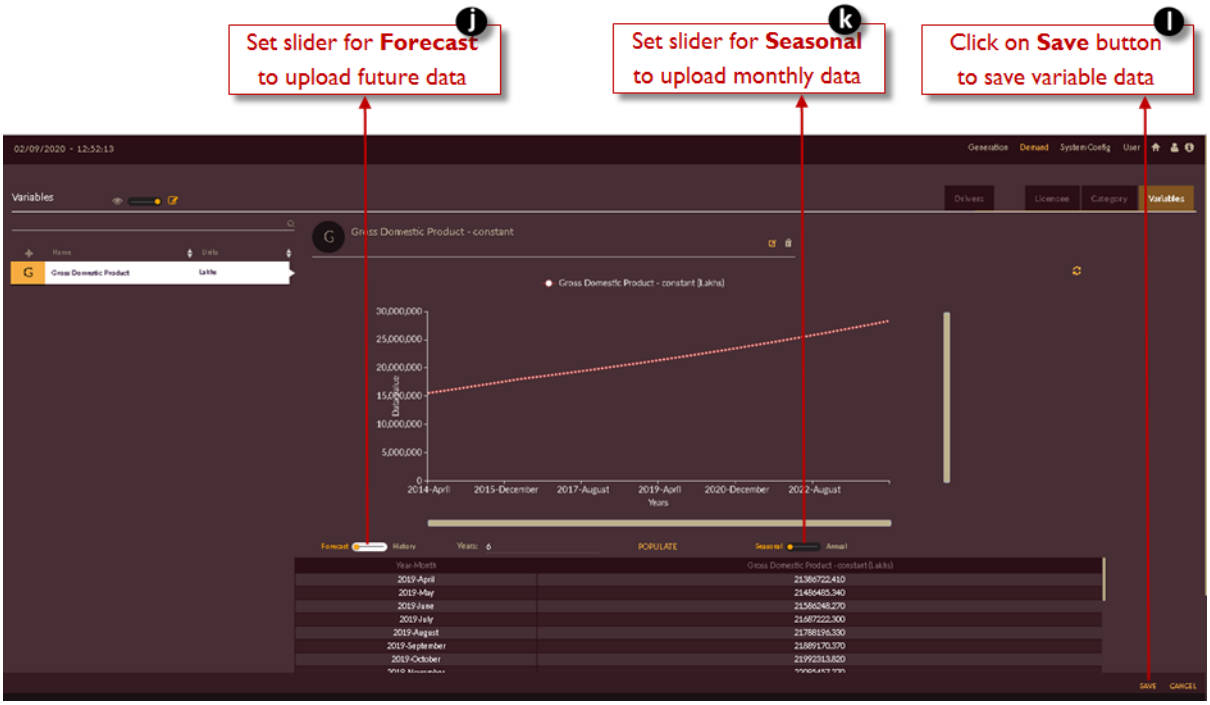


Figure 13. Seasonal Forecast Data of Variable

Repeat the above steps to add all the available variables for DISCOM/State you are carrying out the demand forecast studies.

2.1.2.2 CATEGORY

This section gives you the description and steps to manage the categories.

CATEGORY refers to the various consumer types that are identified and associated with a distribution licensee. Each of these consumer types is associated with independent and dependent variables that are grouped and mapped to it.

The variables thus added can be configured to each category using the ADD variable functionality under Category tab in the software.

STEPS TO ADD CATEGORY

1. Login to the software and access **Demand** tab. The **Demand** tab appears.
2. Click on the **Category** tab. The **Category** tab appears.

After user clicks on Category tab the software page looks like as shown in Figure 14

3. Click on the  **Add Category** icon. An empty record appears.
4. Enter the name of the variable in the **Name** field.
5. Enter the code in the **Code** field.

6. Click on the **Add Variable** icon. An empty record appears.

7. The **Copy From** icon is used to repeat the map same variables for different categories.

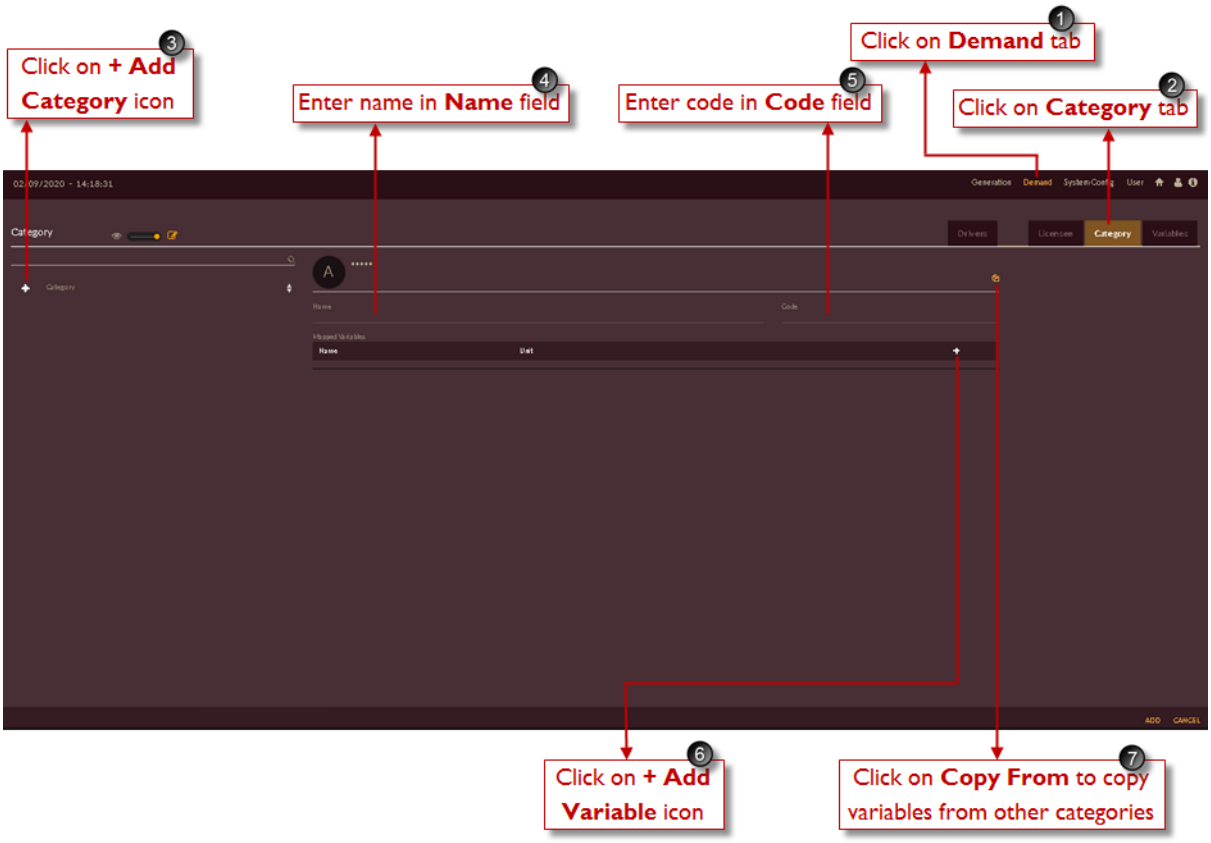


Figure 14. Page to Enter Category List

You have to enter the category details as shown in Figure 15.

Here as shown in Figure 15 you have to map select the independent variables which will be impacting on energy sales of respective category.

Example: In Figure 15 we have shown HT Domestic category. The HT Domestic energy sales are affected by GDP, domestic installations, specific energy, temperature and humidity. Therefore, all those variables which affect HT Domestic category are mapped.

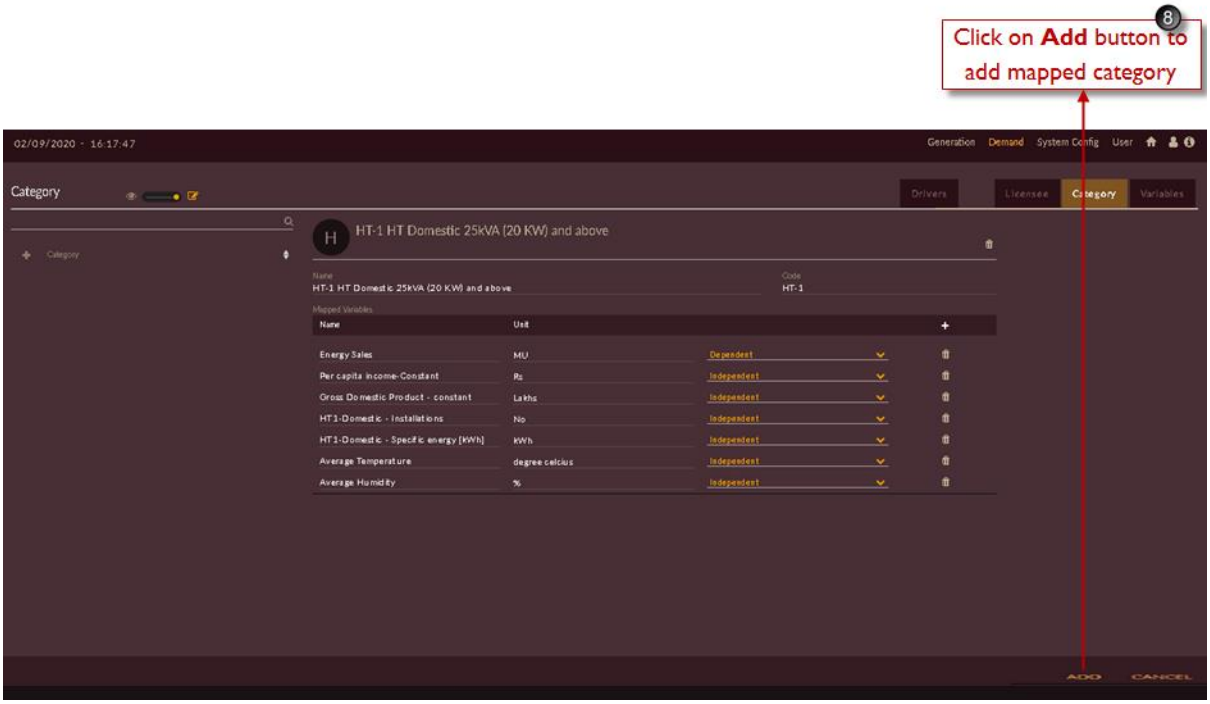
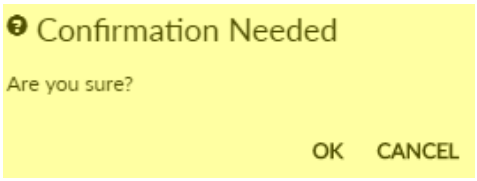


Figure 15. Adding Category and Mapping Variables

8. Click on the **ADD** ADD button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

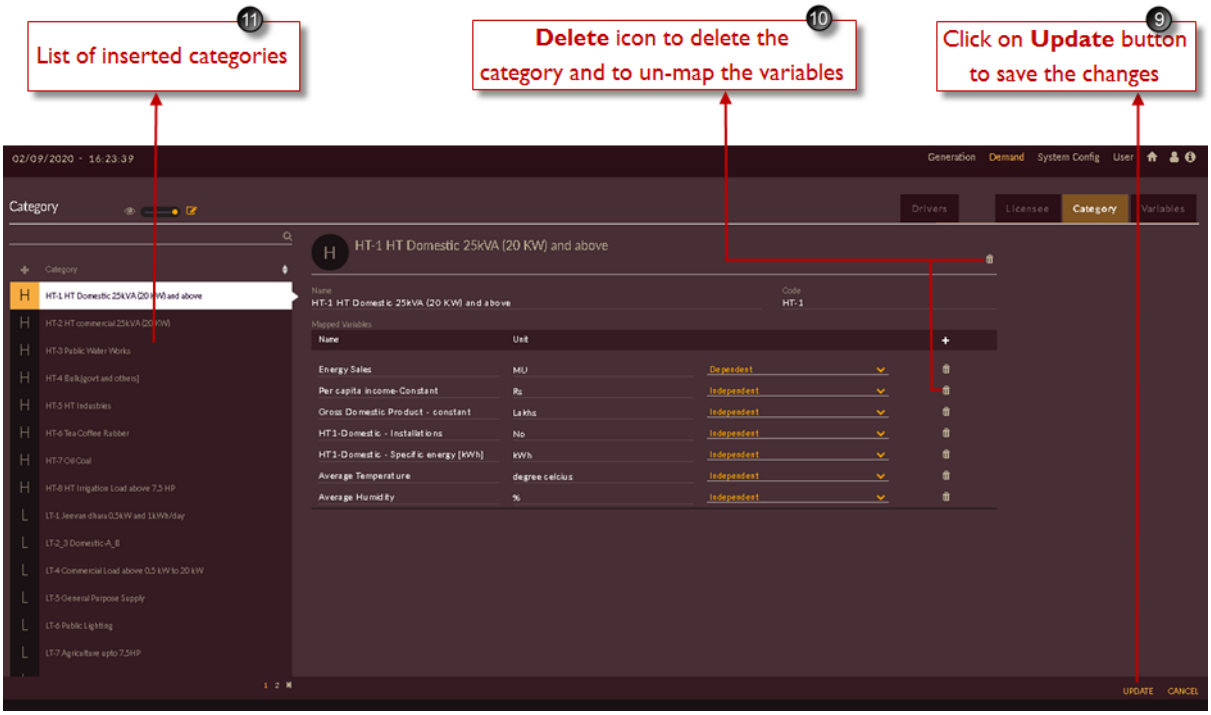


Figure 16. Updated Category Page

9. **ADD** ADD button is changed with **UPDATE** UPDATE button.

10. Use the **DELETE** icon to delete the category or to un-map the variable.

11. The inserted category list appears in the list of categories on left of the page.

Repeat the above steps to add all the available categories and mapping the variables with DISCOM/State you are carrying out the demand forecast studies for.

2.1.2.3 LICENSEE

This section describes how to configure the licensee details in the software.

The **LICENSEE** module is used to model one or more distribution licensees of a State. The distribution licensee could be a state distribution utility, a private DISCOM or a franchisee. The data necessary for each DISCOM are discussed in the below subsections.

Each licensee/DISCOM and its associated parameters are configured using this module. Each of the licensee/DISCOM has a unique **Name** and a **Code**. The type of the Licensee/DISCOM can be configured to be any one of the following: State Distribution, Private DISCOM and Franchisee. The parameters such as **Energy (MU)** of each of the licensee, the **Load Profile (MW)** met by each of the licensee and **Policies** that are mandated by the governing bodies to be strictly adhered to are configured.

Steps to access LICENSEE:

1. Login to the software and access **Demand** tab. The **Demand** tab appears.
2. Click on the **Licensee** tab. The **Licensee** tab appears as shown in Figure 17.

There are three different options under Licensee page

3. The **Energy** tab is used to add licensee/energy data.
4. The **Load Profile** tab is used to add Load profile and Load factor.
5. The **Policies** tab is used to add Polices applicable for each licensee.

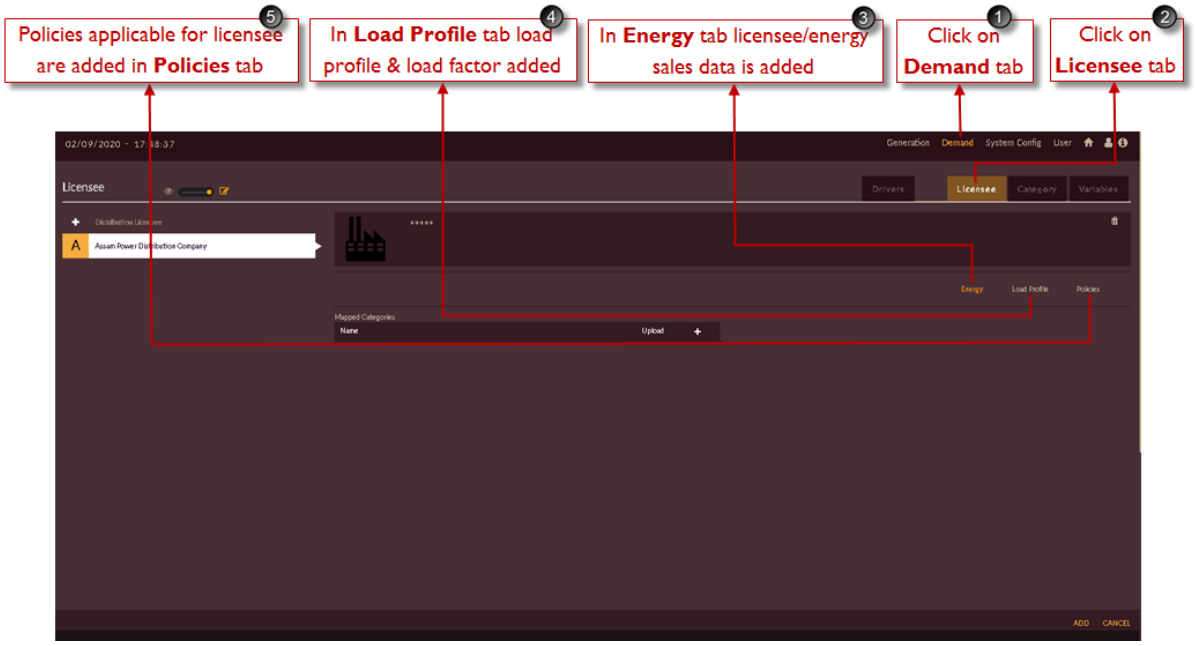


Figure 17. Licensee page

This module handles the following sub modules:

ADDING LICENSEE

This section gives you the steps to add a licensee in the software.

Follow these steps to add licensee.

1. Login to the software and access **Demand** tab. The **Demand** tab appears.
2. Click on the **Licensee** tab. The **Licensee** tab appears.
3. By-default **Energy** tab will be selected. The software page looks like as shown in Figure 18.
4. Click on the **Add Discom** icon. An empty record appears.
5. Enter the name of the variable in the **Name** field.
6. Enter the code in the **Code** field.
7. Select the **Licensee Type** from the drop-down.

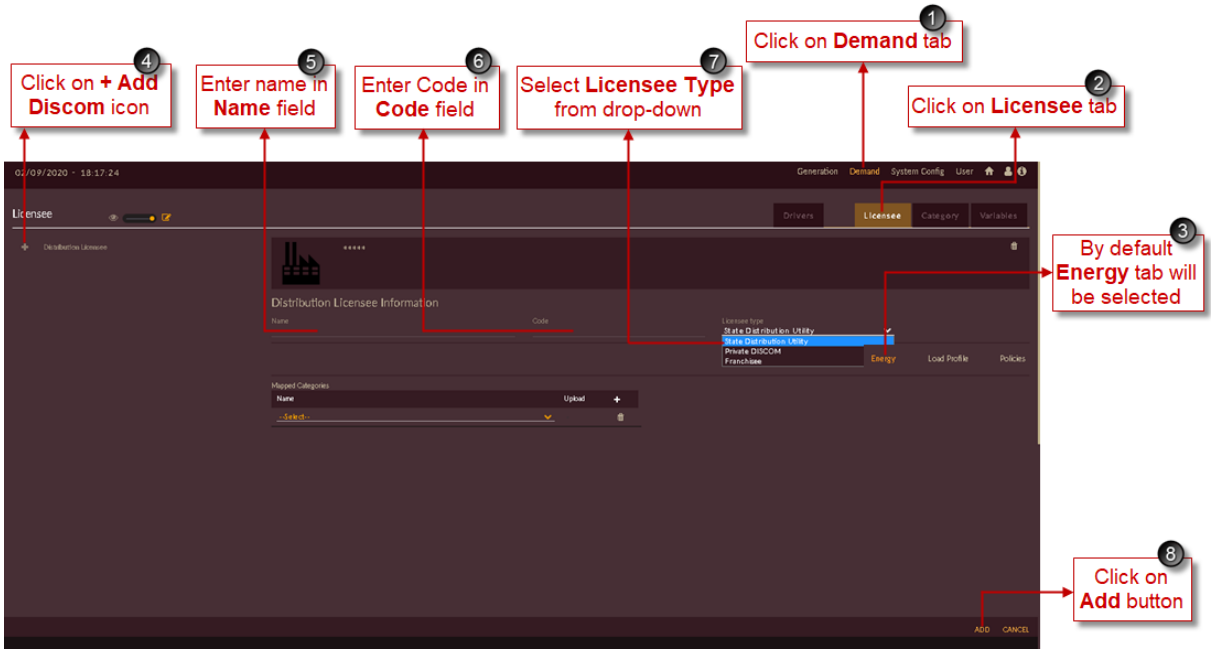
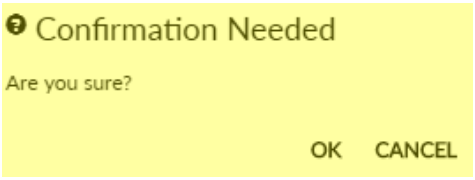


Figure 18. Introduction to Energy tab on Licensee page

8. Click on the **ADD** ADD button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

The inserted licensee appears in the list of licensees as shown in Figure 19.

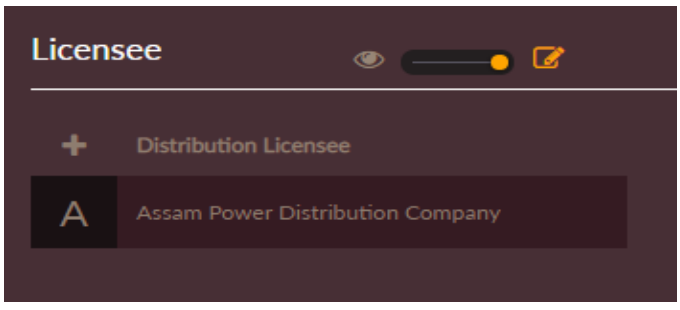


Figure 19. Licensee Added

ADDING ENERGY

This section gives you the steps to add Energy details associated with the licensee/Discom.

Follow these steps to add **Energy** details.

1. Login to the software and access **Demand** tab. The **Demand** tab appears.
2. Click on the **Licensee** tab. The **Licensee** tab appears.
3. By-default **Energy** tab is selected. The **Energy** tab appears.
4. Click on previously added **Distribution Licensee** that appears on left of screen as shown in Figure 20.
5. The **Distribution Licensee Information** appears on top.
6. Select which all categories to be involved in the study from the **Drop-down** below.
7. Click on the **Add Category** icon to select categories for the studies.

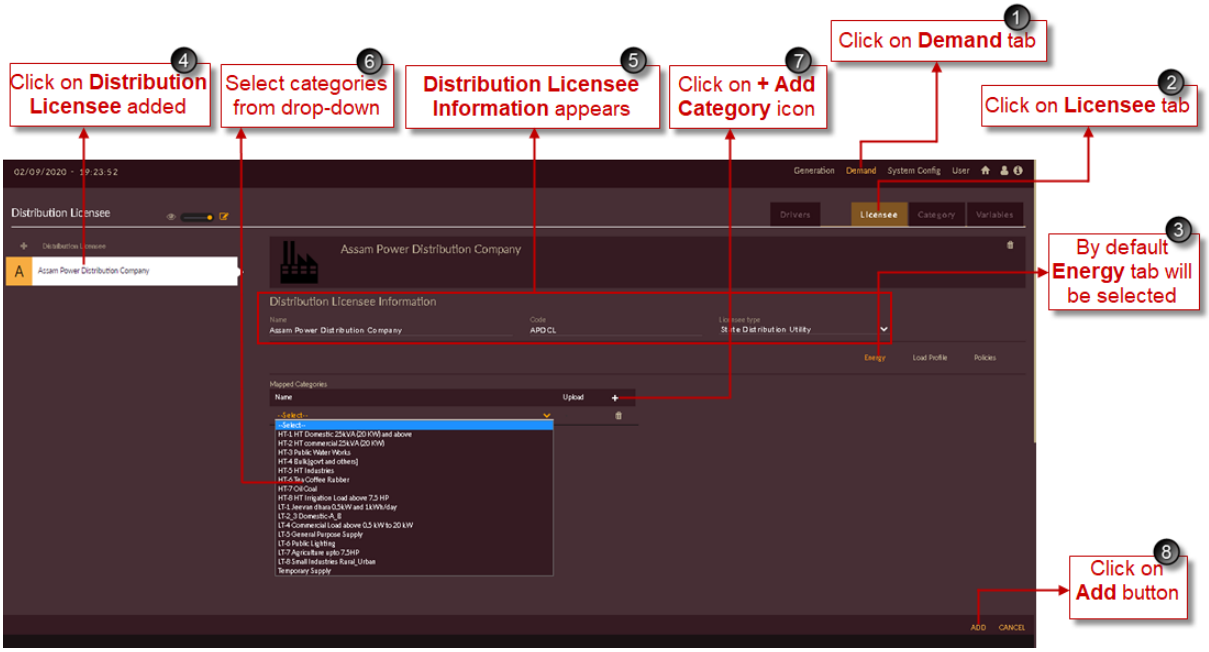
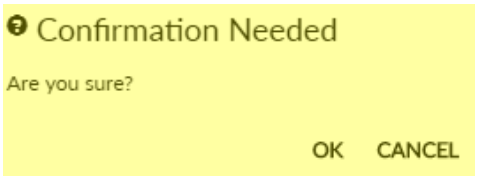


Figure 20. Adding Distribution Licensee

8. Click on the **ADD** ADD button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

Once Distribution Licensee is added, the licensee page appears as shown in Figure 21.

9. Select **Distribution Licensee** you added i.e. **'Assam Power Distribution Company'.**
10. The **Pi-Chart on Energy sales** appears on the right of the page based on categories selected.
11. To upload energy sales data click **Upload** icon for category which you need to upload data.

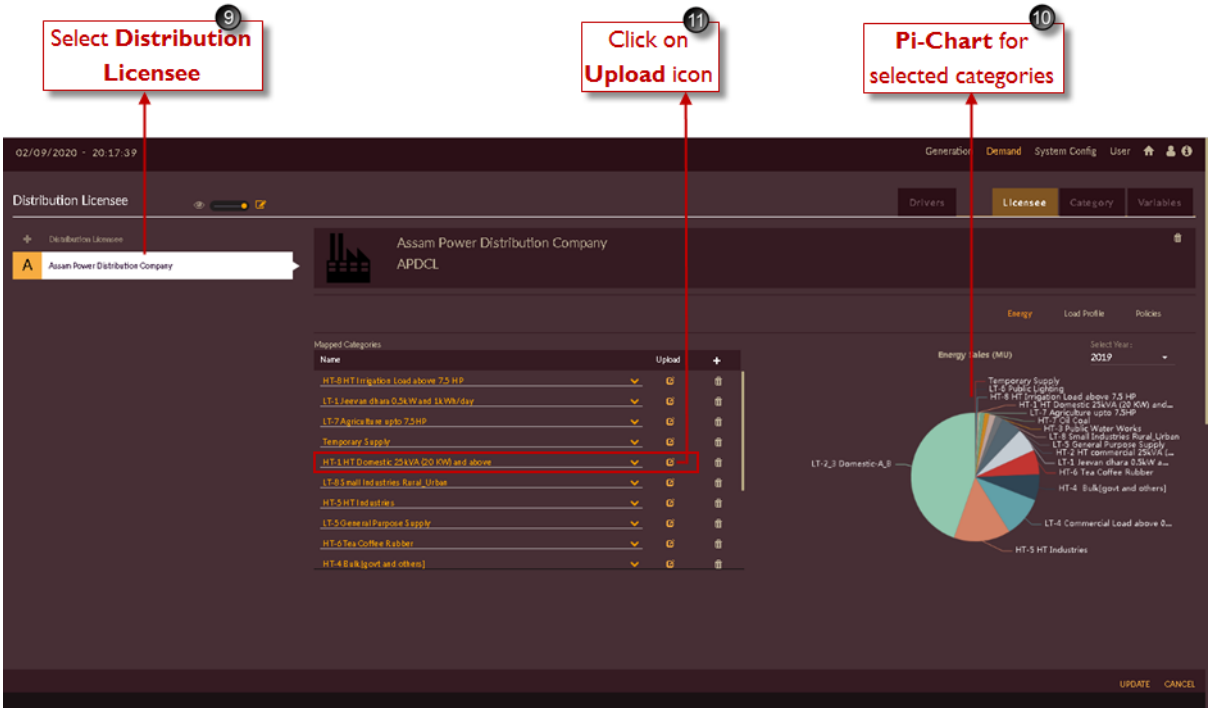


Figure 21. Page after Adding Distribution Licensee

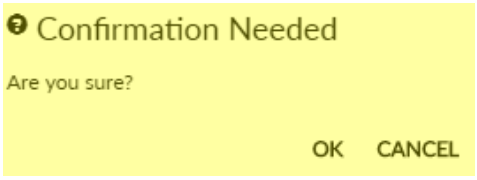
(In the current example, we have considered HT-1 HT Domestic 25kVA (20 KW) category to show how to upload energy sakes data)

Refer Table 2 for annual energy sales data and Table 3 for seasonal energy sales data of HT-1 HT Domestic 25kVA (20 KW) category.

Figure 22 shows uploading the historical annual energy sales for HT-1 HT Domestic 25kVA (20 KW) category.

12. Toggle the icon to **HISTORY** option History Forecast.
13. Toggle the icon to **ANNUAL** option Seasonal Annual.
14. Then upload the energy sales data available for historical years of HT-1 HT Domestic 25kVA (20 KW) category (Table 2).
15. Click on **SAVE** button SAVE

The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears. Click on **CANCEL** to discard the task.

16. Upon successful upoloading & saving of the data, the graph appears on the page that reflects the data uploaded.

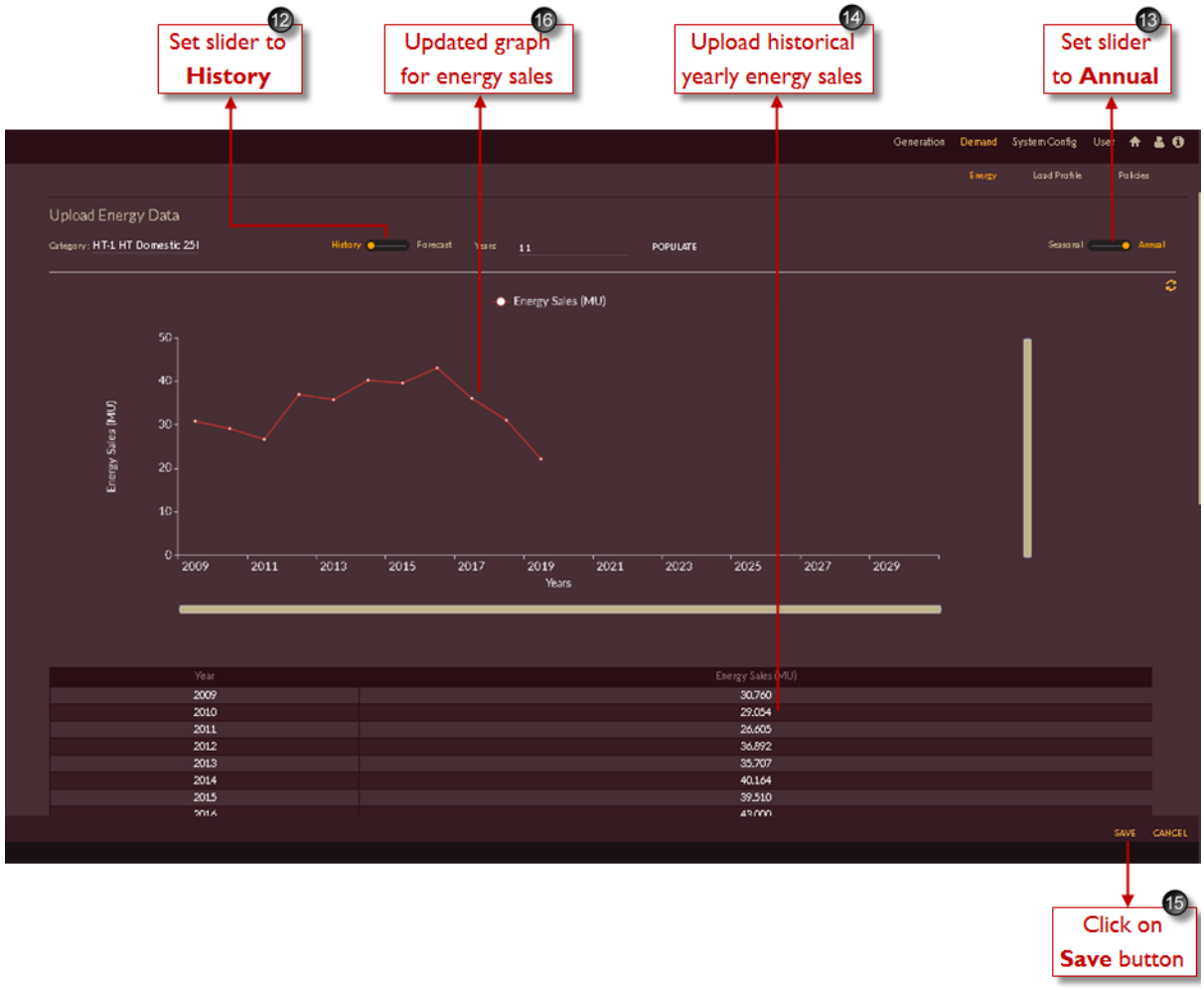


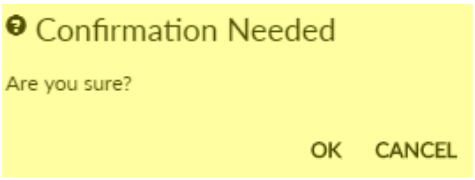
Figure 22. Annual Energy Sales Data

Figure 23 shows uploading of historical seasonal energy sales for HT-1 HT Domestic 25kVA (20 KW) category.

17. Toggle the icon to **SEASONAL** tab 

18. Then upload the energy sales data available for historical months of HT-1 HT Domestic 25kVA (20 KW) category (Table 3).
19. Click on **SAVE** button 

The "Are you sure?" confirmation pop-up appears.



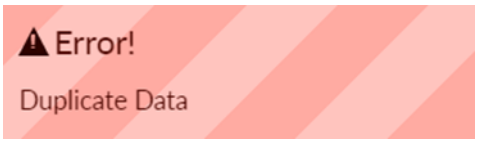
Click on **OK**. The "Inserted successfully" message appears. Click on **CANCEL** to discard the task.

20. After saving the data, the corresponding graph appears on the page for the data uploaded.

Figure 23. Seasonal Energy Sales Data

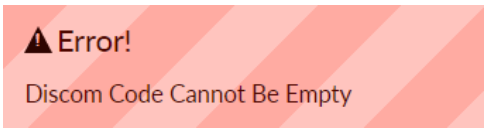
Validations set are as follows:

a) Name of the licensee should be unique: When the user attempts to add a licensee with an already existing name, the software throws the following error message.



b) Licensee/Discom name is a mandatory field. Hence, if no details are added, the software throws the following error message.

c) Licensee/Discom Code field is a mandatory field. Hence, if no details are added, the software throws the following error message.



NOTE: The same steps can be used for editing the values of Energy Sales of all the associated consumer categories by using the **UPDATE** UPDATE icon on the same page in **Edit** mode.

Repeat the above steps to add energy sales data for the categories of the respective distribution Licensee/State to perform the demand forecast studies.

ADDING LOAD PROFILE

This section gives you the steps to add **LOAD PROFILE** details associated with the licensee/Discom. You can configure the **Load Profile Data** and **Load factor** using this functionality.

Load Profile Data

The load profile data section provides a download option to download the empty load profile template, an import option to import the filled in load profile data and an export to export the load profile that is saved in the software. This exported data can serve as a reference document in the future.

Load Factor

The load factor functionality allows you to populate load factor data for 'n' years. This can be either historical or forecast data

Follow these steps to access **load profile page.**

1. Login to the software and access the **Demand** tab. The **Demand** tab appears.
2. Click on the **Licensee** tab. The **Licensee** tab appears.
3. Click on the **Load Profile** tab. The **Load Profile** tab appears.

   After you click on Load Profile tab, the Load Profile data page appears as shown in Figure 24.

4. The pre-configured distribution licensee '**Assam Power Distribution Company'** is displayed.
5. **Load Profile Data** Load Profile Data is the option where you can upload the load profile available.
6. **Load Factor** Load Factor is the option where you can either upload load factor manually or generate load factor by uploading Load Profile Data.
7. **Export** EXPORT is the option where you can download the uploaded/imported load profile.

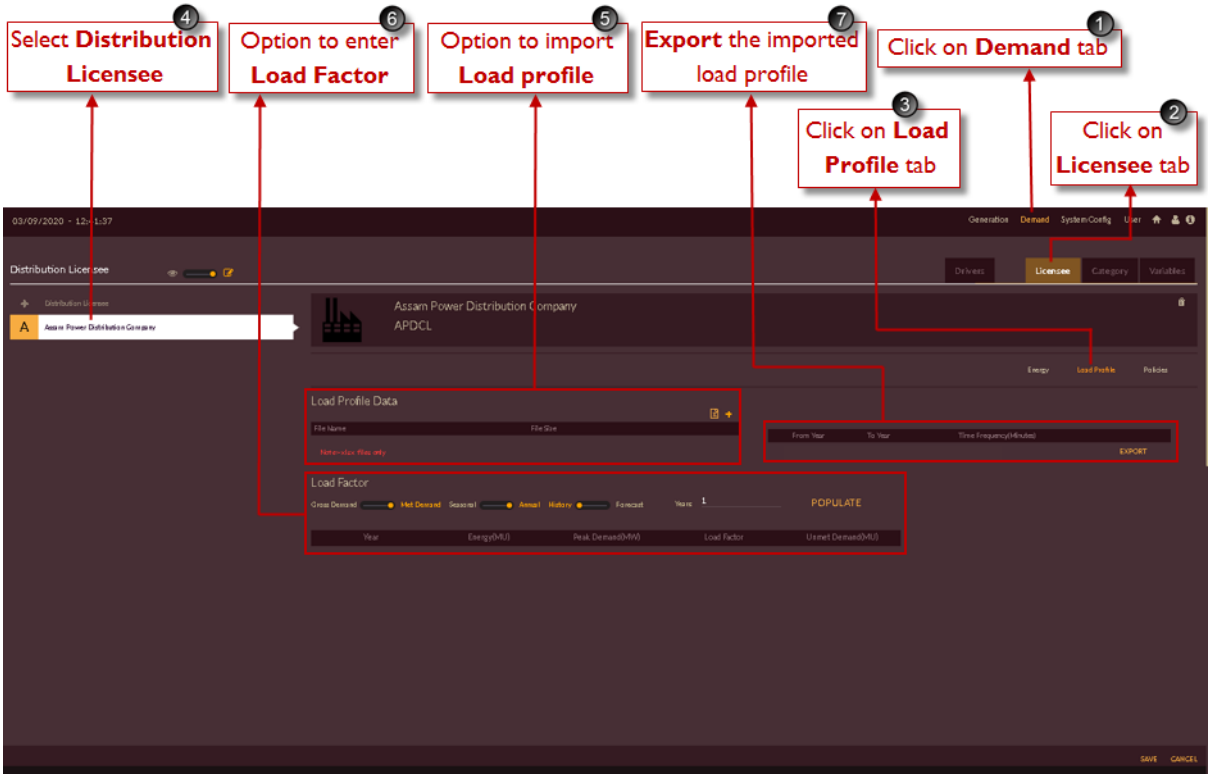


Figure 24. Understanding the Load Profile Page

Follow these steps to add load profile details.

Repeat steps from 1 to 3 in section ADDING LOAD PROFILE

4. **Do the following to configure Load Profile Data**

Figure 25. Load Profile Data Uploading Page

a) Click on the **DOWNLOAD TEMPLATE** icon. The **Download Load Profile Template** pop-up appears. Enter "From" and "To" date and click on the **Download** icon.

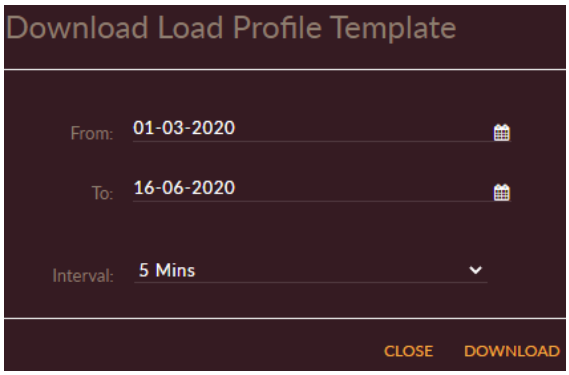


Figure 26. Download Load Profile Template

The demand template gets downloaded as template in a separate browser tab.

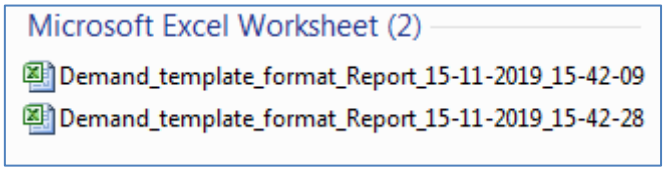


Figure 27. Downloaded Template for Load Profile

The "Demand template downloaded successfully" message appears. Click on **CLOSE** CLOSE icon to close the pop-up window.

	A	B	C	D	E	F
1	**Years**	0	**Block Limit**	60	**Type**	Historical
2						
3	**Date**	**Block**	**Met Demand(MWh)**	**Gross Demand(MWh)**		
4	01-03-2020	1	-	-		
5	01-03-2020	2	-	-		
6	01-03-2020	3	-	-		
7	01-03-2020	4	-	-		
8	01-03-2020	5	-	-		
9	01-03-2020	6	-	-		
10	01-03-2020	7	-	-		
11	01-03-2020	8	-	-		
12	01-03-2020	9	-	-		
13	01-03-2020	10	-	-		
14	01-03-2020	11	-	-		
15	01-03-2020	12	-	-		
16	01-03-2020	13	-	-		
17	01-03-2020	14	-	-		
18	01-03-2020	15	-	-		
19	01-03-2020	16	-	-		
20	01-03-2020	17	-	-		
21	01-03-2020	18	-	-		

Demand_template_format

Figure 28. Load Profile Data Template Downloaded

b) Enter the required data in the template and save it.

	A	B	C	D
1	Date	Interval	Met Demand(MWh)	Gross Demand(MWh)
2	01-04-2015	1	741.010000	-
3	01-04-2015	2	738.320000	-
4	01-04-2015	3	706.790000	-
5	01-04-2015	4	704.670000	-
6	01-04-2015	5	717.540000	-
7	01-04-2015	6	783.930000	-
8	01-04-2015	7	816.510000	-
9	01-04-2015	8	821.550000	-
10	01-04-2015	9	833.170000	-
11	01-04-2015	10	820.180000	-
12	01-04-2015	11	814.540000	-
13	01-04-2015	12	826.400000	-
14	01-04-2015	13	839.040000	-
15	01-04-2015	14	760.370000	-
16	01-04-2015	15	756.380000	-
17	01-04-2015	16	781.830000	-
18	01-04-2015	17	848.250000	-
19	01-04-2015	18	1079.600000	-
20	01-04-2015	19	1139.990000	-
21	01-04-2015	20	1103.120000	-
22	01-04-2015	21	1016.510000	-

Figure 29. Template Filled in with Appropriate Data

c) Click on **Choose File**  icon to add the Load profile data. The Windows **Open** dialog appears.

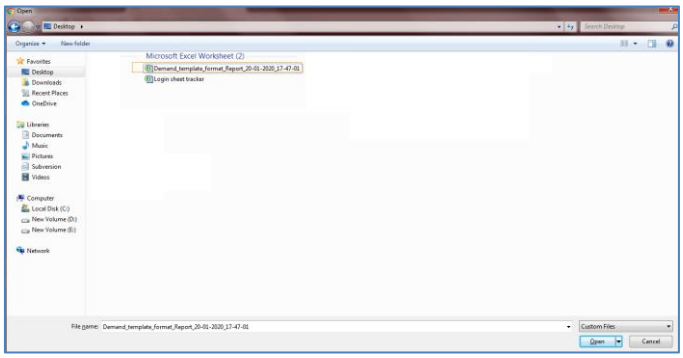


Figure 30. Selecting the Filled in Template File to Upload

d) Choose the filled in load profile file and click on the **IMPORT** button. The file gets imported. The name appears below "**File Name"** and the size of the file appears under "**File Size."**

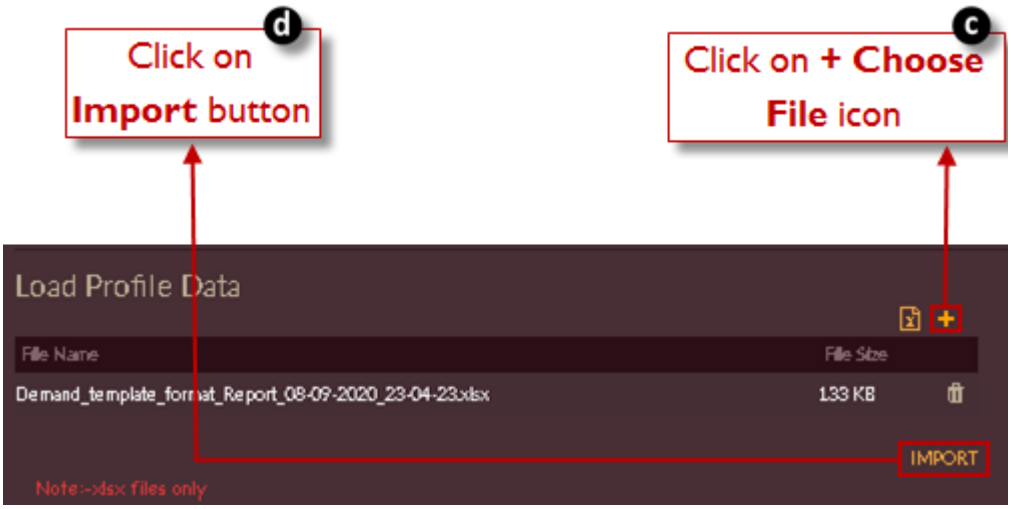
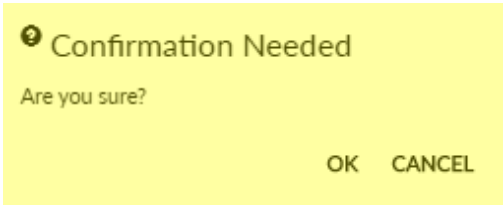
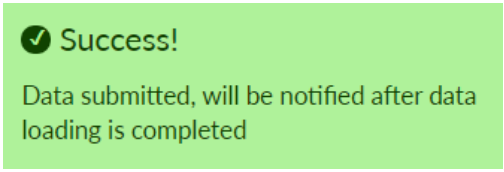


Figure 31. Select the Demand Template and IMPORT the Profile Data

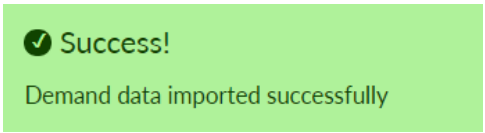
The "Are you sure?" confirmation message appears.



Click on OK icon. The success message appears.



If the file submitted is correct, the success message "Demand data imported successfully" appears.



5. Once you upload Load profile, the other parameters like Load factor, Energy, Peak Demand & Unmet Demand is calculated automatically and the page appears as shown in Figure 32.
   a) You can see the parameters like Load factor, Energy, Peak Demand & Unmet Demand calculated based on the Load profile data. You can view the data by selecting either Gross Demand or Met Demand based on Load profile you have chosen.

   b) You can see that once the Load profile is uploaded the range of years, he selected appears in the **Export** button. You can download the uploaded profile by clicking on **Export** button.

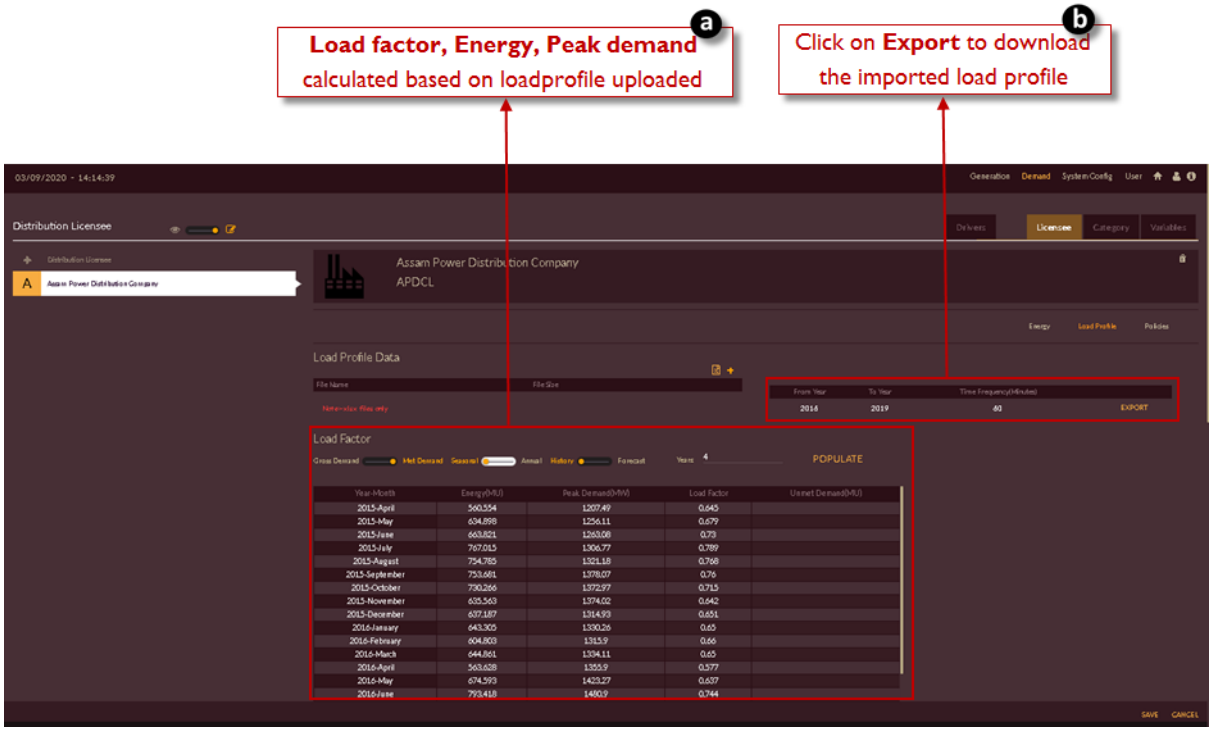


Figure 32. Load Factor Calculation after Uploading Load Profile

Follow these steps to add load factor details.

You can directly upload the Load factor, Energy, Peak Demand & Unmet Demand data if available.

1. Login to the software and access **Demand** tab. The **Demand** tab appears.
2. Click on the **Licensee** tab. The **Licensee** tab appears.
3. Click on the **Load Profile** tab. The **Load Profile** tab appears.

   Once you click on the Load Profile tab, the page appears as shown in Figure 33.
4. Select the toggle icons based on the data you are uploading

   a) Set the slider to **Seasonal** or **Annual** based on the data you are uploading.
   Seasonal – for Monthly data & **Annual** – for Yearly data
   b) Set the slider to **History** or **Forecast** based on the data you are uploading.
   History – for Historical data & **Forecast** – for Future data
   c) Enter the number of years for which you have data to upload and click on the **Populate** POPULATE icon. Based on number of years entered, empty rows appear to upload the data.
5. You can fill the data for Energy, Peak Demand, Load Factor and Unmet Demand in the empty rows generated.

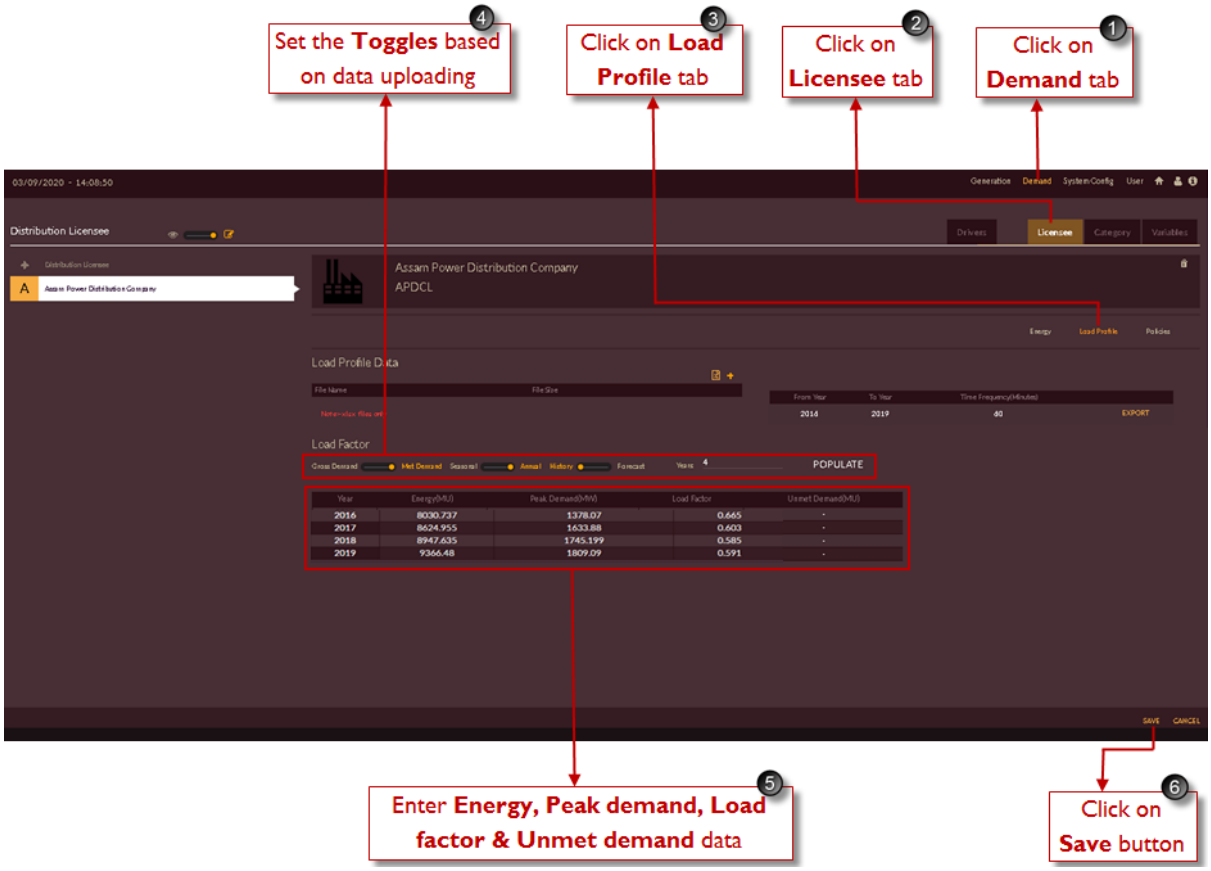
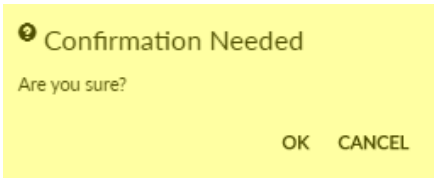


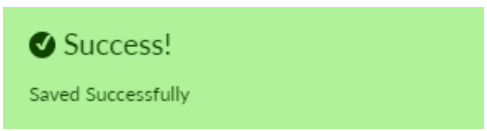
Figure 33. Load Profile Data page to Update Load Factor Details Manually

6. Click on the **SAVE** SAVE button.

   The "Are you sure?" confirmation message appears.



   Click on OK icon. The "Saved Successfully" message appears.



ADDING POLICIES

This section gives the steps to add policies for the licensee/Discom. You can add policies and map them from the library using this module. While adding a new policy, it is important to add the name of the policy, the years it is active, for which category the policy is for and the factors it impacts to learn the load forecasting.

FOLLOW THESE STEPS TO ADD NEW POLICIES INTO THE SOFTWARE

Let us consider government has introduced new policy which will be impacting on Licensee or Category or Variable.

The new policy introduced will not be present in software as pre-configured, in such a case you have to create new policy and configure it into the software.

1. Login to the software and access **Demand** tab. The **Demand** tab appears.
2. Click on the **Licensee** tab. The **Licensee** tab appears.
3. Click on the **Policies** tab. The **Policies** tab appears.
4. Set slider to **New** and **Annual/Seasonal** based on data to be uploaded.

Uploading new policy data is shown in Figure 34.

5. Enter the Policy Name in **Name field**.
6. Choose the option from drop-down on which the new policy impacts (Licensee, category or variable).
7. Click on **Add Year** 

tab to add new rows and **Remove Year** 

tab to delete the rows based on data and study period.
8. Zeros will be pre-filled in the page; you have to upload the policy data for which Licensee or Category or Variable it is impacting.

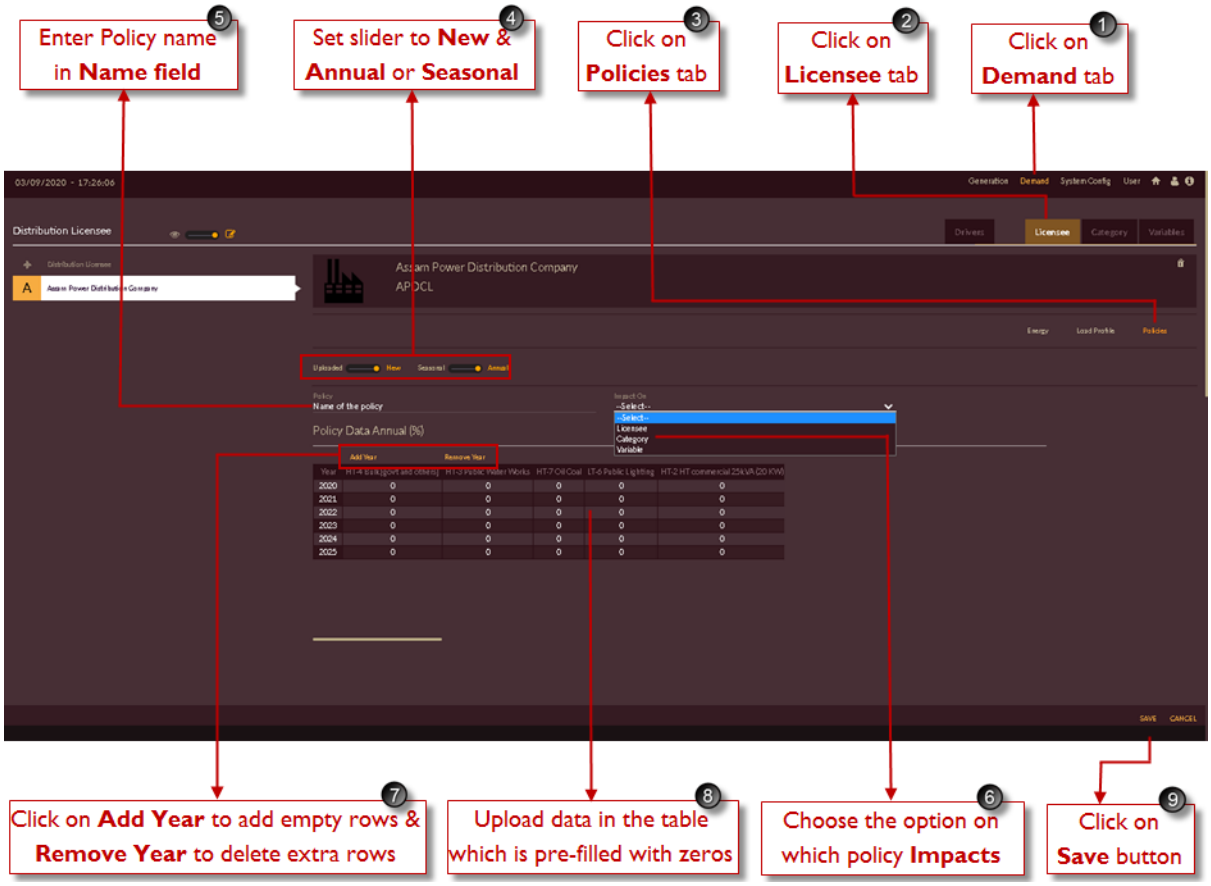
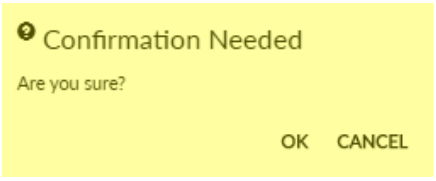


Figure 34. Steps to Add New Policy

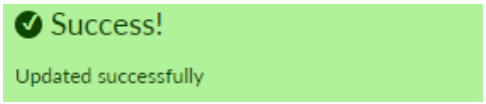
9. Click on **SAVE** SAVE button to save the data.

The "Are you sure?" confirmation pop-up appears.



Click on **OK** icon.

The "Saved Successfully "confirmation message appears.



Repeat the above steps to add new policies into the software which will impact on the pre-configured State/DISCOM Licensee or Category or Variable for carrying out the demand forecast studies.

Let us consider we have only added list of policies into the application and no data is added. Once policies are configured, we have to add data into it.

FOLLOW THESE STEPS TO ADD POLICIES' DETAILS

Let us consider Policy named **LED PENETRATION** which is configured in software is impacting on **HT 1- HT DOMESTIC** category and sample data is shown in Table 4.

1. Login to the software and access **Demand** tab. The **Demand** tab appears.
2. Click on the **Licensee** tab. The **Licensee** tab appears.
3. Click on the **Policies** tab. The **Policies** tab appears.
4. Set slider to **Uploaded** and **Annual** as required

Uploading policy data is shown in Figure 35.

5. Select the policy which you need for studies say here **'LED Penetration'**.
6. Automatically impact of policy will be mapped say here selected policy has impact on **'Category'**.
7. Upload the data for category which is getting impacted by selected policy say here **'HT-1 HT Domestic'** category.

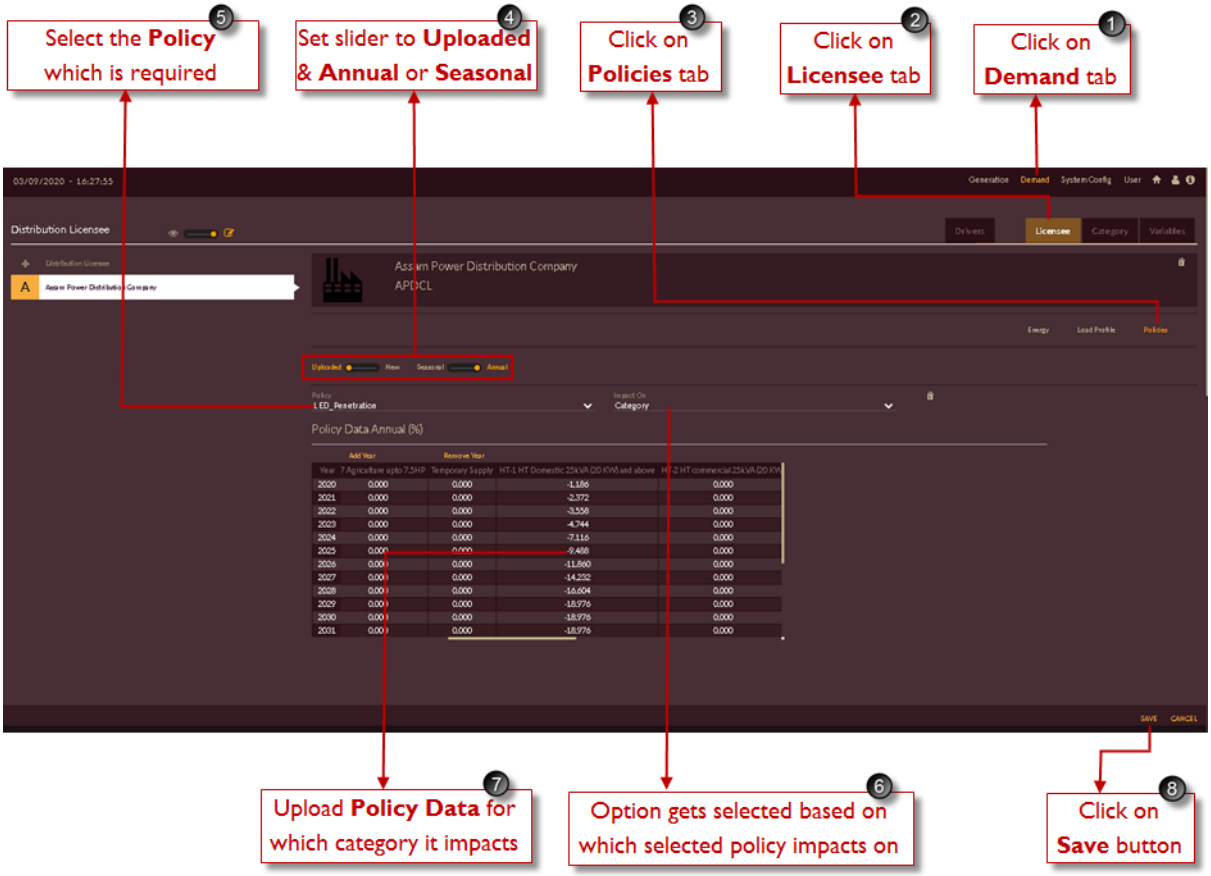
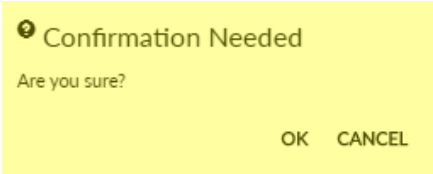


Figure 35. Uploading Policy Data for the Category

8. Click on **SAVE** SAVE button to save the data.

The "Are you sure?" confirmation pop-up appears.



Click on **OK** icon. The "Saved Successfully "confirmation message appears.

VIEWING LICENSEE

This section gives you the steps to view the licensee details.

Repeat first two steps of

ADDING LICENSEE section

3. Move the **View or Edit** slider to **View** side.

4. The **Licensee** page appears as shown in Figure 36.

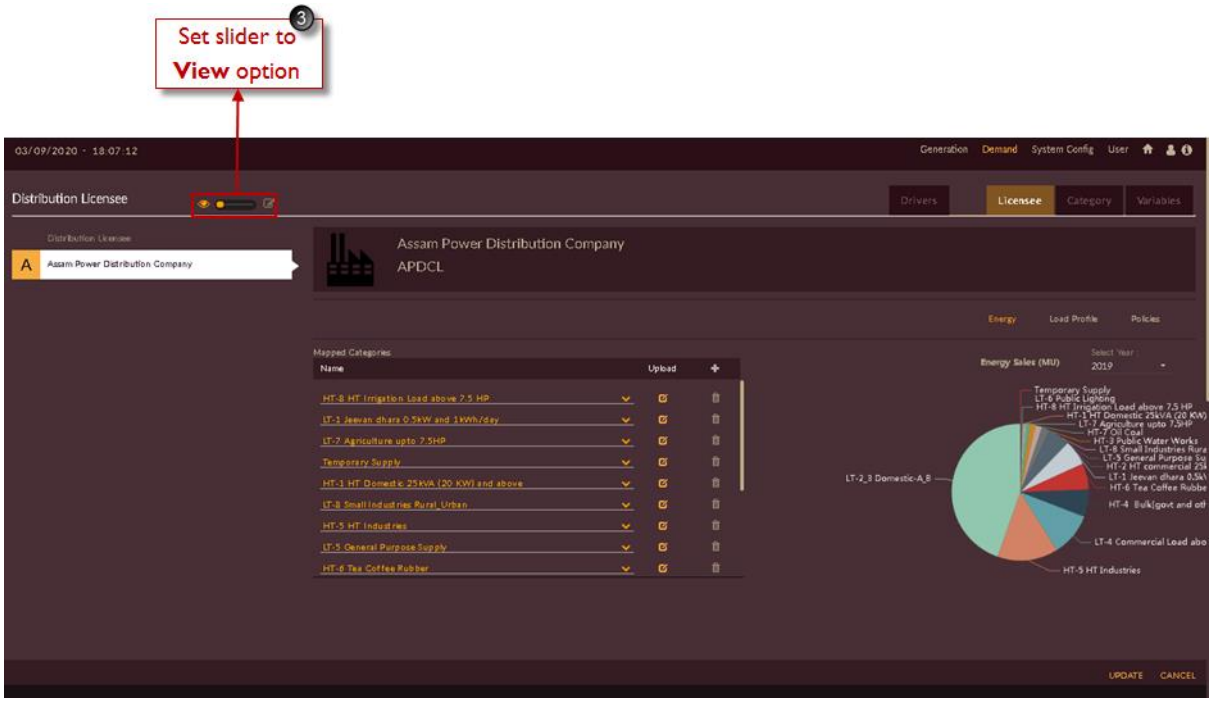


Figure 36. Viewing Licensee

EDITING LICENSEE

This section gives you the steps to edit the licensee details. You are allowed to edit the energy, load profile and policies data of a licensee using these editing options.

Editing Energy Data:

Repeat first three steps of **ADDING ENERGY** section

You will see the page as shown in Figure 37

4. Move the **View or Edit** slider to **Edit**  .

5. Click on the **Upload Energy Data**  icon for which category you need to edit energy sales. In manual it is shown for **HT-1HT Domestic** category.

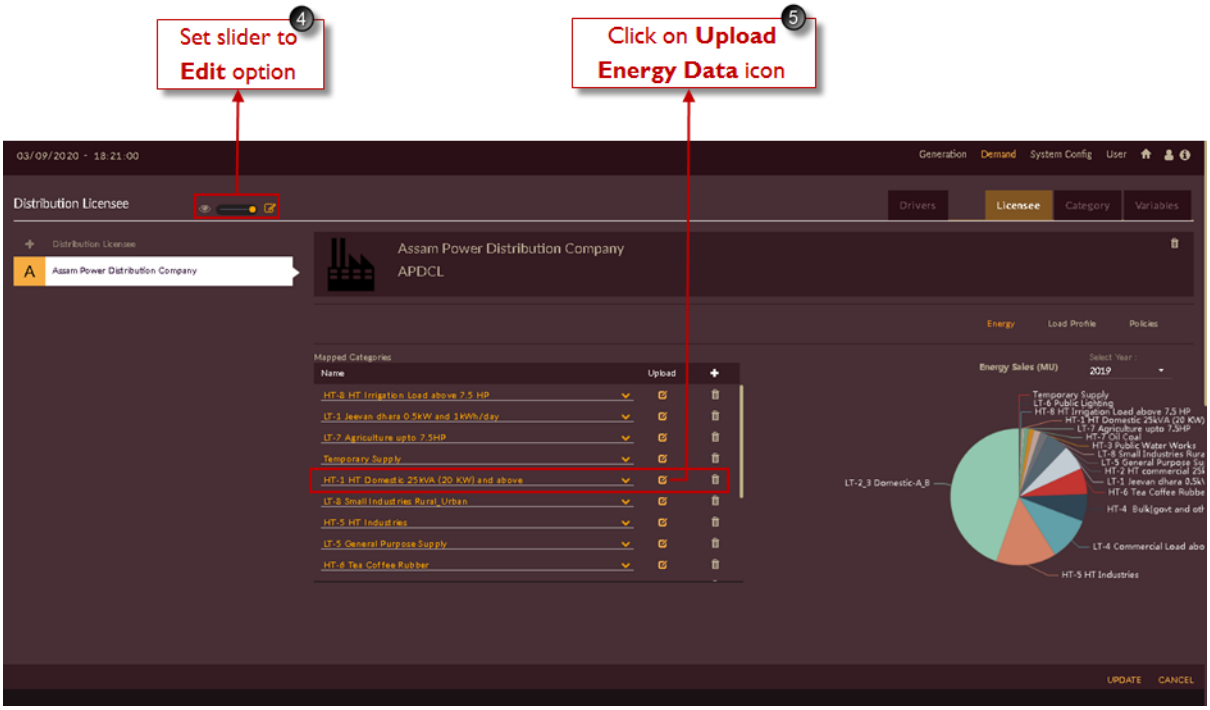


Figure 37. Editing Enegy Sales Data on Energy Page

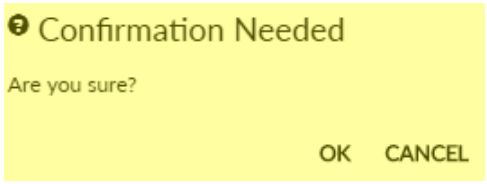
As you click edit icon the Energy page appears as shown in Figure 38.

6. Double-click on the row to make the table editable and make the changes in the table by altering a specific value of energy sales as needed and as shown in below Figure 38.

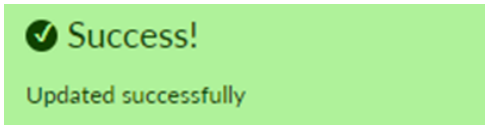
Figure 38. Editing Energy Sales Data

7. Click on **SAVE** SAVE button to make the changes.

   The "Are you sure?" confirmation message appears.



   Click on **OK** icon. The "Updated successfully" message appears. Click on **CANCEL** to discard the changes.



   The edited record appears in the list and graph gets updated.

   Repeat the above steps to edit energy sales data for other categories.

Editing Existing Load Profile Data:

This section gives you the steps to edit the existing load profile data of a licensee.

Repeat first three steps of **ADDING LOAD PROFILE** section

The Load Profile page appears as shown in Figure 39.

4. Follow these steps to edit the uploaded load profile. :

   a) Download the previously imported load profile by clicking on **Export** EXPORT button.

b) Downloaded file will appear on **Task bar** of the page in **.xlsx** format.

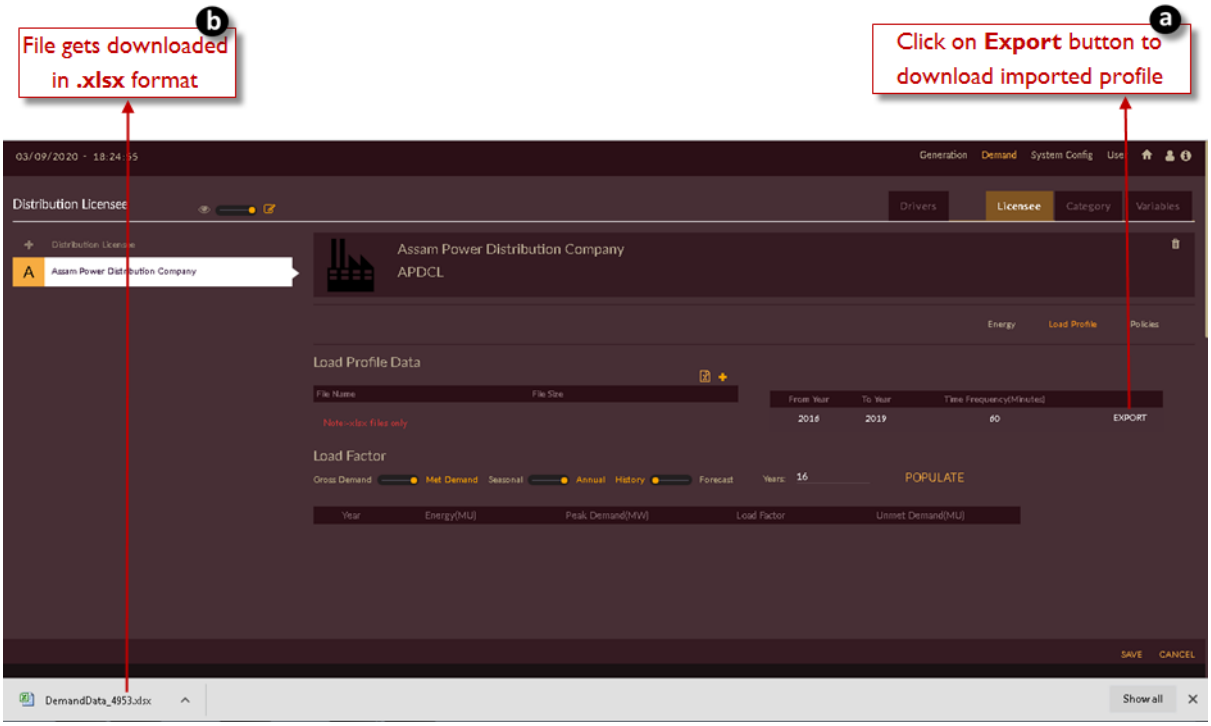


Figure 39. Editing Load Profile Data

You can edit the profile and can import it again by repeating the steps shown in **ADDING LOAD PROFILE** section.

Editing Existing Load Factor Data:

Follow the following steps to edit the load factor uploaded manually by user

1. Login to the software and access **Demand** tab. The **Demand** tab appears.
2. Click on the **Licensee** tab. The **Licensee** tab appears.
3. Click on the **Load Profile** tab. The **Load Profile** tab appears.

After you click on Load Profile tab, the page appears as shown in Figure 40.

4. Move the **View or Edit** slider to **Edit** side 
5. You have to select the toggle icons based on the you need to edit

d) Set the slider on **Seasonal** or **Annual** based on the data you need to edit.
Seasonal – for Monthly data & **Annual** – for Yearly data

e) Set the slider on **History** or **Forecast** based on the data you need to edit.
History – for Historical data & **Forecast** – for Future data

f) Enter number of years based on data to edit and click on **Populate** POPULATE tab, based on number of year's uploaded data will appear on page.

6. To edit data, double click on the cell you need to edit.

   As you change Energy/Peak Demand value **Load Factor** will get automatically updated in **Load factor** column.

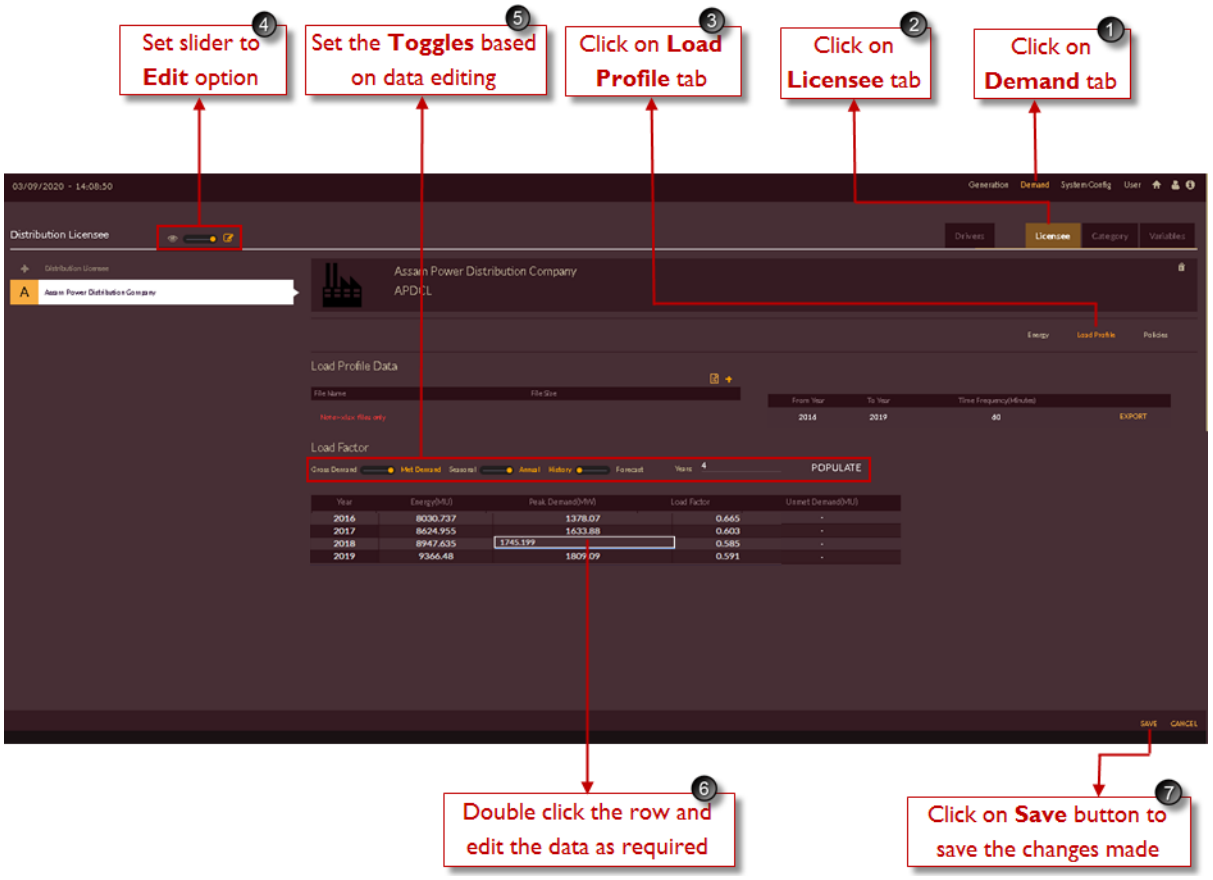
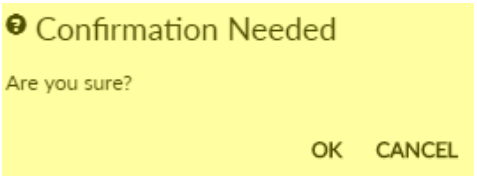


Figure 40. Editing Load Factor Data Manually

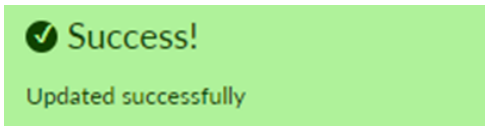
7. Click on **SAVE** SAVE button.

The "Are you sure?" confirmation message appears.



Click on **OK** to make the changes. Click on CANCEL to discard the changes.

The "Updated successfully" message appears.



The updated details appear on the page.

Editing Existing Policies Data:

This section will help user to edit policy data by following the given steps

1. Login to the software and access the **Demand** tab. The **Demand** tab appears.
2. Click on the **Licensee** tab. The **Licensee** tab appears.
3. Click on the **Policies** tab. The **Policies** tab appears.

After you click on Policies tab, the page appears as shown in Figure 41.

4. Move the **View or Edit** slider to **Edit** side 
5. Set the slider to **Uploaded** 

option and select **Seasonal/Annual** and **Policy** name based on you need to edit the data for policy.
   Here example is shown for editing data of **LED Penetration** policy
6. Double click on the row which you need to edit the data.

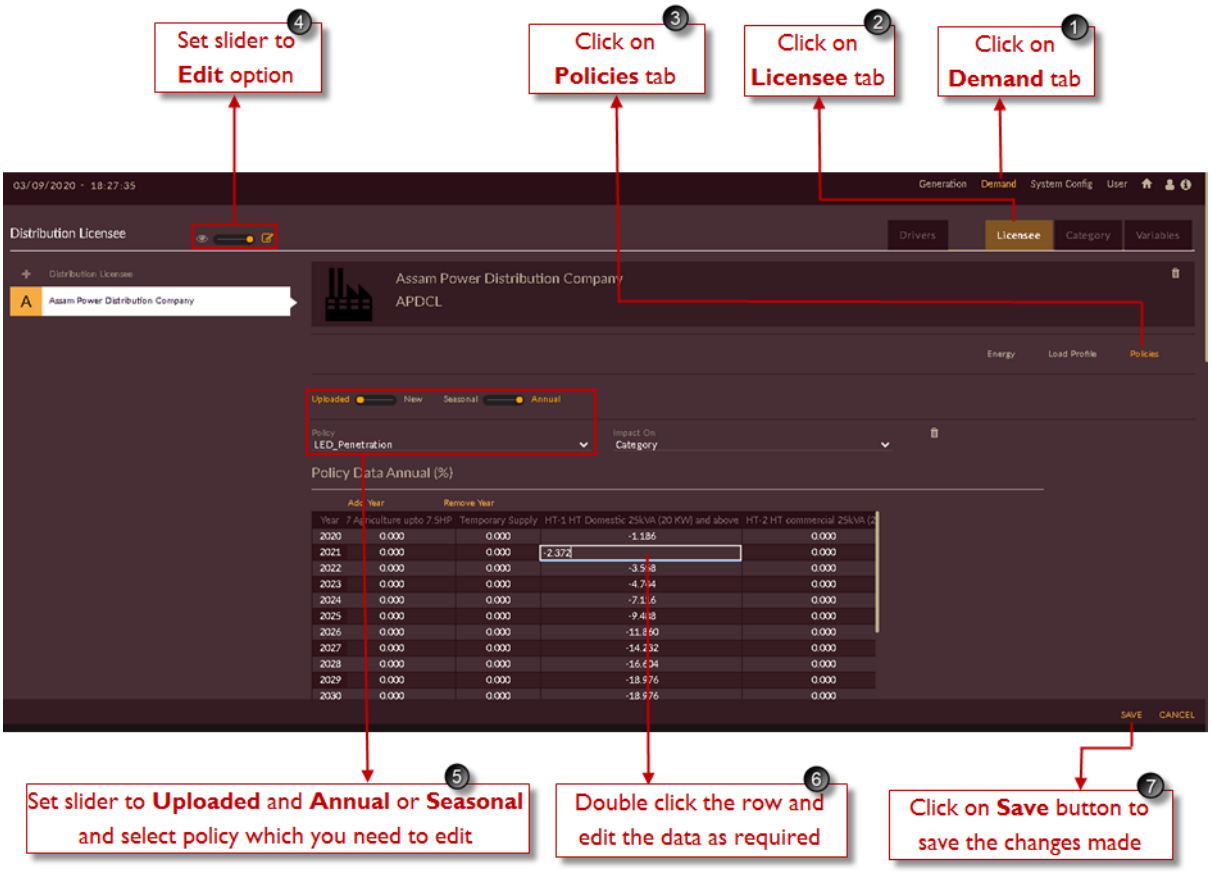
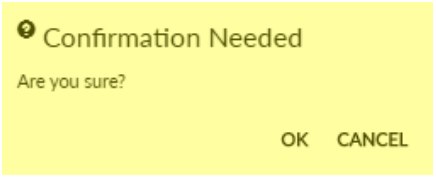


Figure 41. Editing Policy Data

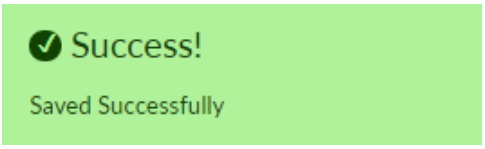
7. Click on **SAVE**  button to save the data.

The "Are you sure?" confirmation pop-up appears.



Click on OK button. Click on the CANCEL button to discard the changes.

The "Saved Successfully "confirmation message appears.



The Edited policy details appear on the page.

Repeat the above steps to edit other policy data for other categories.

2.1.3 Additional Parameters

The additional parameters include the system configuration information such as seasons and Transmission & Distribution Losses as both these parameters are observed to have higher impact on the demand experienced by the utility. The seasons and T&D modules are provided under **SYSTEM CONFIG** tab.

Steps to access SYSTEM CONFIG page:

1. Login to the software and access **System Config** tab. The **System Config** tab appears

After you click on **System Config** tab the software page looks like as shown in Figure 42.

2. **Seasons** tab is used to enter seasons data
3. **T & D Loss** tab is used to configure transmission – distribution losses in to system.
4. Click on the  **Add Season data** icon to add the season's data.
5. **RPO** tab is used to enter RPO targets data.

Figure 42. Introduction To System Config Page

2.1.3.1 SEASONS

Along with the demand parameters considered for demand forecasting, the additional parameters such as seasons and T&D Losses are to be considered. This section gives the introduction and steps to configure the seasons' variable that gets used in the execution of load forecast studies. In general, the seasons are of four types as shown in Table 5.

Table 5. Seasons List

SL. NO.	SEASONS	FROM – TO PERIOD
1	Autumn	July - August
2	Monsoon	September – November
3	Summer	March – June
4	Winter	December - February

STEPS TO ADD SEASONS DATA

1. Login to the software and access **System Config** tab. The **System Config** tab appears.
2. Click on the **Seasons** tab. The **Seasons** tab appears.

   After you click on Seasons tab the software page looks like as shown in Figure 43.

3. Click on the  **Add Season Data** icon. An empty record appears.
4. Add name in **Name** field and select "**From**" & "**To**" period from the calendar as shown in Figure 43.

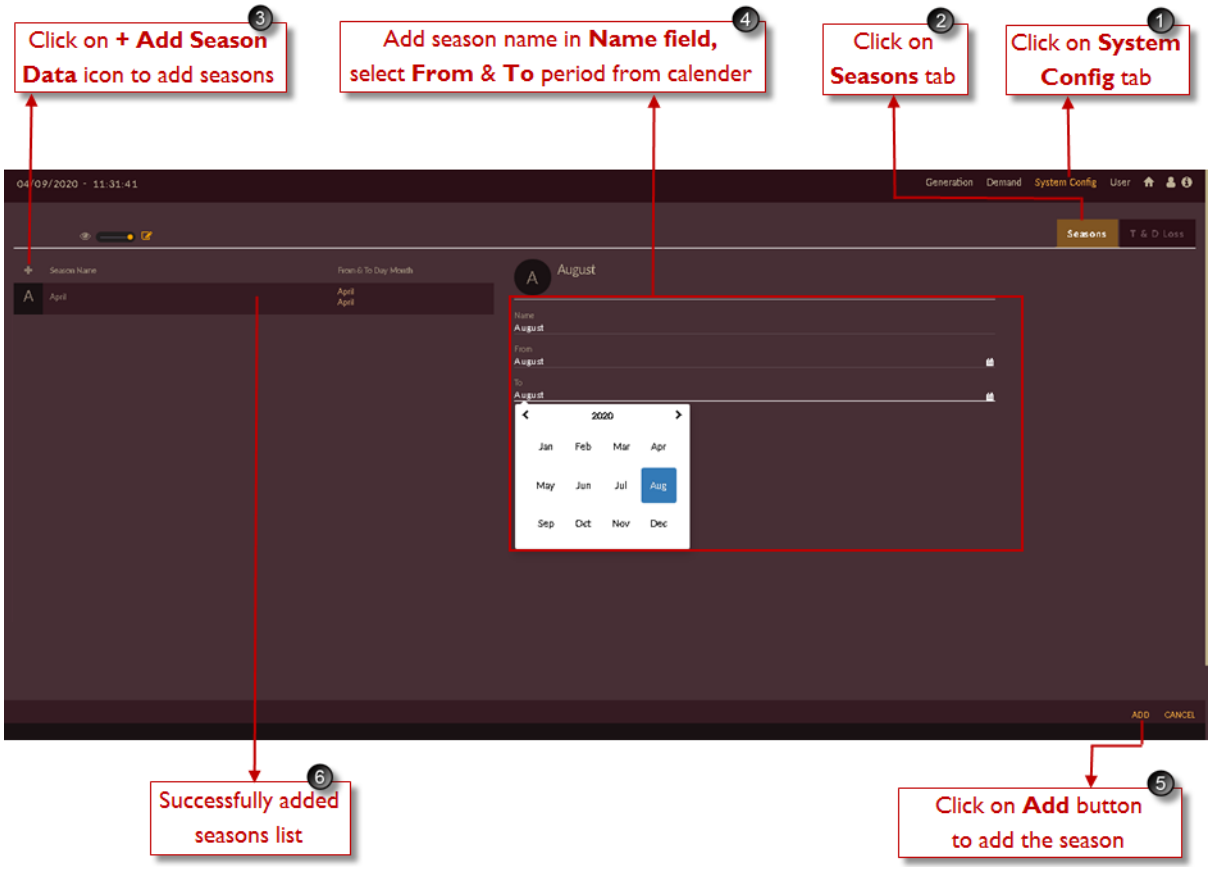
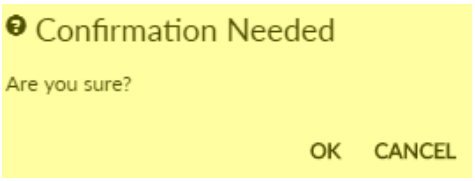


Figure 43. Adding Seasons

5. Click on the **ADD** ADD button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

6. The inserted seasons' list will appear on left of the page in alphabetic order.

STEPS TO VIEW/EDIT/DELETE SEASONS DATA:

Repeat first two steps as given in **SEASONS** section

3. Select which season data you need to view/edit/delete.
   (In Figure 44, January is selected as an example)
4. Set the **View-Edit**  slider as user requirement.

5. If you need to edit data set slider to edit option and make the changes required like name, from & to period.

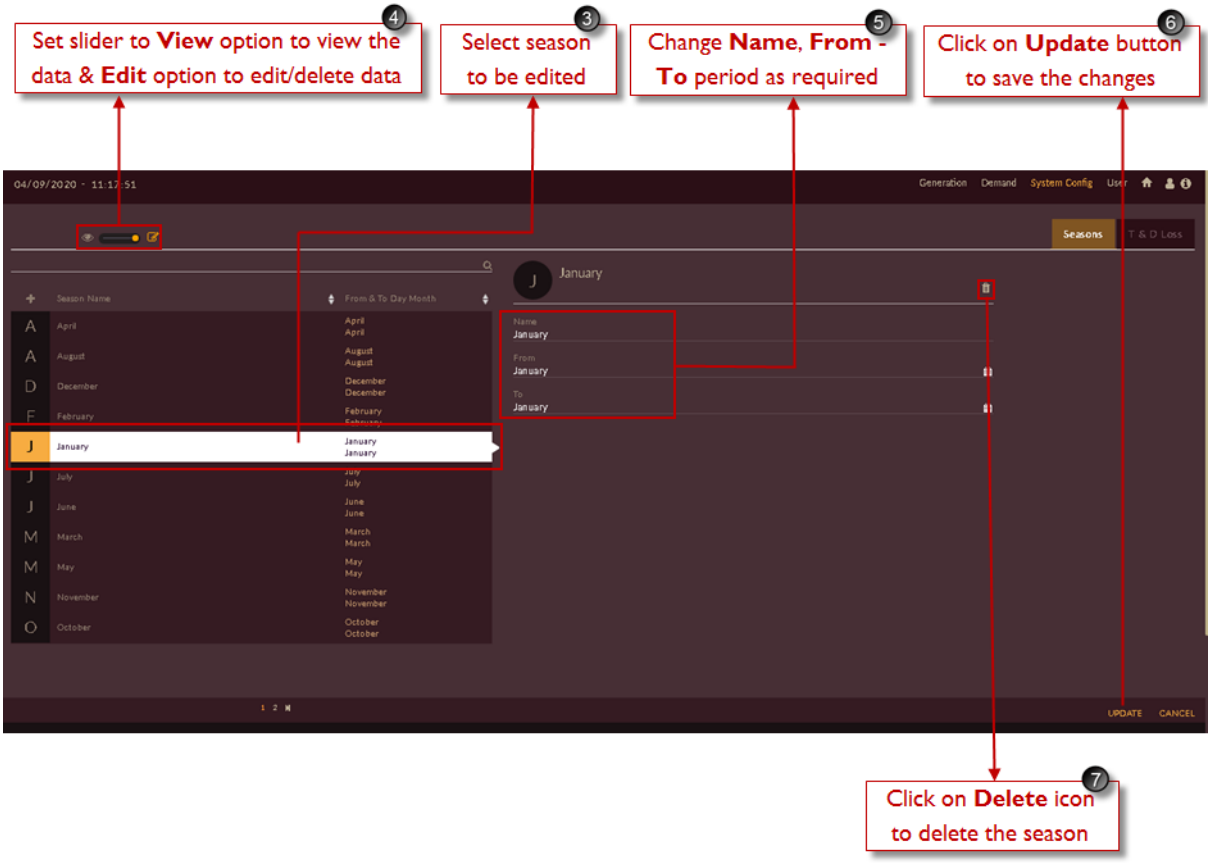
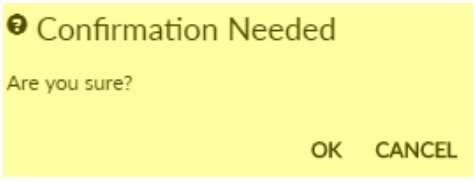


Figure 44. View/Edit/Delete Seasons

6. Click on **UPDATE** UPDATE button to save the changes.

   The "Are you sure?" confirmation message appears.

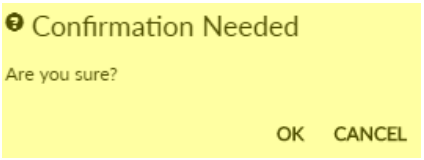


   Click on **OK** to accept the changes made. The "Updated successfully" message appears.

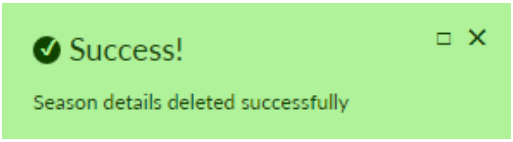
   The updated record appears in the list.

7. You can also delete the record by clicking on **Delete** icon.

   The "Are you sure?" confirmation message appears.



Click on **OK**. The "Season details deleted successfully" message appears.



The deleted record is removed from the list.

2.1.3.2 TRANSMISSION & DISTRIBUTION LOSSES

This section gives the description on Transmission and Distribution losses and this functionality gives the steps to configure, add, view, edit and delete T & D losses in the software.

T&D losses also account for a reduction in the total demand of a State. Programs like Ujjwal Discom Assurance Yojana (UDAY), Integrated Power Development Scheme (IPDS), and etc. aim at bringing down the AT&C losses of the country. For instance, IPDS aims at reducing the AT&C losses by strengthening of sub-transmission and distribution network and by metering of distribution transformers /feeders / consumers in the urban areas. This is supported by establishment of IT enabled energy accounting / auditing system, improvement in billed energy based on metered consumption and improvement in collection efficiency. In line with this program, DISCOMs have developed trajectories of loss reduction, which shall be considered in Demand Forecast. In addition to these trajectories, the actual reduction of T&D losses in the past years shall also be weighed to arrive at the most probably rate of loss reduction.

You can choose either the historical data or the forecast data. When you choose the historical data, by default 16 years data is considered. The percentage of loss against the number of years is populated as both graph and table data.

STEPS TO CONFIGURE TRANSMISSION & DISTRIBUTION LOSSES INTO THE SOFTWARE:

1. Login to the software and access **System Config** tab. The **System Config** tab appears.
2. Click on the **T & D Loss** tab. The **T & D Loss** tab appears.
   After you click on T & D Loss tab the software page looks like as shown in Figure 45.
3. Set **Seasonal/Annual, History/Forecast** and number of **Years** based on data configuration then click on **POPULATE** POPULATE icon.

4. Upload the data for T&D Losses in **Loss(%)** column.

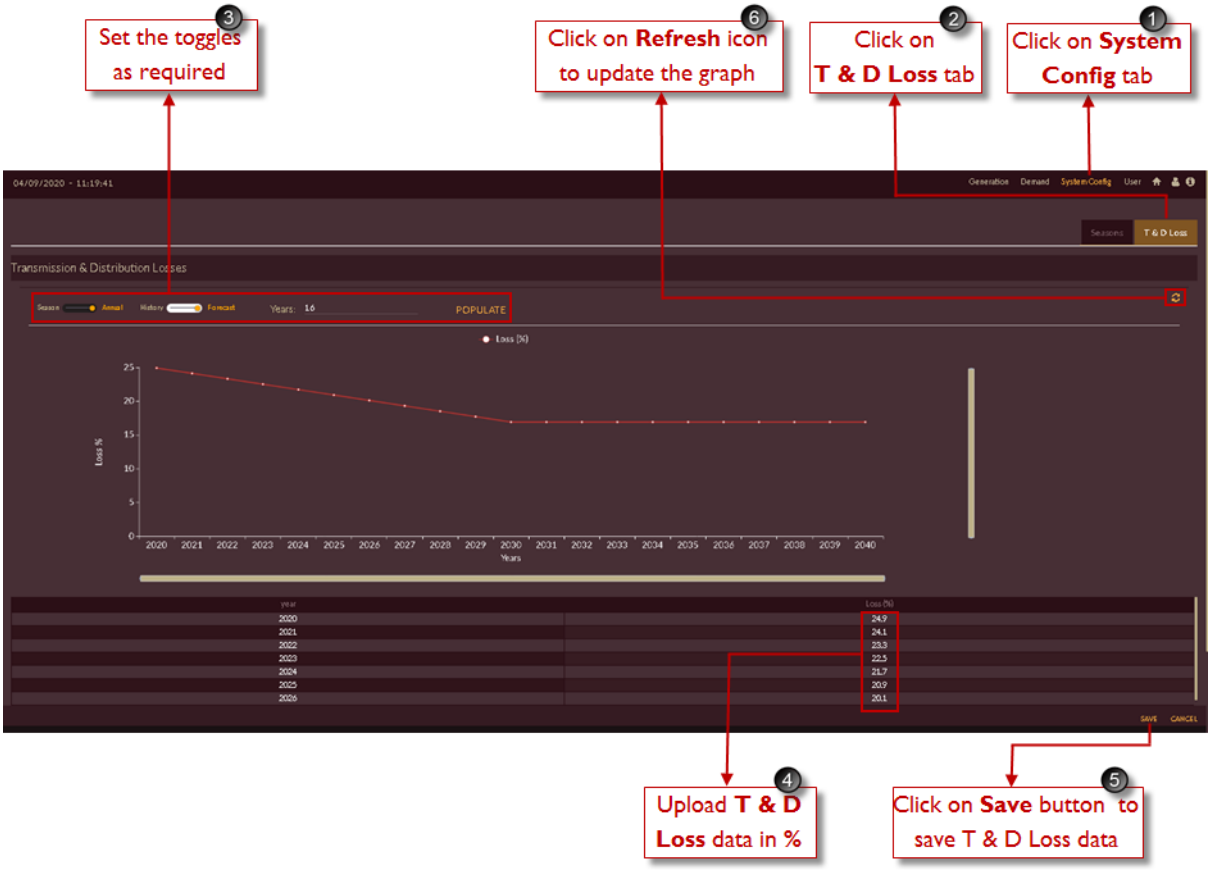
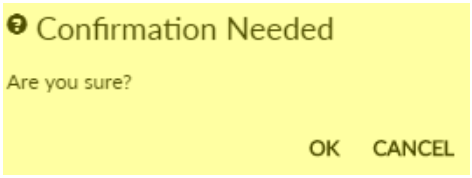


Figure 45. Addition T & D Loss

5. Click on **SAVE** SAVE button.

   The" Are you sure?" confirmation message appears.



   Click on **OK** to confirm adding the role. The "Inserted successfully" message appears. Click **CANCEL** to discard the task.

6. Click **Refresh** icon, the graph gets generated and it shows T & D Losses percentage for populated years.
7. The same data is also provided in tabular format below the graph.
8. You can also modify the data and save using the SAVE icon and regenerate the graph.

2.1.3.3 DRIVERS

This section describes the driving factors that impact the load pattern for the selected period of time. The resultant assessed variations are either added or subtracted from the proposed generation to match the demand.

The factors included for the execution are the following:

Open Access (OA)

Open access is the share of energy that is consumed from sources other than the Licensee/DISCOMs by the consumers. The increase or decrease in **Open Access** energy is configured annually for "n" years selected by the user. This value is subtracted from the total generation figure for the Discom.

The OA module allows the user to configure the OA values for a selected period of time and use it for final estimation.

Captive Power Plant (CPP)

A captive Power Plant is a facility that provides a localized source of power to an energy user. Usually these are the industries or large facilities or commercial office units. They can operate in two modes: Island mode – where the CPP works independently of the local electricity distribution systems and Grid Parallel mode – where these facilities are capable of exporting their surplus power to the local electricity distribution network. Captive power plants are a form of distributed generation, generating power close to the source of use. Distributed generation facilitates the high fuel efficiency along with minimizing losses associated with the transmission of electricity from centralized power plants.

The CPP module allows you to configure the energy share that is taken from the CPPs and not from DISCOMS. Hence this share is subtracted from the estimated power to be generated.

Distributed Energy Resources (DER)

DER stands for Distributed Energy Resources**.** These are the micro-grids (solar/rooftop solar) units of power generation sources that provide power to the consumers locally. The share of DERs are essential to be subtracted from the estimated load on the Discom, hence the generation can be optimized accordingly.

The DER module allows you to configure the DER categories and DER configuration details that participates in the demand forecast.

Electric Vehicles (EV)

Based on the policies, the increase in the number of electric vehicles is expected to rise rapidly. The grid is expected to experience a higher EV penetration. In order to provide the exact demand experienced by the utility, it is essential to include the EV penetration data therefore; EV data should be added for the estimated load on Discom. This module allows you to create the categories of EVs, the configure the EVs' specifications, and the quantum of energy these consumes, the re-charging cycles

and all other details essential to determine the impact of EVs in the demand forecast. The EV module is used to configure the **EV category** and **EV configuration** data.

ACCESSING DRIVERS DETAILS

This section gives you the steps to access Driver details in the software.

Prerequisite

- The Licensee/DISCOM should be mapped with appropriate variables before uploading the OA Values.
- You must have appropriate rights to configure the data.

Follow these steps to access **Drivers** page.

1. Login to the software and access **Demand** tab. The **Demand** tab appears.
2. Click on the **Drivers** tab. The **Drivers** tab appears.
   Then you will see the page as shown in Figure 46
3. The **Drivers** tab details appear. It has four sub-tabs: **OA**, **CPP**, **DER**, **and EV**.

4. By default, **OA – Open Access** is selected.

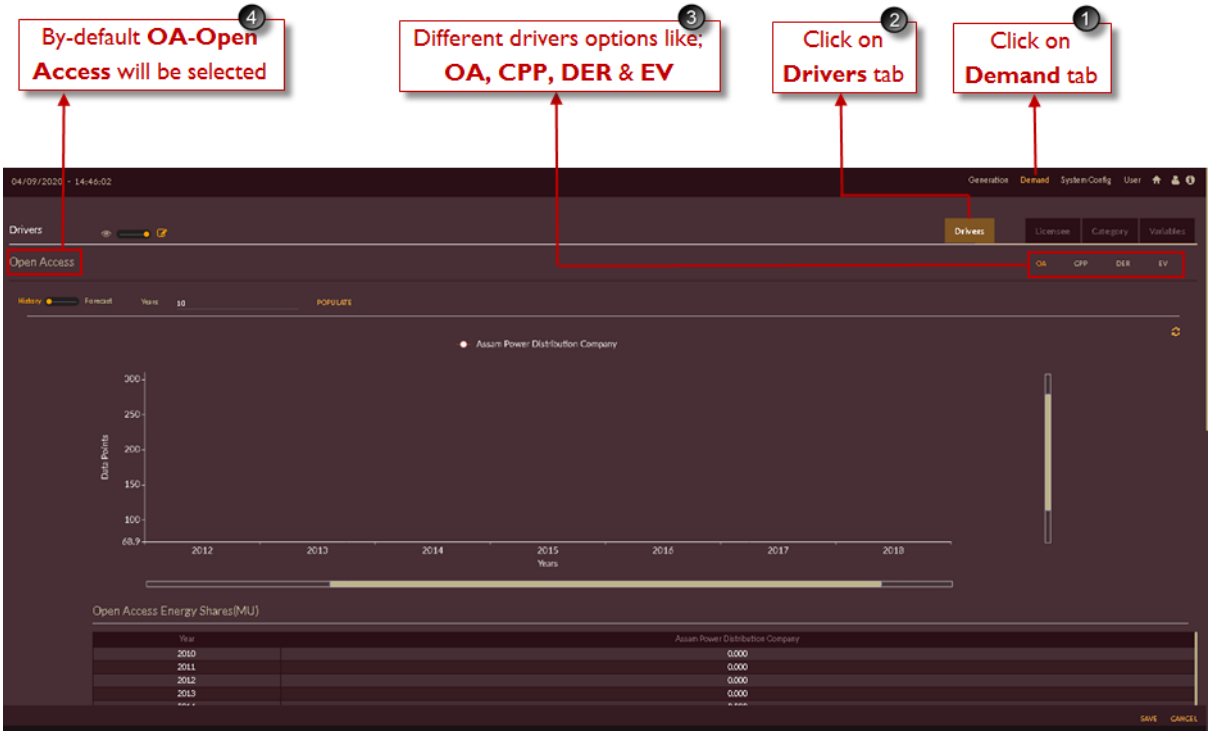


Figure 46. Introduction to Drivers Page

CONFIGURING OPEN ACCESS (OA)

STEPS TO CONFIGURE OPEN ACCESS (OA)

Repeat first two steps given in **ACCESSING DRIVERS DETAILS**.

3. You have to select **History/Forecast** and number of **Years** based on you need to upload the data then click on **Populate** POPULATE icon.
4. Initially the chart shows **Open Access** value as "0", you have to enter the data for respective years manually.

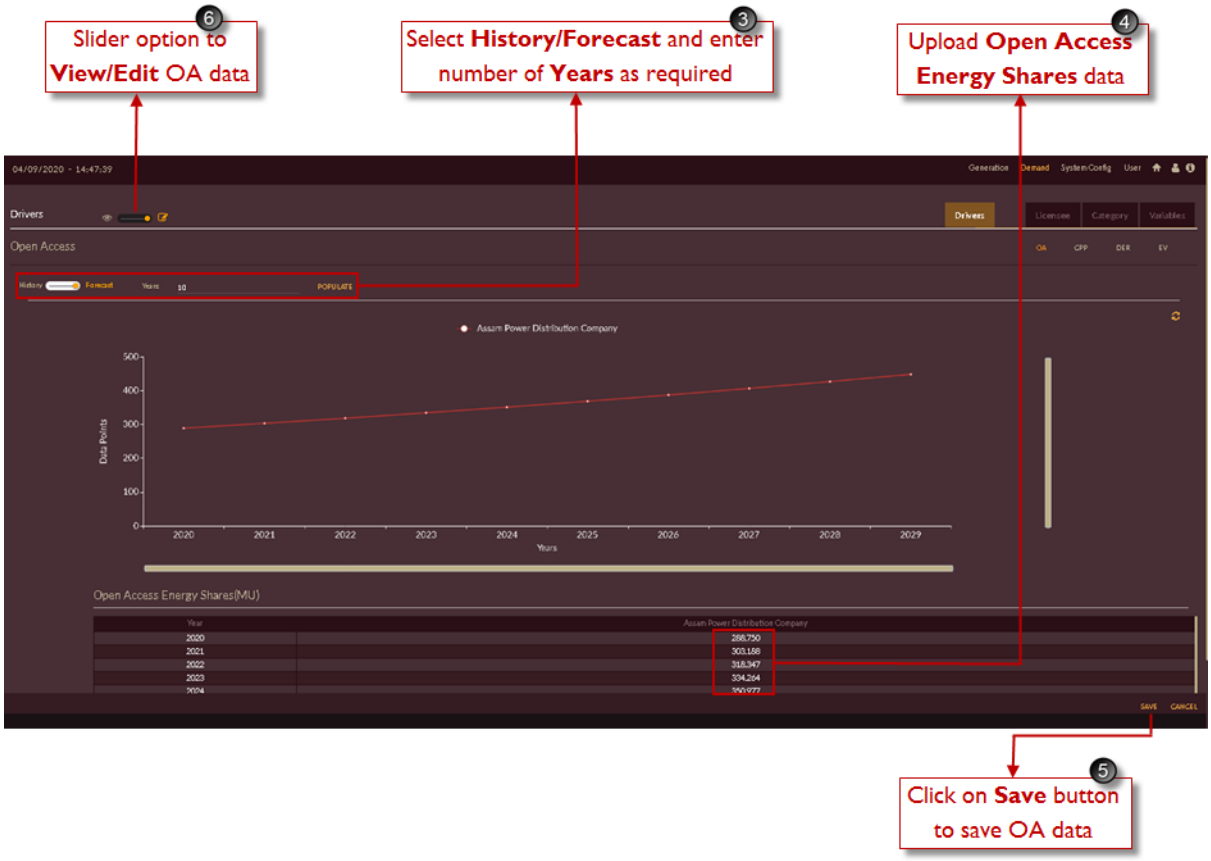
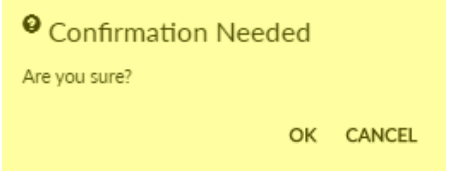


Figure 47. Configuring Open Access (OA) Data

5. Click on SAVE button to save the open access values to be considered for the final calculation of the generation value. The table gets saved.

   The "Are you sure?" confirmation message appears.



   Click on **OK** to save the details. Click on **CANCEL** to discard the changes.

   The "Saved Successfully" message appears.

Click on the **Refresh Graph**  icon. The energy share value across years appears on the page.

6. You can **View/Edit** by setting  slider in required mode.

CONFIGURING CAPTIVE POWER PROCUREMENT (CPP)

This section gives you the steps to configure the demand variations expected owing to CPP values in Million Units (MU) against the year in which the CPP serves the consumers. These values can be configured either for the historic data or for the forecast data.

STEPS TO CONFIGURE CAPTIVE POWER PROCUREMENT (CPP)

Follow these steps to configure CPP.

Repeat the first two steps given in **ACCESSING DRIVERS DETAILS**

3. Click on **CPP** CPP icon.
4. You have to select **History/Forecast** and number of **Years** for which you need to enter the data then click on **Populate** POPULATE icon.
5. Initially chart area shows **Captive Power Procurement Energy Shares** value as "0", you have to upload the data for respective years.

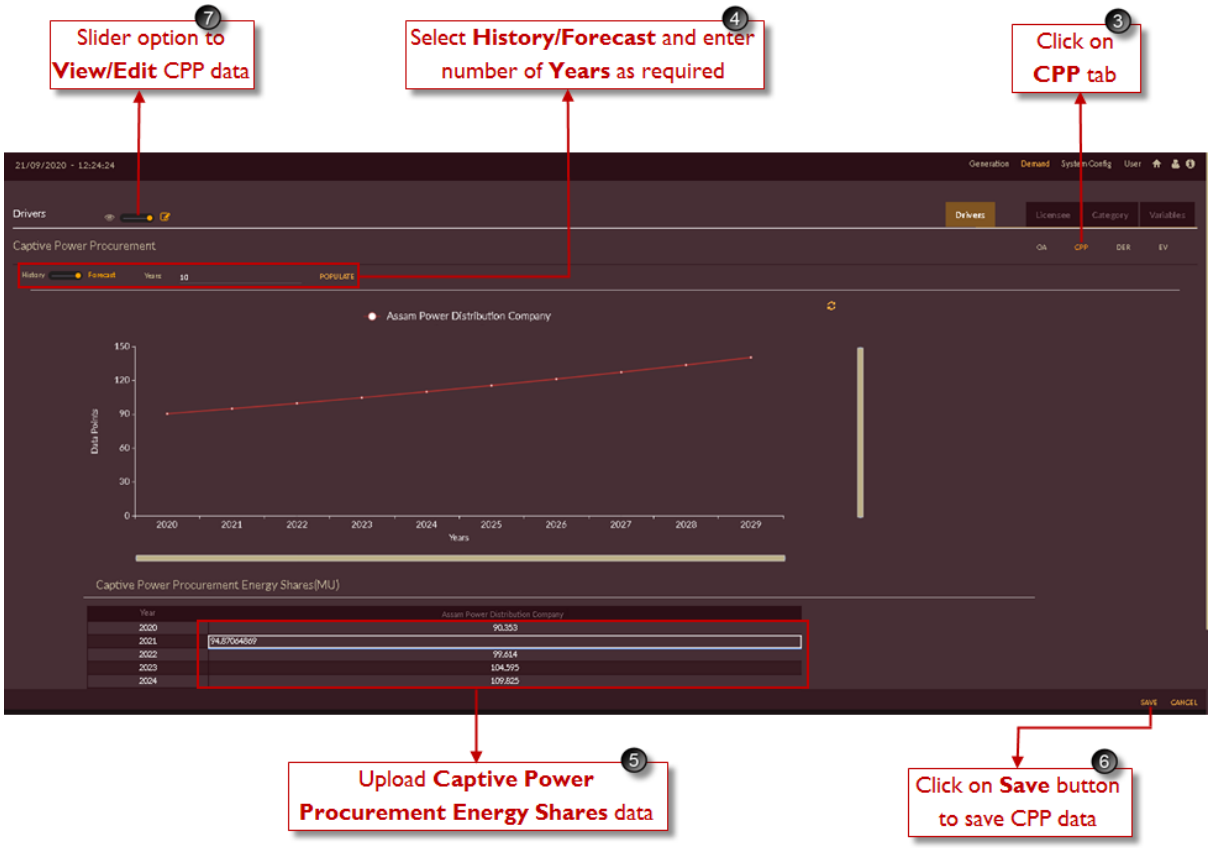
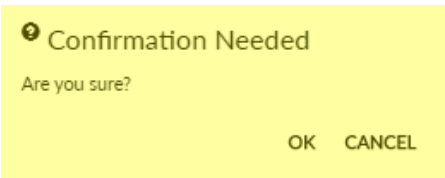


Figure 48. Configuring Captive Power Procurement (CPP) Data

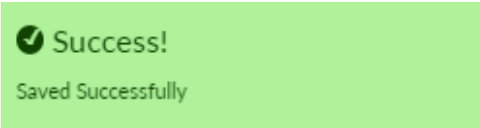
6. Click on SAVE button to save the open access values to be considered for the final calculation of the generation value. The table gets saved.

   The "Are you sure?" confirmation message appears.



   Click on **OK** to save the details. Click on **CANCEL** to discard the changes.

   The "Saved Successfully" message appears.



Click on the **Refresh Graph**  icon. The energy share value across years appears on the page.

7. User can **View/Edit by setting**  slider in required mode.

Note:

- The CPP data shown in Figure 48 is an imaginary data considered as there is no CPP data available for Assam state.

CONFIGURING DISTRIBUTED ENERGY RESOURCES (DER)

This section gives you the steps to configure DERs in the software.

There are sub categories to be configured under DER Drivers options and are.

i. DER Category

ii. DER Configuration

- DER Specification
- Generation Profile

STEPS TO CONFIGURE DER CATEGORY

Repeat first two steps given in **ACCESSING DRIVERS DETAILS**

Click on **DER** 

icon

Once you click DER then page will appear as shown in Figure 49.

Set the **View/Edit**  slider to **Edit** option.

By default, **DER Category** 

tab is selected.

Click on the **Add Category**  icon to add new DER Category. To delete category, click on **Delete Category**  icon.

An empty row appears. Enter the **Name** and **Code** of the DER category. In this example, it is Solar and the code is PV.

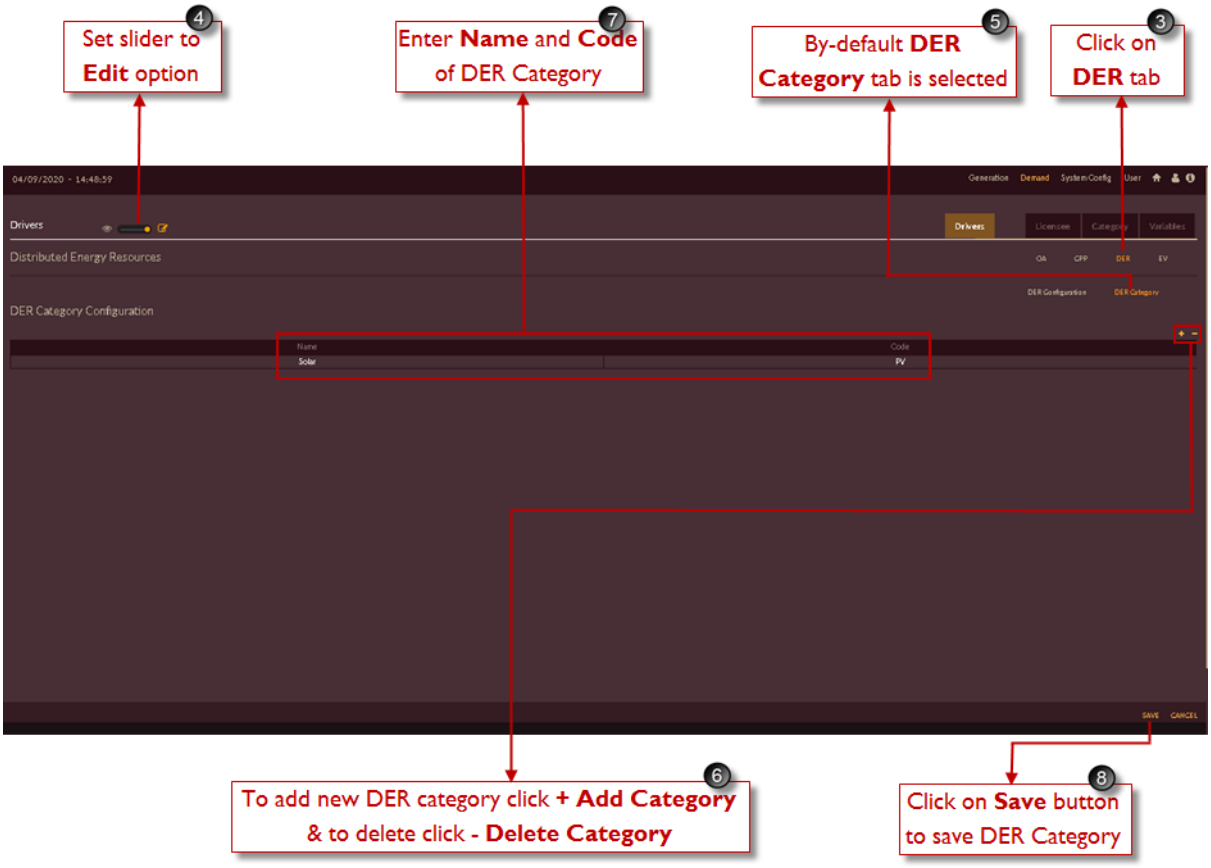
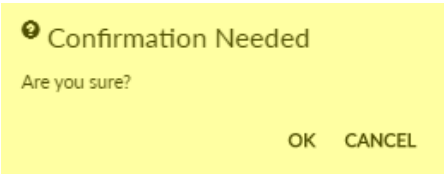


Figure 49. Configuring DER category

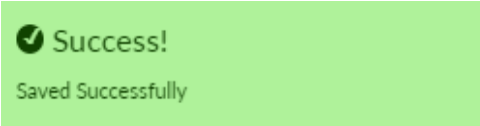
Click on **SAVE** SAVE button.

The "Are you sure?" confirmation message appears.



Click on **OK** to save the details. Click on **CANCEL** to discard the changes.

The "Saved Successfully" message appears.



STEPS TO CONFIGURE DER SPECIFICATION

After saving DER Category, next step is to add data under DER CONFIGURATION

Click on **DER Configuration** DER Configuration icon.

Once you click DER Configuration tab then page will appear as shown in Figure 50.

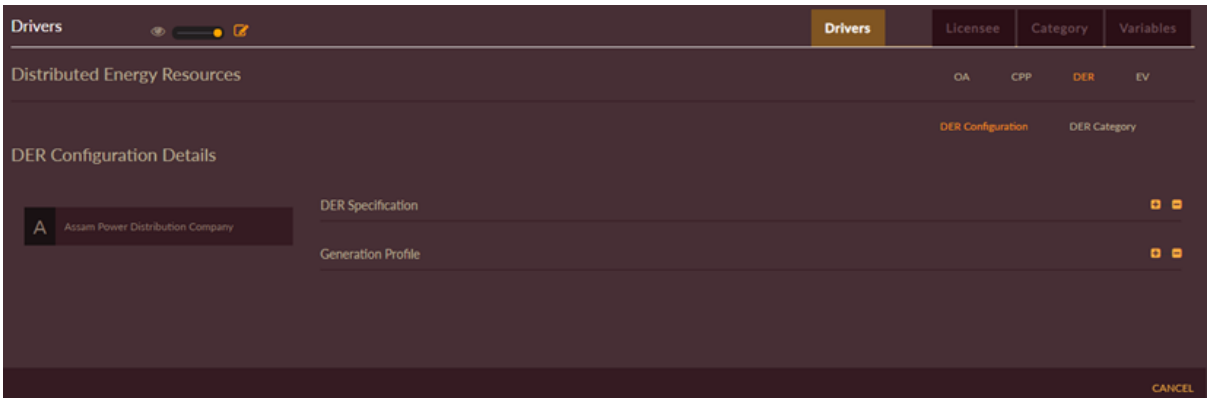


Figure 50. DER Configuration Page

Click on the name of the utility you have configured: here we have **Assam Power Distribution Company**. The **DER Specification** table appears as shown in Figure 51.

Click on the **Specification** icon to add data, empty table appears with single row pre-filled with '0'.

Click on **Add year** icon to add more years to the table. Click on **Delete Last Row** icon to delete extra rows.

The year on year data on installed capacity of the solar equipment and its CUF has to upload for respective year.

- IC - Installed Capacity
- CUF – Capacity Utilization Factor (%) are configured for the historic period and the forecasting period.

Enter the IC values and the CUF percentages in the table.

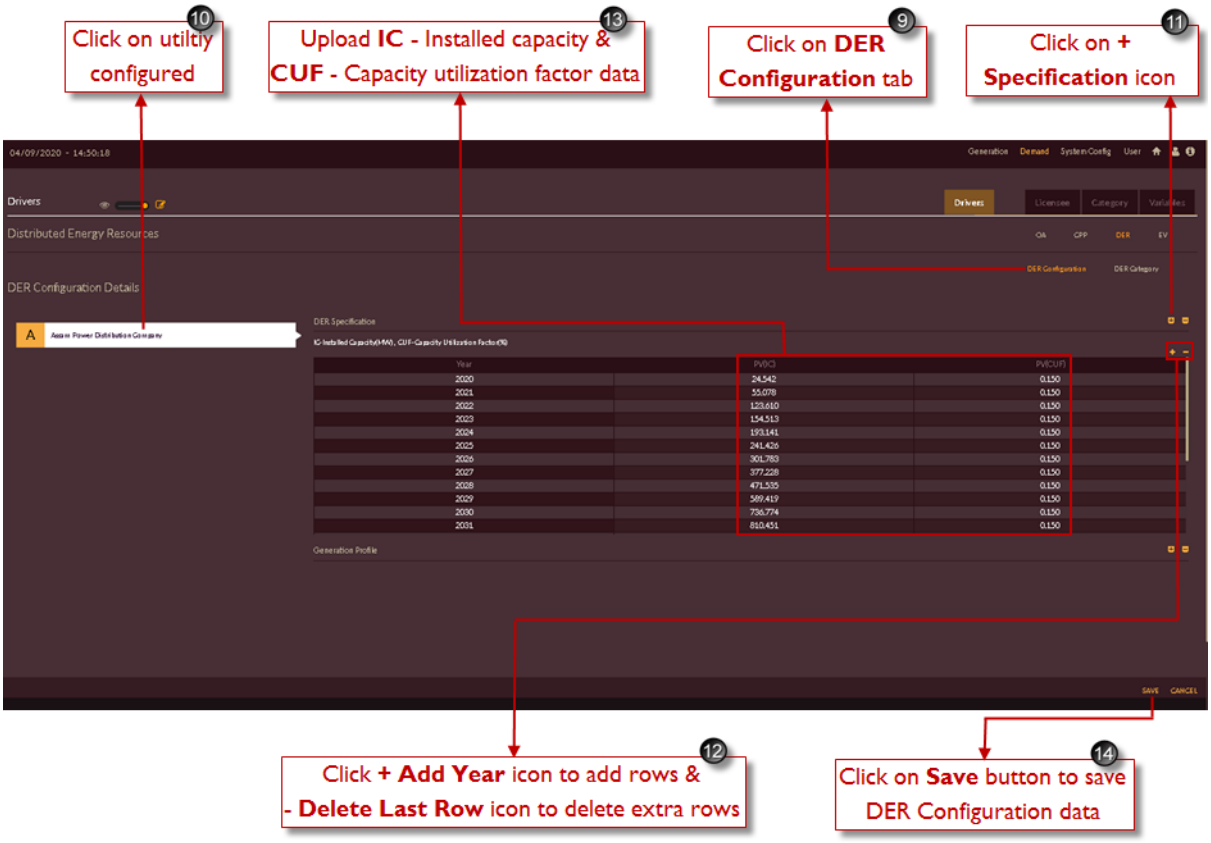
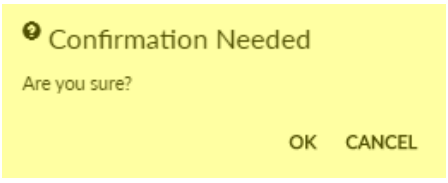


Figure 51. Configuring DER Specification Under DER Configuration

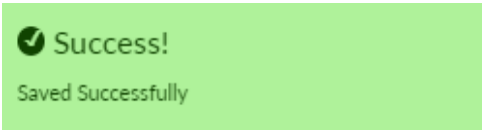
14. Click on **SAVE** SAVE button to save the details.

    The "Are you sure?" confirmation message appears.



    Click on **OK** to save the details. Click on **CANCEL** to discard the changes.

    The "Saved Successfully" message appears.



STEPS TO CONFIGURE GENERATION PROFILE

15. Click on **Generation Profile** + icon.
16. Set the slider to **New** Uploaded New option.
17. Enter generation profile name in **Generation Name** field.
18. Add houlry generation profile data in the table as shown in Figure 52.

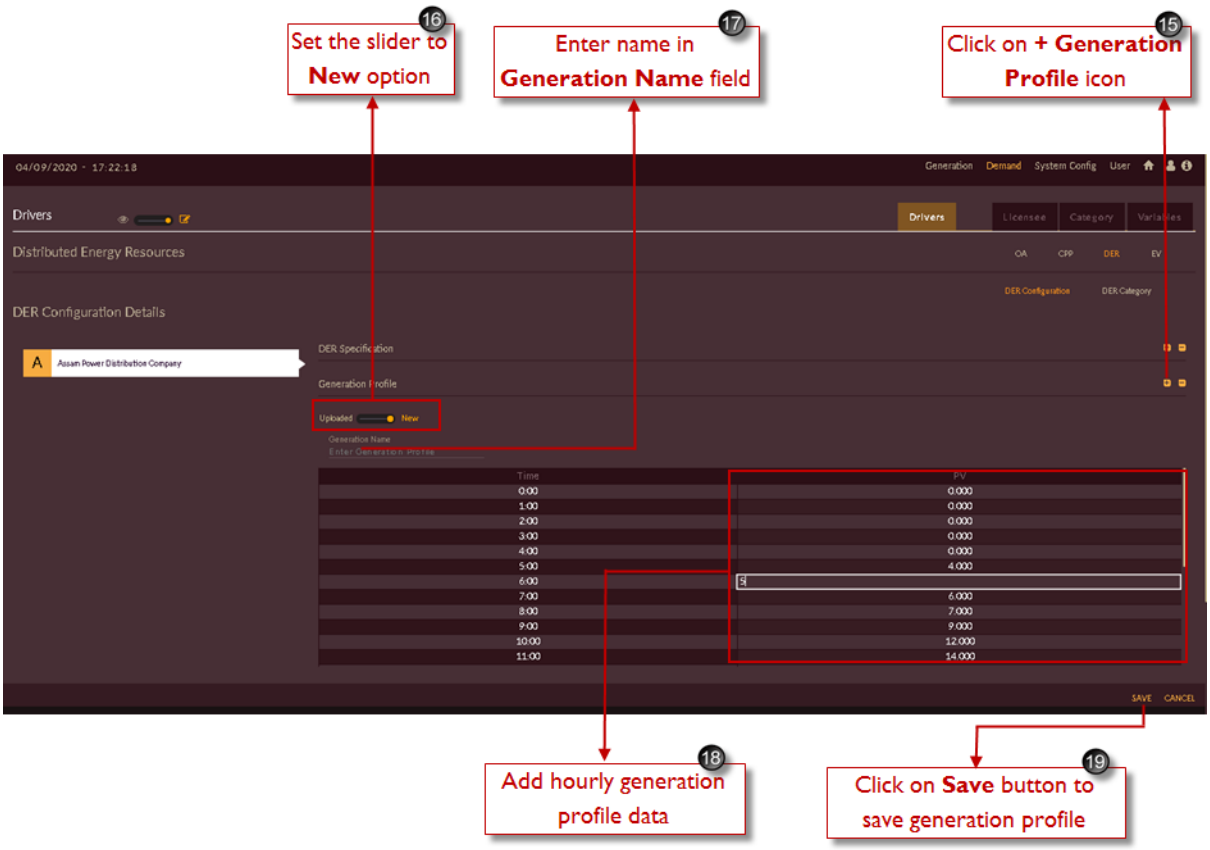
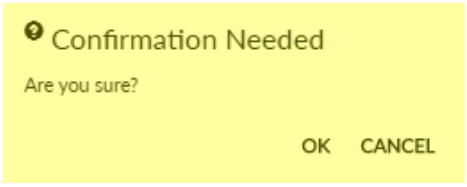


Figure 52. Configuring Generation Profile Under DER Configuration

19. Click on **SAVE** SAVE button to save the details.

    The "Are you sure?" confirmation message appears.



    Click on **OK** icon to add the values. Click on **CANCEL** to discard the changes.

    The "Saved successfully" added message appears.

STEPS TO VIEW CONFIGURED GENERATION PROFILE

20. Set the slider to **Uploaded** Uploaded New option as shown in Figure 53.
21. You can view the uploaded Generation profile by selecting from **Drop-down.**

    You can also edit the generation profile and save.

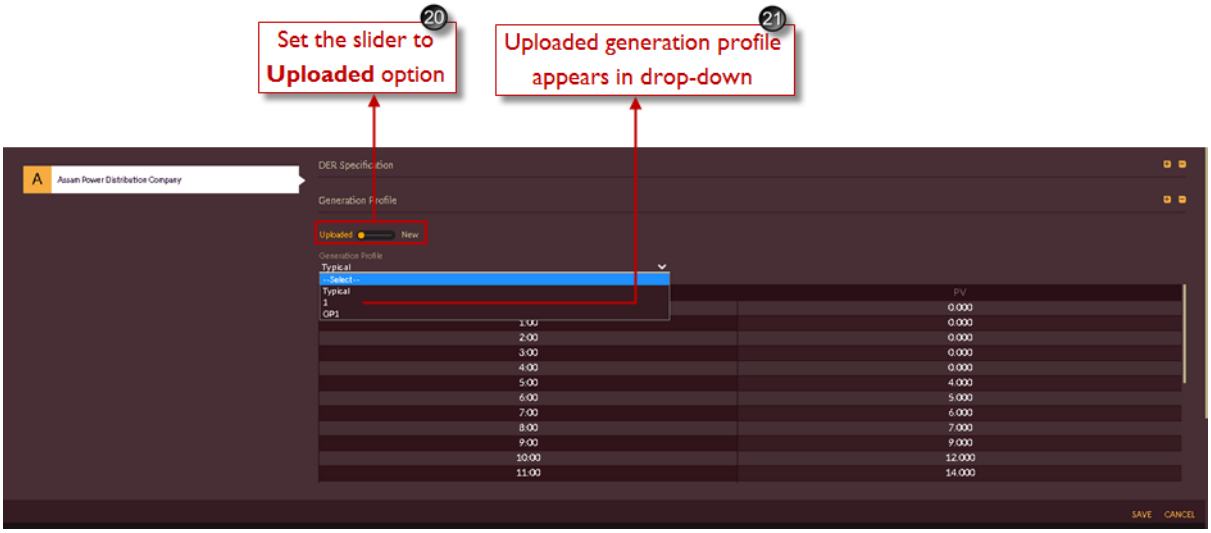


Figure 53. Uploaded Generation Profile

CONFIGURING ELECTRIC VEHICLES (EV)

This section gives you the steps to configure the variations in the demand caused by EV penetration. The module allows you to configure both EV Specifications using EV configuration and EV Category.

There are sub categories to be configured under EV Drivers options and are.

i. EV Category

ii. EV Configuration

- EV Vehicle Specifications
- Count
- Charging Profile

STEPS TO CONFIGURE EV CATEGORY

Repeat first two steps given in **ACCESSING DRIVERS DETAILS**

3. Click on **EV** EV icon

   Once you click EV then page will appear as shown in Figure 54.

Set the **View/Edit** slider to **Edit** option.

By default, **EV Category** EV Category tab is selected.

Click on the **Add Category** icon to add new EV Category. To delete category, click on **Delete Category** icon.

An empty row appears. Enter the **Name** and **Code** of the EV category. In this example, it is 4W-PV, Bus, 3W and 2W code shown.

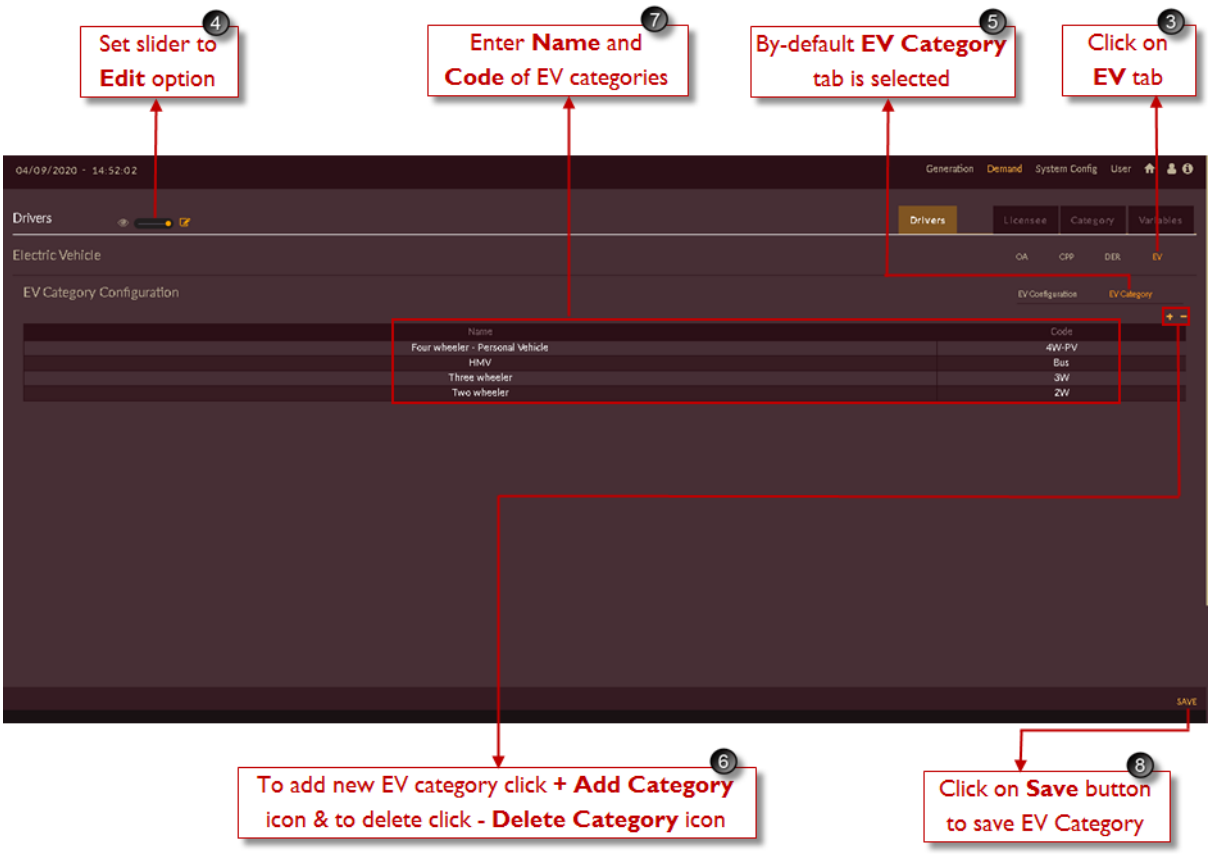
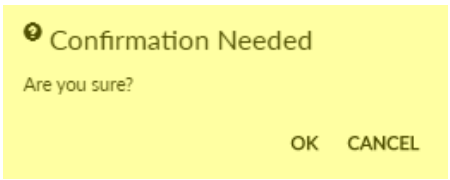


Figure 54. Configuring EV category

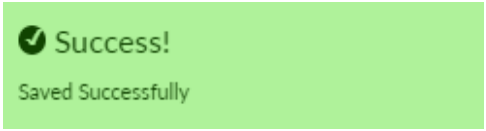
Click on **SAVE** SAVE button.

The "Are you sure?" confirmation message appears.



Click on **OK** to save the details. Click on **CANCEL** to discard the changes.

The "Saved Successfully" message appears.



STEPS TO CONFIGURE ELECTRIC VEHICLE SPECIFICATIONS

Once you save EV Category, next step is to add data under EV CONFIGURATION

Click on **EV Configuration** EV Configuration button.

Once you click EV Configuration tab then page will appear as shown in Figure 55.

Figure 55. EV Configuration Page

Click on the name of the utility you have configured: here we have **Assam Power Distribution Company**. The **EV Specification** table appears as shown in Figure 56

Click on the **Electric Vehicle Specification** icon to add data, empty table appears with vehicle category what user has added while configuring EV Category and rows are pre-filled with '0'. Click **Collapse** icon to cancel.

Add the data available for **Avg battery size, Complete charging cycle efficiency, Avg km run/day, Energy requirement per km & Charging cycles per hour** for each vehicle category.

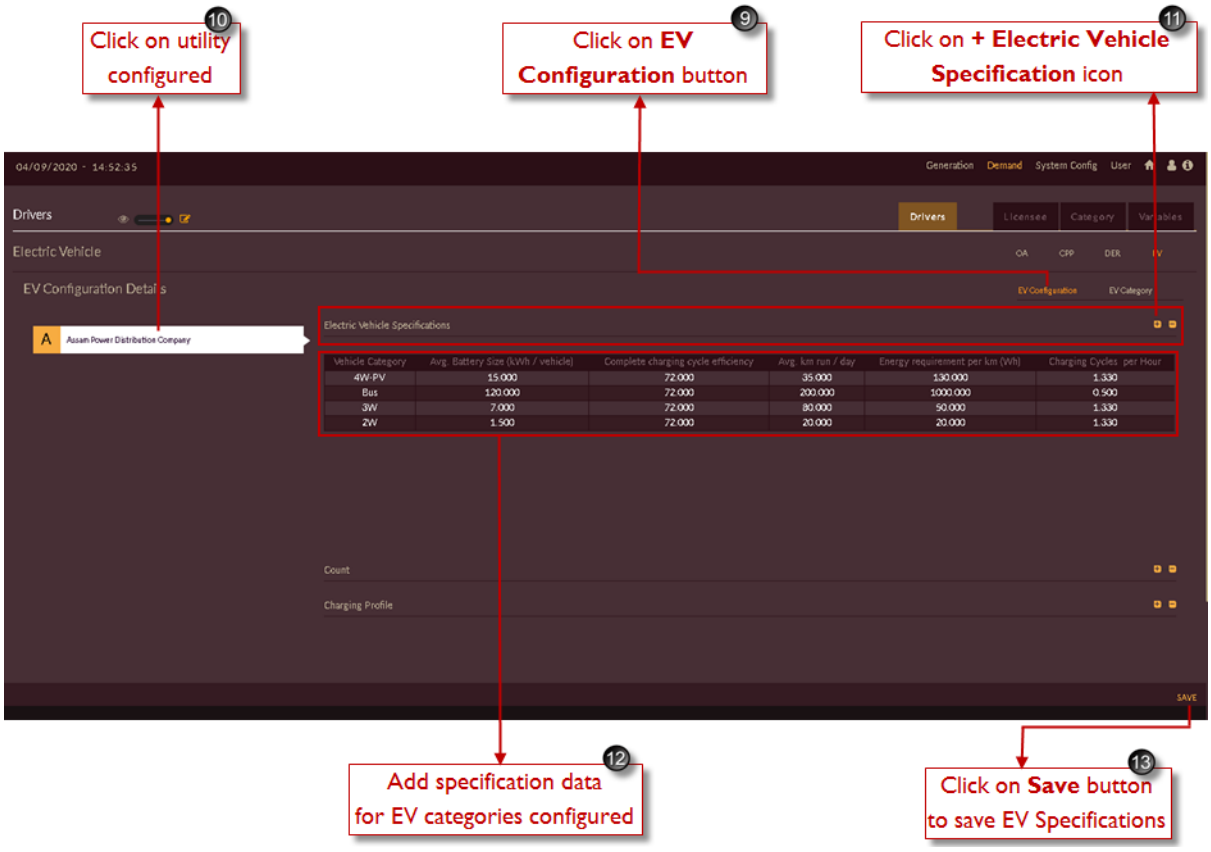
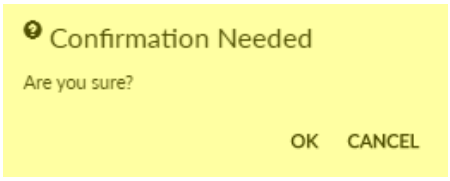


Figure 56. Configuring Electric Vehicle Specifications

Click on **SAVE** SAVE button.

The "Are you sure?" confirmation message appears.



Click on **OK** to save the details. Click on **CANCEL** to discard the changes.

The "Saved Successfully" message appears.

STEPS TO CONFIGURE EV COUNT

Click on the **Count** + icon to add empty table with vehicle category as heading one row pre-filled '0'.

Click **Collapse** − icon to cancel.

Once you click **Count** + icon, the count page appears as shown in Figure 57.

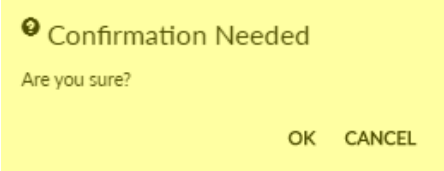
Click on the **Add Year** + icon to add multiple rows.

Add count of vehicle for the category you added like **2W, 3W, 4W-PV** & **Bus**.

Figure 57. Configuring EV's Count

Click on **SAVE** SAVE button.

The "Are you sure?" confirmation message appears.



Click on **OK** to save the details. Click on **CANCEL** to discard the changes.

The "Saved Successfully" message appears.

STEPS TO CONFIGURE EV CHARGING PROFILE

Click on **Charging Profile** + icon.

Set the slider to "**New**" Uploaded New option.

Enter name in **Profile Name** field. Example shown is Typical Charging Profile.

Add houlry charging profile data in the table as shown in Figure 58.

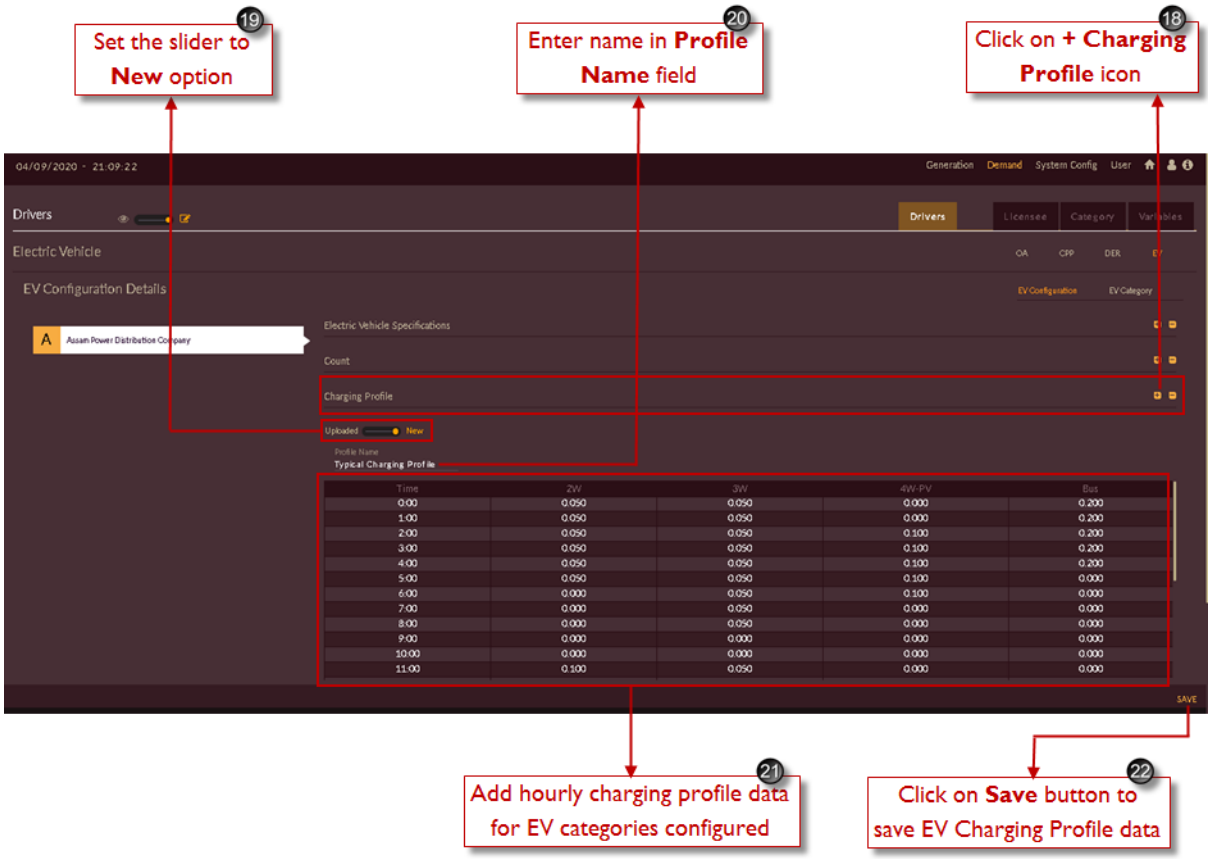
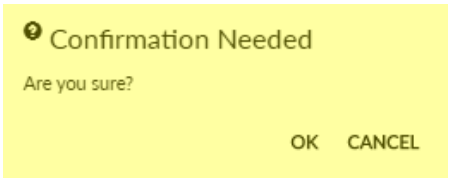


Figure 58. Configuring EV Charging Profile

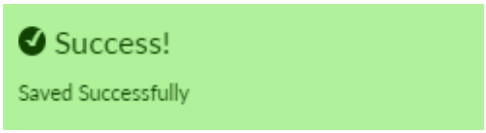
Click on **SAVE**  button.

The "Are you sure?" confirmation message appears.



Click on **OK** to save the details. Click on **CANCEL** to discard the changes.

The "Saved Successfully" message appears.



STEPS TO VIEW CONFIGURED CHARGING PROFILE

23. Set the slider to **Uploaded**  option as shown in Figure 59.
24. You can view the uploaded Charging profile by selecting from drop-down**.**

    You can also edit the charging profile and save.

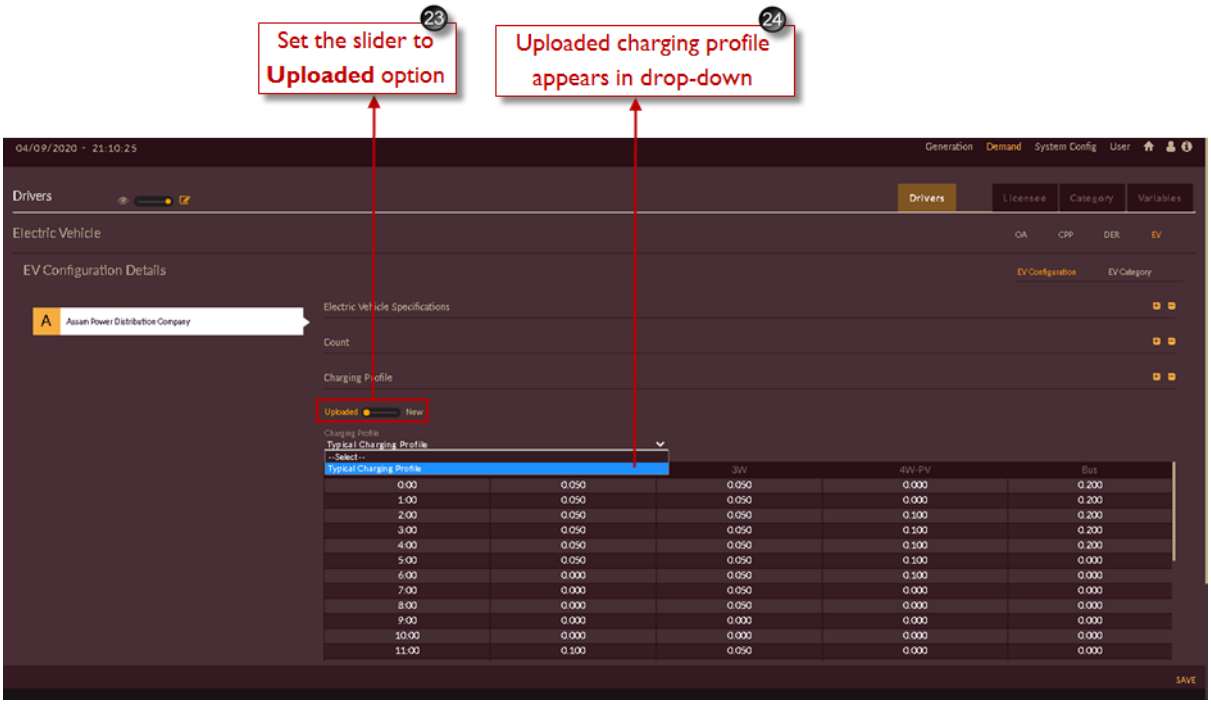


Figure 59. Uploaded Charging Profile

2.1.4 Building Scenarios for Demand Forecast Studies

Once you update all the inputs to the software, you can perform the **Demand Forecast Studies.**

For performing demand forecast studies in DISCOM – REPOSE software you have to create study scenarios.

Let us perform our studies with and without drivers.

For performing studies without the impact of drivers on Discom load you have to create a scenario say – **Business As usual (BAU)**.

For performing studies with the impact of drivers on Discom load you have to create a scenario say – **Scenario with Drivers**.

All the LDFC and MDFC executions are run based on the scenarios that are configured. The user is allowed to configure the scenarios for both or either of long term or medium term forecast studies. The configuration details include the method, history data and forecast data period to run the load forecast.

Note:

- LDFC – Long term demand forecast is the study period of more than 5 years
- MDFC - Medium term demand forecast is the study period of 1 year to 5 years

2.1.4.1 BAU & REPORT

BAU-Business As Usual is the scenario for performing both Medium - term (LDFC) and Long- term (MDFC) demand forecast studies for the defined duration.

CREATE BAU SCENARIO

This section gives you the steps to access and create BAU scenario.

Follow these steps to add a scenario.

1. Login to the software. The **Dashboard/ Home** page appears.

   Alternatively, click on **Home**  icon to access the execution page. The page will appear as shown in Figure 60.

2. Click on **settings** option provided on LDFC or MDFC block 

to add the scenario creation page.

Figure 60. DISCOM – REPOSE Home Page

Once you click settings icon, an empty record appears on the page as shown in Figure 61.

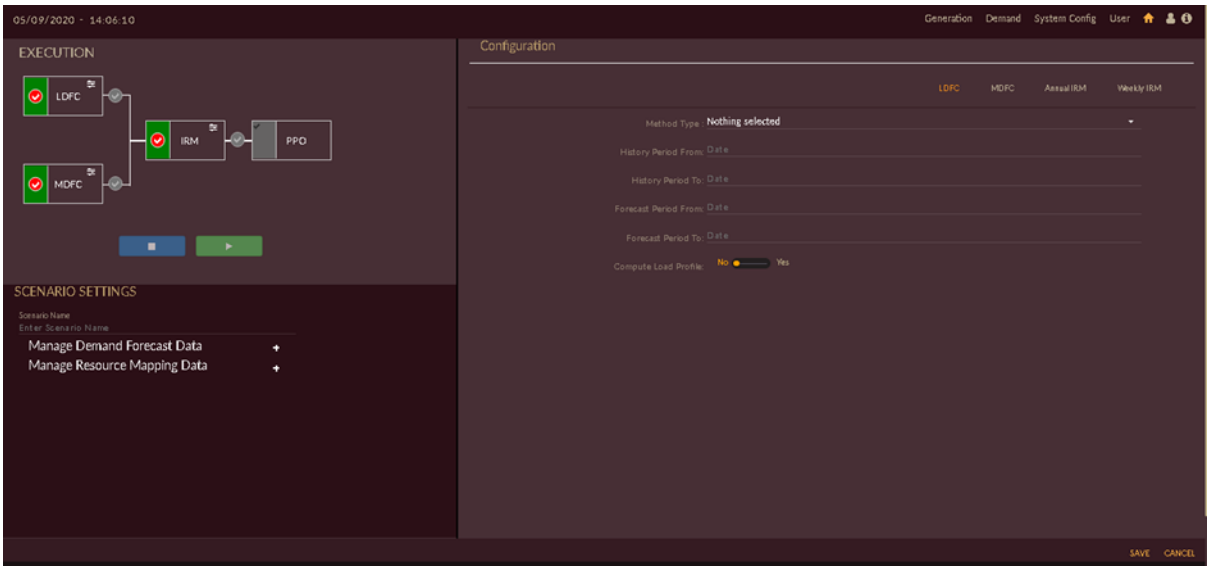
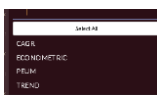


Figure 61. Blank Record to Create Scenario for DFC Studies

3. By default **LDFC** LDFC option will be selected.
4. Give appropriate scenario name in **Scenario Name** field, here we have named as '**Business As Usual**'.
5. Add LDFC data as shown in Figure 62.
    - Select LDFC **Method Type** from the drop-down



- Select historical from and to period and forecast from and to period
- Set **Compute Load Profile** slider 

on **No/Yes** option if required.

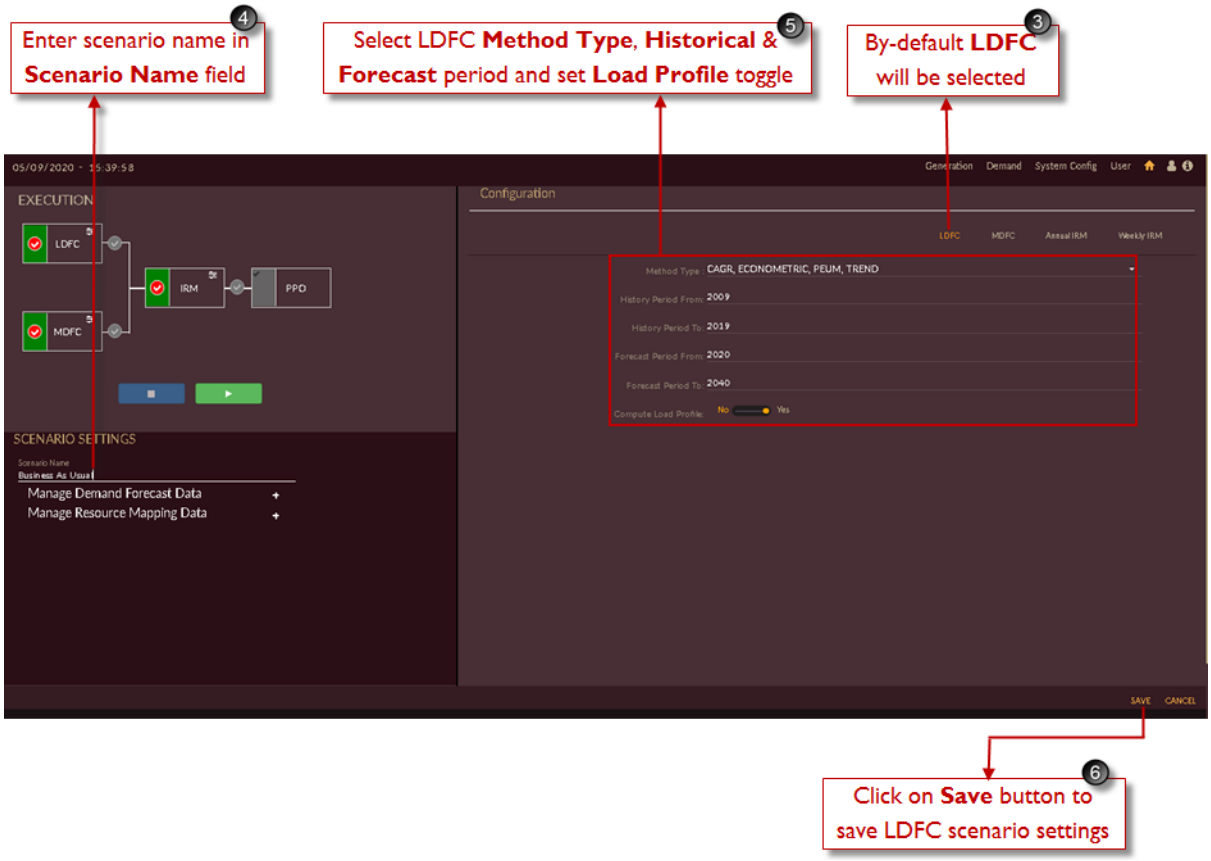
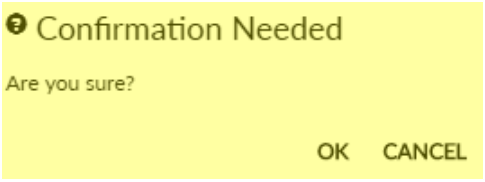


Figure 62. Creating BAU Scenario & Adding LDFC Details

6. Click on the **SAVE** 

button to save LDFC scenario settings.

   The **"Are you sure?"** confirmation message appears.



   Click on the **OK** icon to save the scenario.

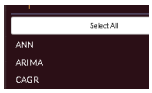
   The "Saved Successfully" message appears.

7. Click on **MDFC** 

tab to add medium term study details.

   You will see the page as shown in Figure 63.

8. Add MDFC data; as shown in Figure 63.
   - Select MDFC **Method Type** from the drop-down

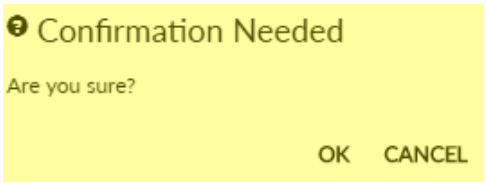


- Select historical from and to period and forecast from and to period
- Set **Compute Load Profile** slider  on **No/Yes** option if required.

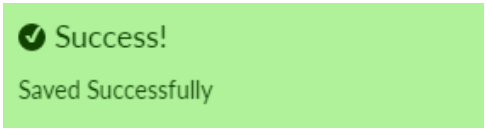
Figure 63. Adding MDFC Details

9. Click on the **SAVE**  button to save MDFC scenario settings.

   The **"Are you sure?"** confirmation message appears.



   Click on the **OK** icon to save the scenario.



   The "Saved Successfully" message appears.

10. The scenario appears in the scenario list as shown in Figure 64.

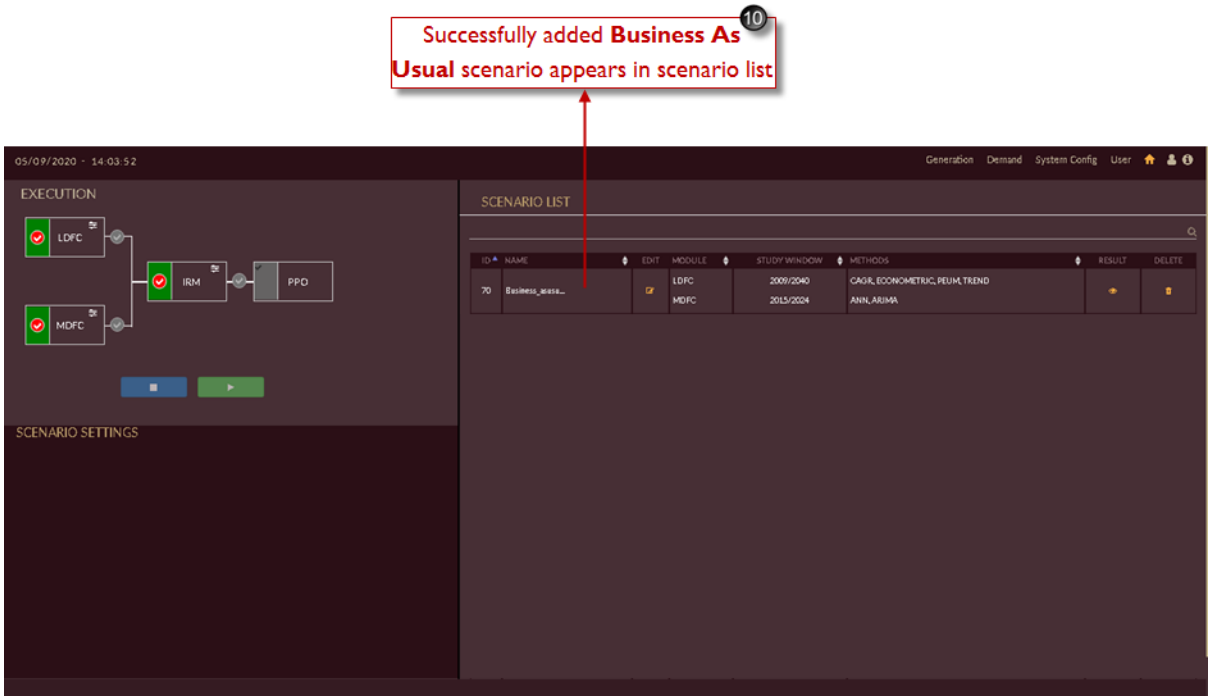


Figure 64. BAU Scenario in Scenario List

The scenario page and the scenario will be having following features;

Figure 65. Scenario List and Scenario Features

-  icon to sort the records.
- **View Result**  icon to view the results.
- **Edit Scenario**  icon to edit the scenario.
- **Delete**  icon to remove the scenario from the list.

EDIT BAU SCENARIO

When a scenario is created and it appears on the page, it will not be having any data, you have to configure all the data which you have given as input.

This section gives explains how to edit the scenario.

Follow these steps to edit a scenario.

1. In the scenario list shown in Figure 66 click on the **Edit scenario**  icon.

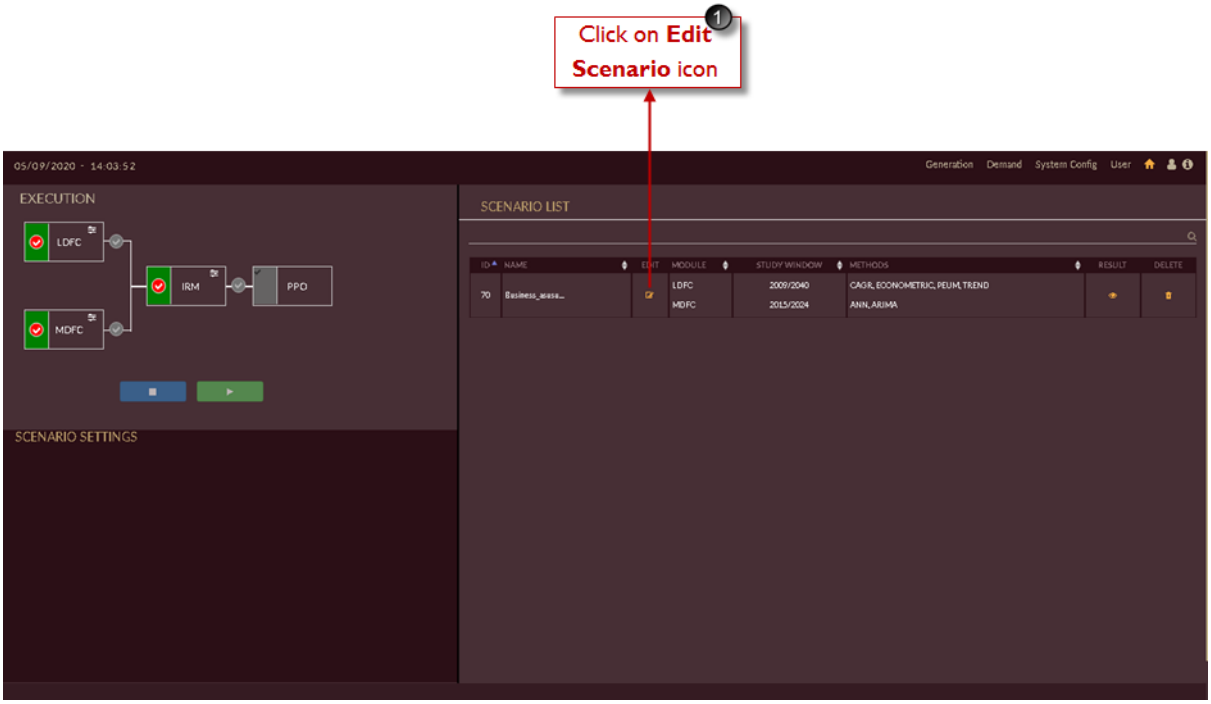


Figure 66. Edit in Scenario List Page

Once you click **Edit scenario** icon, the Manage Demand Forecast section appears as shown in Figure 67.

2. Click on **Manage Demand Forecast Data** icon.
3. The drop-down appears from which you can select which data need to configured into the scenario.

   The drop- down has the following list:

   - Licensee projection data
   - State data
   - T & D loss data
   - Open access
   - Captive power plant
   - Distributed energy resources
   - Electric vehicle

From the drop-down list for BAU scenario you have to configure Licensee projection data, State data and T & D loss data.

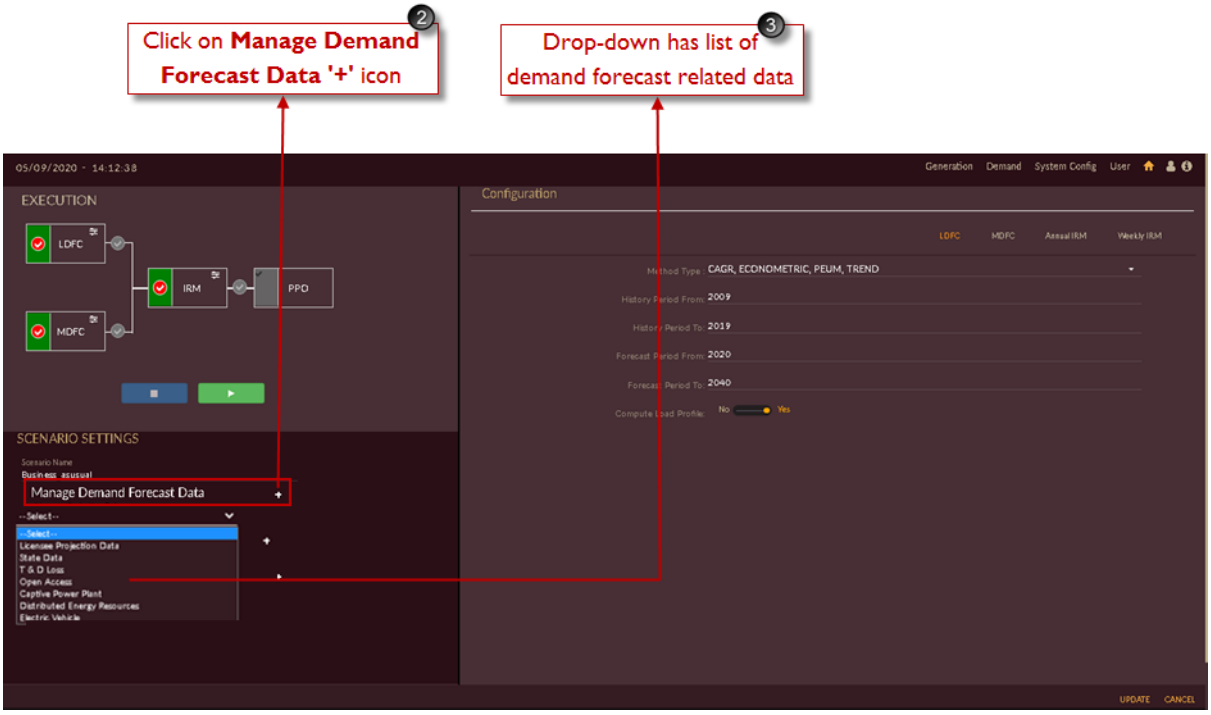


Figure 67. Manage Demand Forecast Data

Once Scenario is created you need add the required data for studies from raw data section by selecting required data's from **Manage Demand Forecast Data** drop-down list.

STEPS TO EDIT/CONFIGURE LICENSEE PROJECTION DATA

1. Click on **Manage Demand Forecast Data** icon and select **Licensee projection data** from the drop-down list as shown in Figure 68.

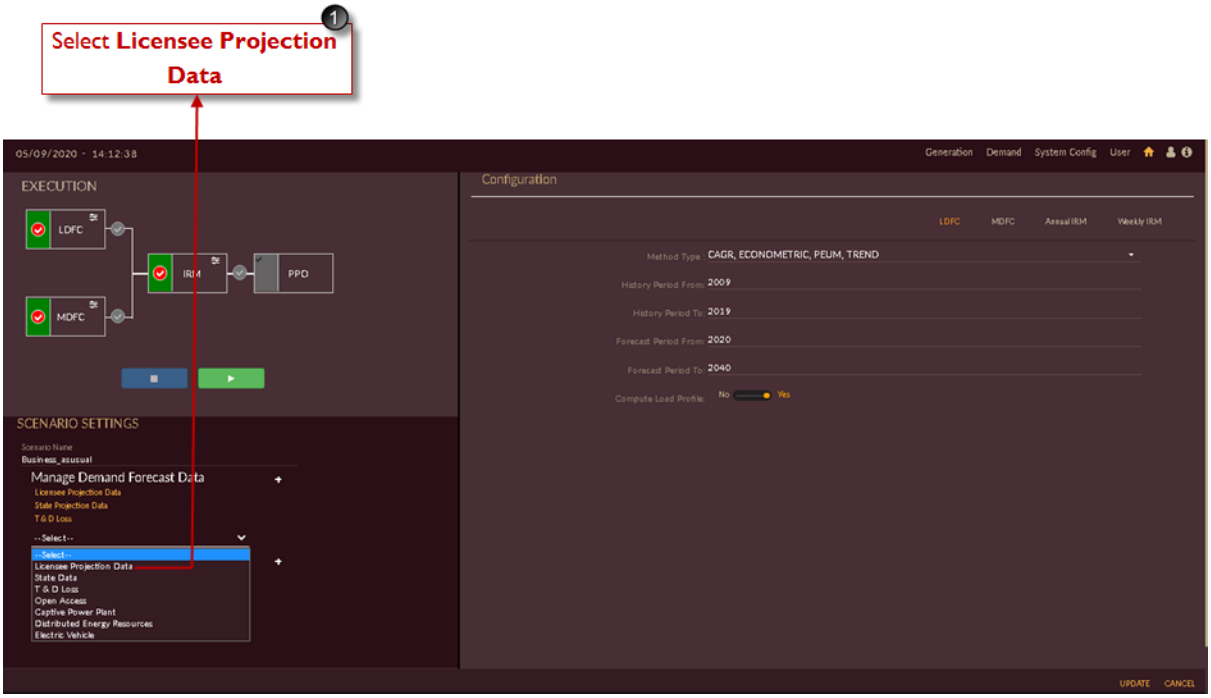


Figure 68. Manage Licensee Projection Data

Once you click on **Licensee Projection Data** link, the scenario specific **Licensee Configuration** data page appears shown in Figure 69.

2. By default, **Energy**  option will be selected.
3. Select all the categories you need to consider in the scenario for the studies.
4. Set **Seasonal /Annual** slider to **Annual** option to configure annual licensee data.
5. Click **Edit**  icon for the categories whose data need to edit

   Here HT-1 HT Domestic category is shown.

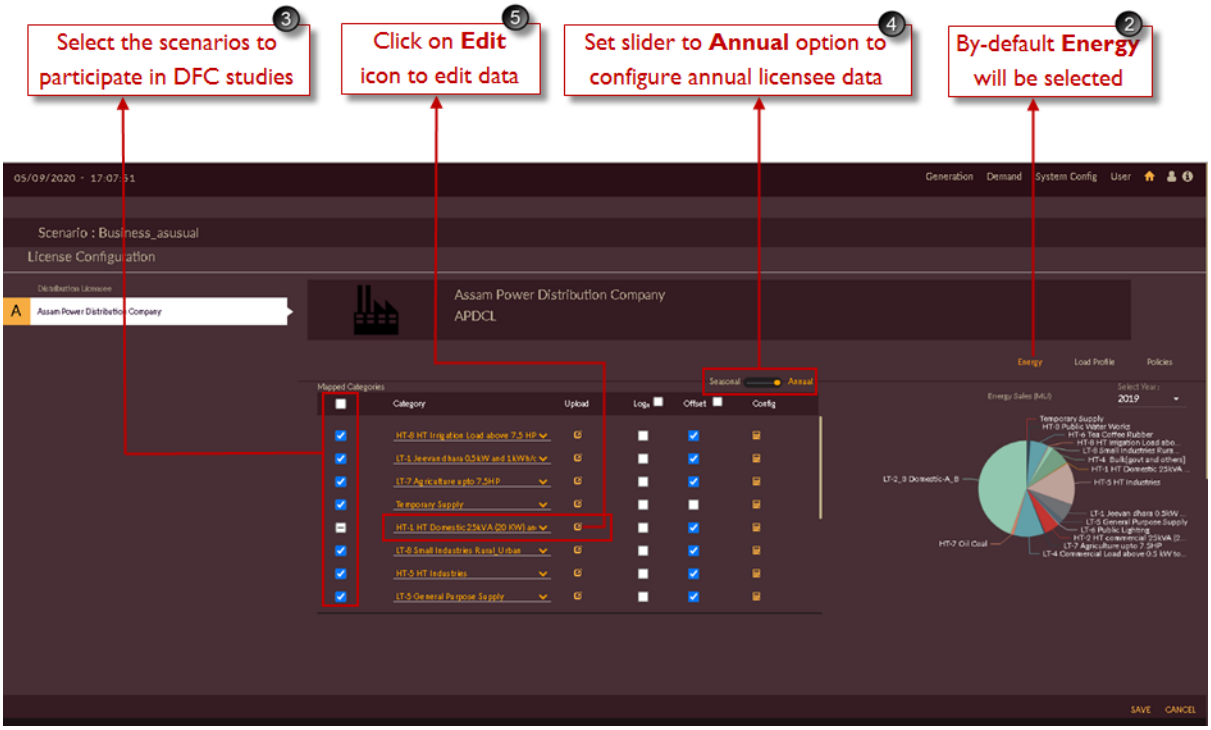


Figure 69. Edit Licensee Configuration Data

As you click on edit icon of the category the data page will open as shown in Figure 70.

6. Table shows the data for all the variables mapped to categories (seen in CATEGORY section) the variables selected here by checking the check box will participate in **Econometric method** of LDFC.
7. By clicking **Add dummy** icon you can add column for adding dummy variables.

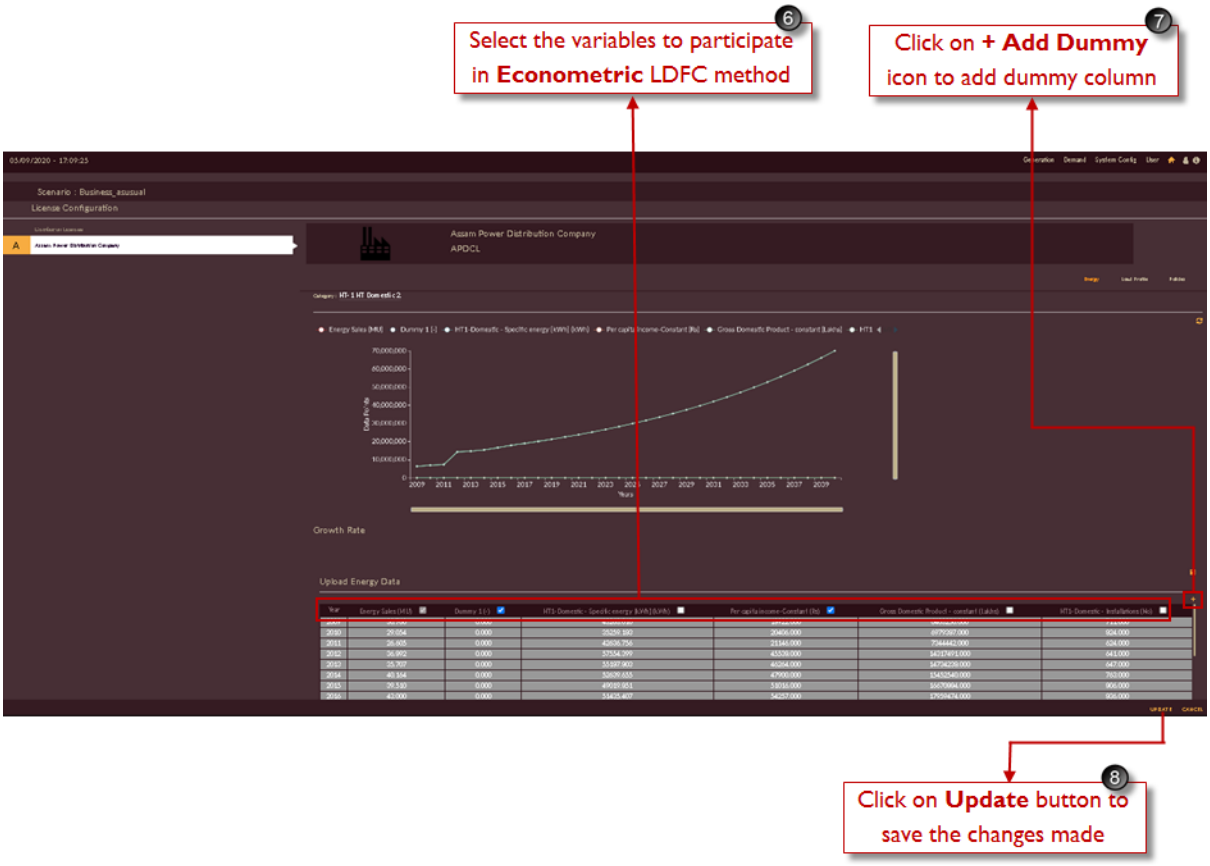


Figure 70. Configuring Econometric Variable Data of Category

8. Click on **Update** button the changes made will be updated.

The above steps explained the configuration LDFC using the econometric method. Figure 71 shows configuration of data for LDFC methods using CAGR, TREND and PEUM methods.

9. Click **Config** icon for repective categories. Here HT-1 HT Domestic category is shown.

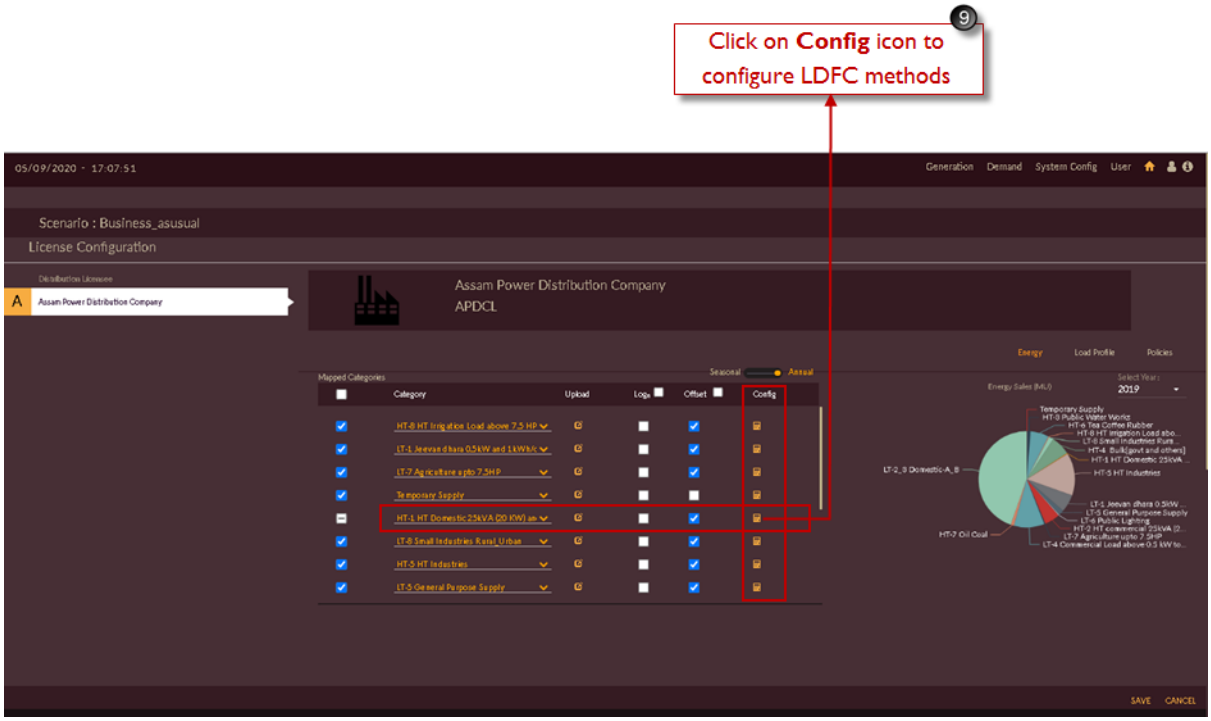


Figure 71. Configuring the Category

Once you click **Config** icon, the page as shown in Figure 72 appears.

10. There are four different options under **Config** of each category;

- UD – User Defined
- CAGR – Coumpound Annual Growth Rate
- Trend
- PEUM – Partial End Use Method

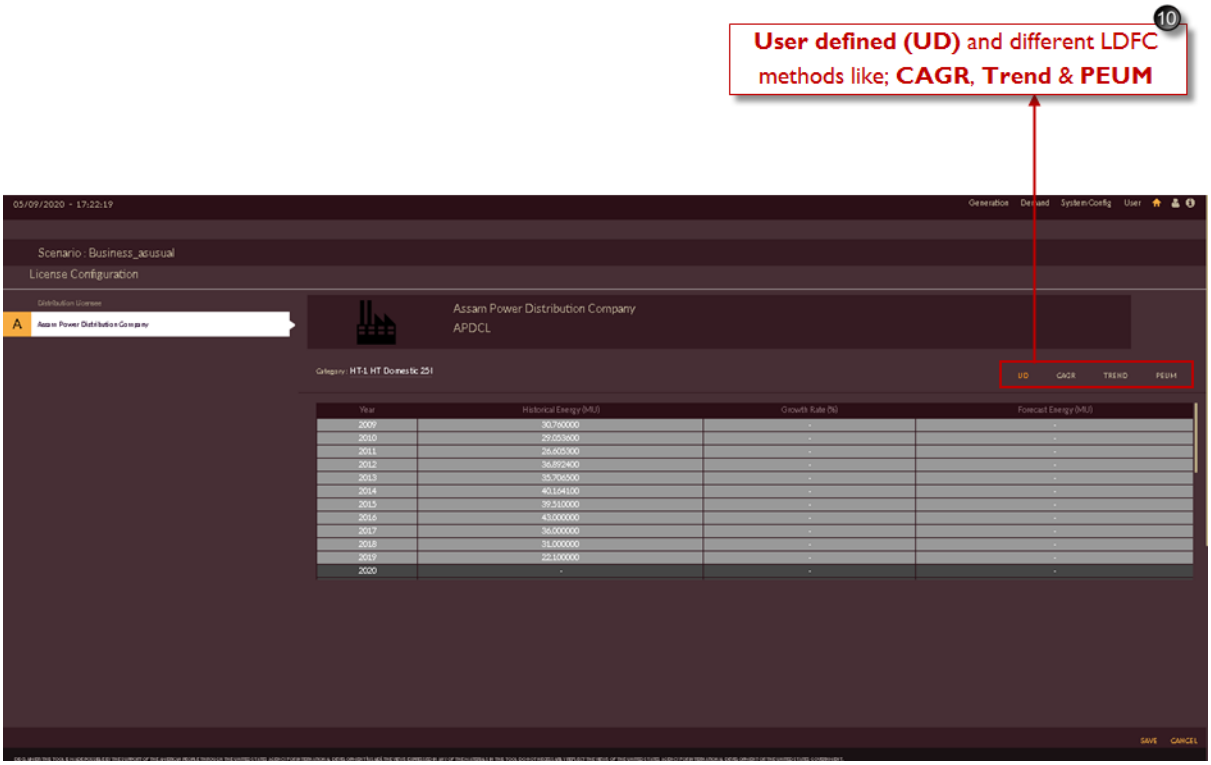


Figure 72. Configuring LDFC Methods

Steps to configure User defined – UD method:

Figure 73 shows the steps to configure user defined method to LDFC studies.

a) By default **UD** UD icon will be selected

b) You have to enter the percentage gowth rate for respective forecast years in **Growth rate (%)** column. Automatically **Forecast Energy (MU)** will be calculated and displayed by the software.

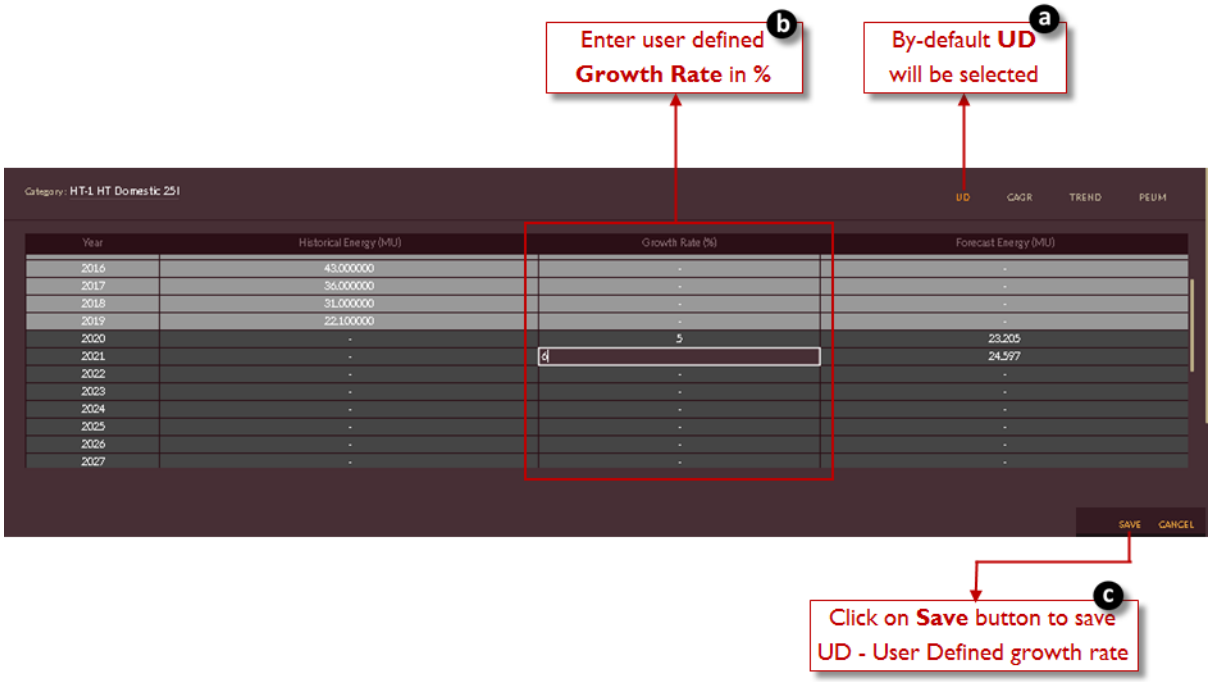
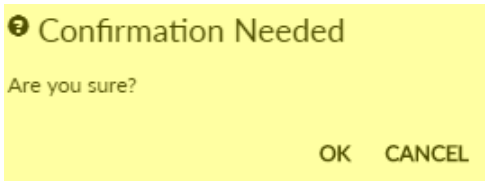


Figure 73. Configuring User Defined Method

c) Click on the **SAVE** SAVE button to save the configured UD growth rate.

The **"Are you sure?"** confirmation message appears.



Click on the **OK** icon to save the scenario.

The "Saved Successfully" message appears.

Steps to configure Compound Annual Growth Rate – CAGR method:

Figure 74 shows the steps to configure CAGR method to LDFC studies.

d) Click on **CAGR** CAGR button.

e) You have to select **History Period From** and **History Period To** from the calender option whcich will be applied for CAGR current and base year formula.

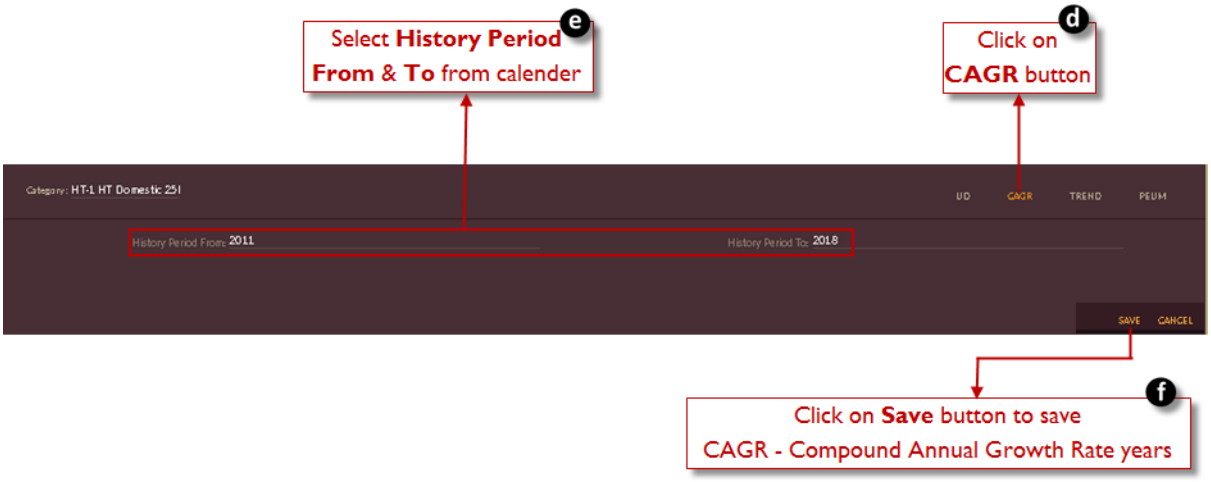
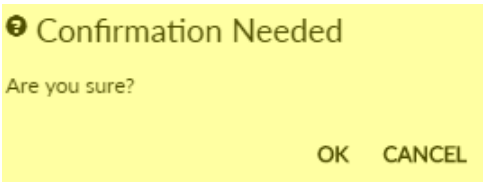


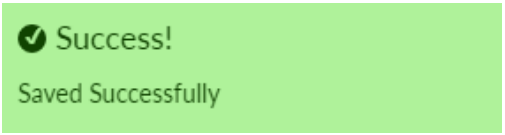
Figure 74. Configuring CAGR Method

f) Click on the **SAVE** SAVE button to save the configured CAGR years.

The **"Are you sure?"** confirmation message appears.



Click on the **OK** icon to save the scenario.



The "Saved Successfully" message appears.

Steps to configure TREND method:

Figure 75 shows the steps to configure TREND method to LDFC studies.

g) Click on **TREND** TREND button.

h) You have to select the **Curve Option** from the list required for TREND method LDFC studies.

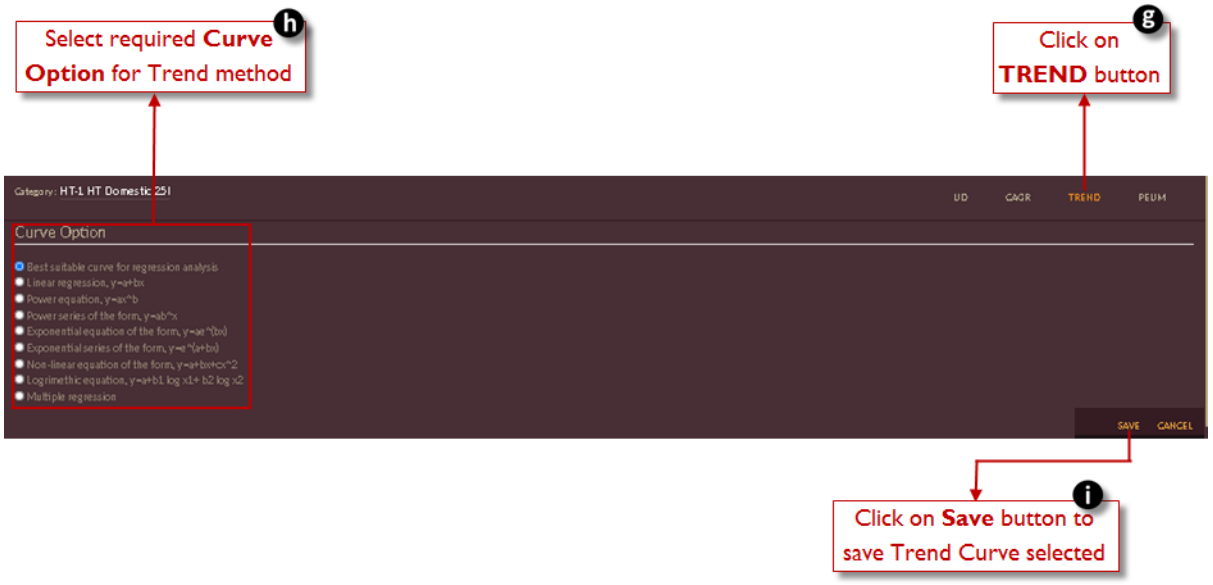
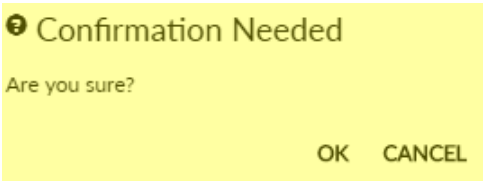


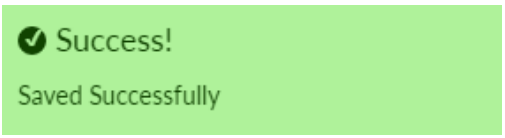
Figure 75. Configuring Trend Method

i) Click on the **SAVE** SAVE button to save the configured TREND curve.

The **"Are you sure?"** confirmation message appears.



Click on the **OK** icon to save the scenario.



The "Saved Successfully" message appears.

Steps to configure Partial End Use Method - PEUM:

Figure 76 shows the steps to configure PEUM method to LDFC studies.

j) Click on **PEUM** PEUM button.

k) **List of Idependent Variables** mapped to category will appear in table with **Variable Name** and **Short Code**.

l) You have to enter the **Equation** required to compute energy sales using PEUM method.

m) Once equation is entered click on **Refresh** icon.

n) **Energy** calculated will be displayed in table along with the independent variabled used in equation.

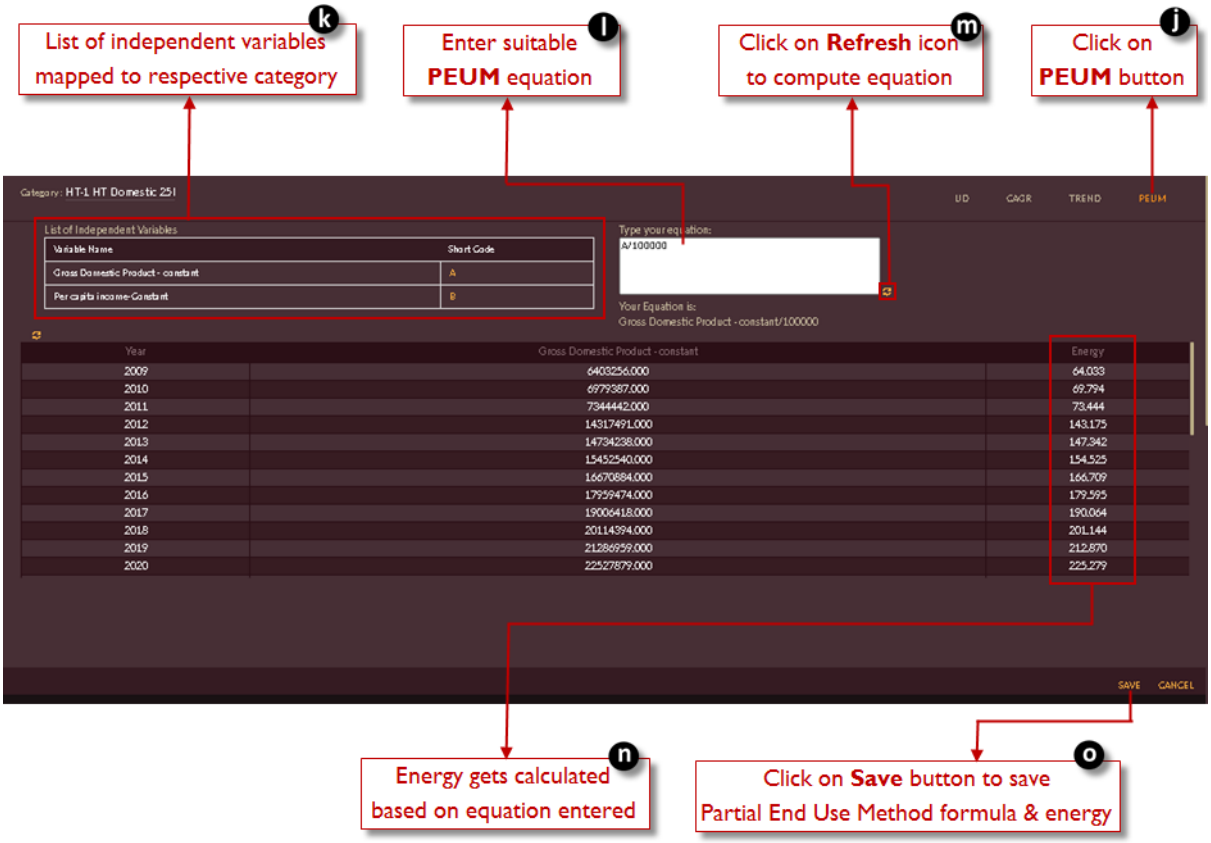
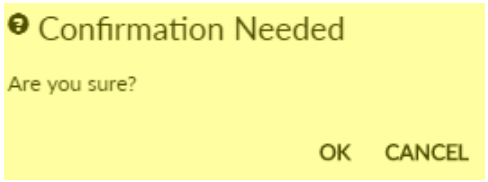


Figure 76. Configuring PEUM Method

o) **Click** on the **SAVE** SAVE button to save the configured PEUM equation and results.

The **"Are you sure?"** confirmation message appears.



Click on the **OK** icon to save the scenario.

The "Saved Successfully" message appears.

11. Set **Seasonal /Annual** slider to **Seasonal** option to configure monthly licensee data.
12. Enter suitable or calculated **P/D/Q** values in the boxes.

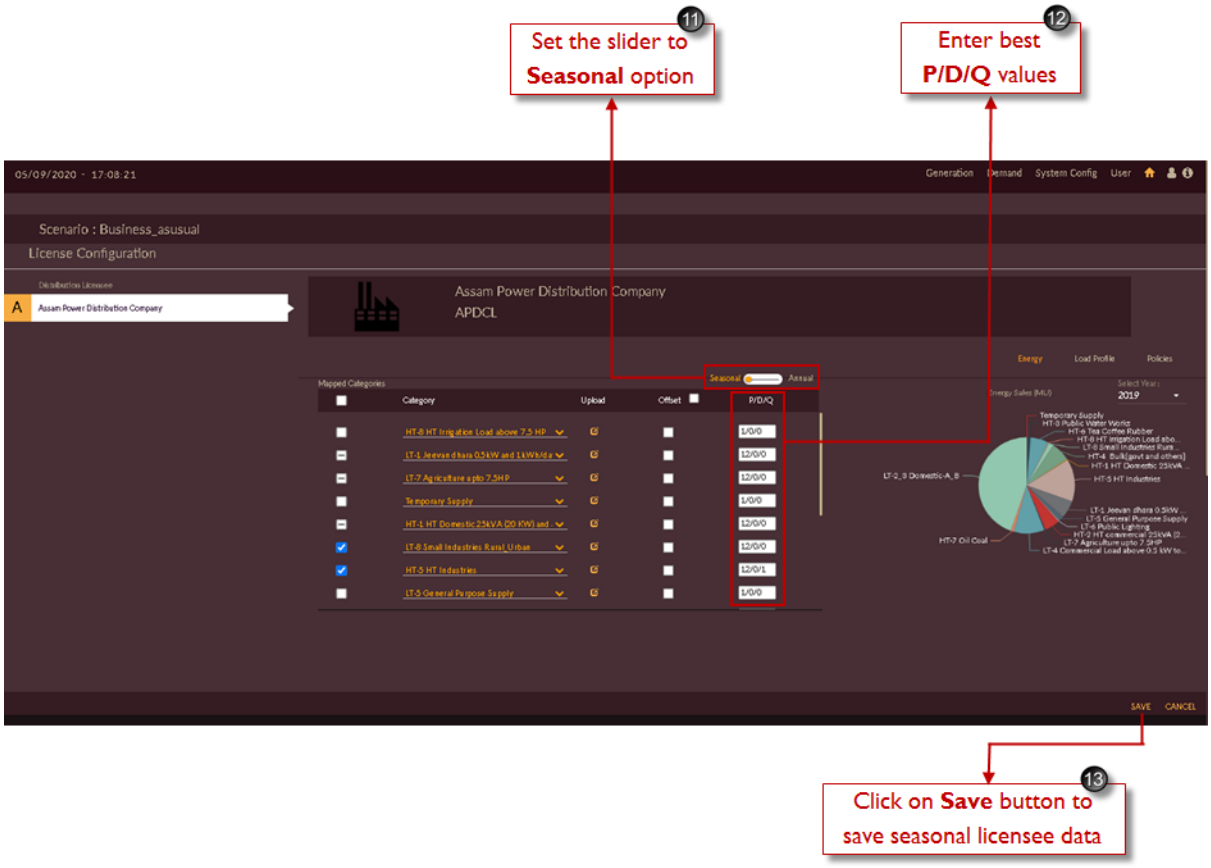
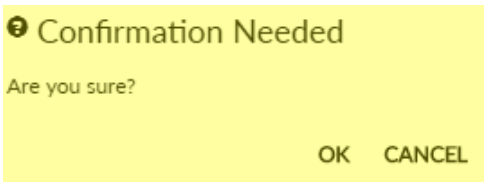


Figure 77. Editing Seasonal Licensee Data

13. Click on the **SAVE** SAVE button.

The **"Are you sure?"** confirmation message appears.



Click on the **OK** icon to save the scenario.

The "Saved Successfully" message appears.

Steps to configure Load Profile into the Licensee data:

Repeat the first step of **STEPS TO EDIT/CONFIGURE LICENSEE PROJECTION** DATA section.

14. Click on **Load Profile** Load Profile button.
15. Select the **Reference Year For Load Profile** from the drop-down.

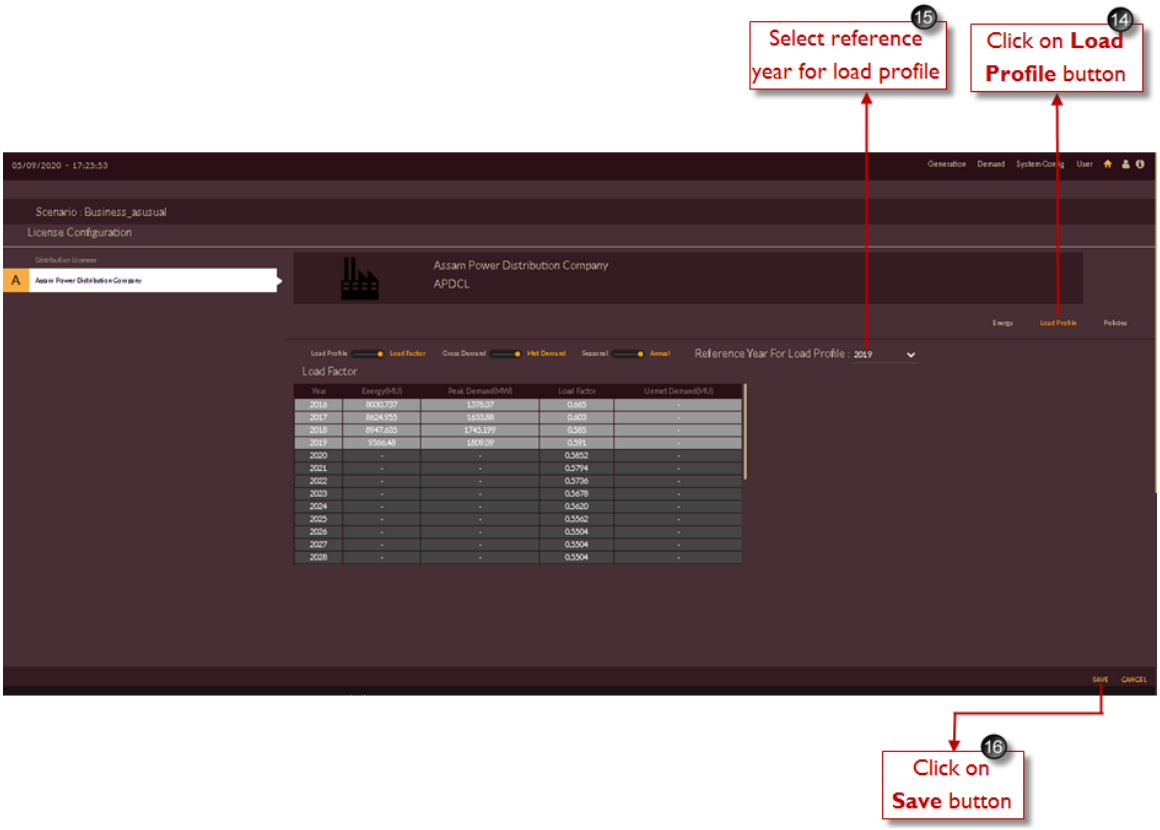
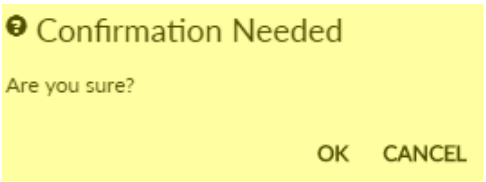


Figure 78. Configuring Load Profile for the Scenario

16. Click on the **SAVE** SAVE button.

The **"Are you sure?"** confirmation message appears.



Click on the **OK** icon to save the scenario.

The "Saved Successfully" message appears.

STEPS TO EDIT/CONFIGURE STATE DATA:

1. Click on **Manage Demand Forecast Data** + icon and select **State Data** from the drop-down list as shown in Figure 79.

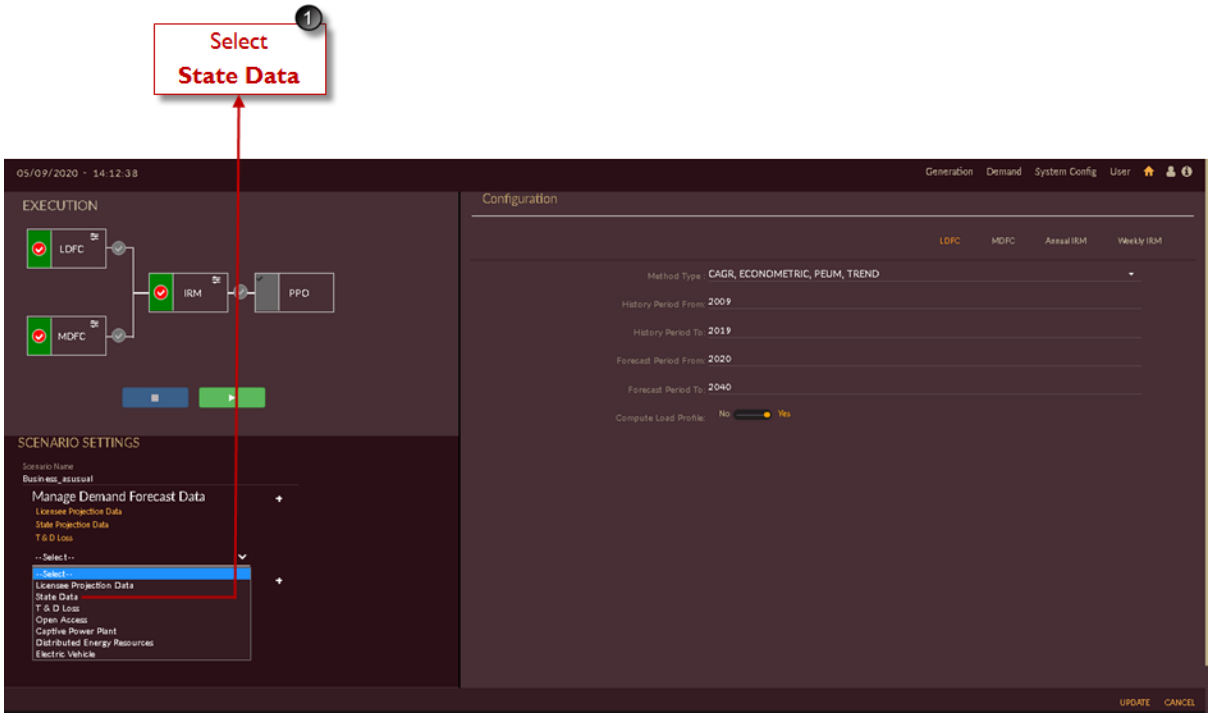


Figure 79. Manage State Projection Data

Once you click **State Data**, software will take user to **State Variable Data Configuration** page of **Business As Usual** senario as shown in Figure 80.

2. You will observe the graph generated for all the independent variables selected for ecoometric method in Licensee manage data.
3. Yearly values of independent variables will be tabulated in the table whereas, dependent variables (energy sales of each category) columns will be empty filled with '-' .
4. You can view/edit seasonal & annual data by setting slider to **Seasonal/Annual** option.

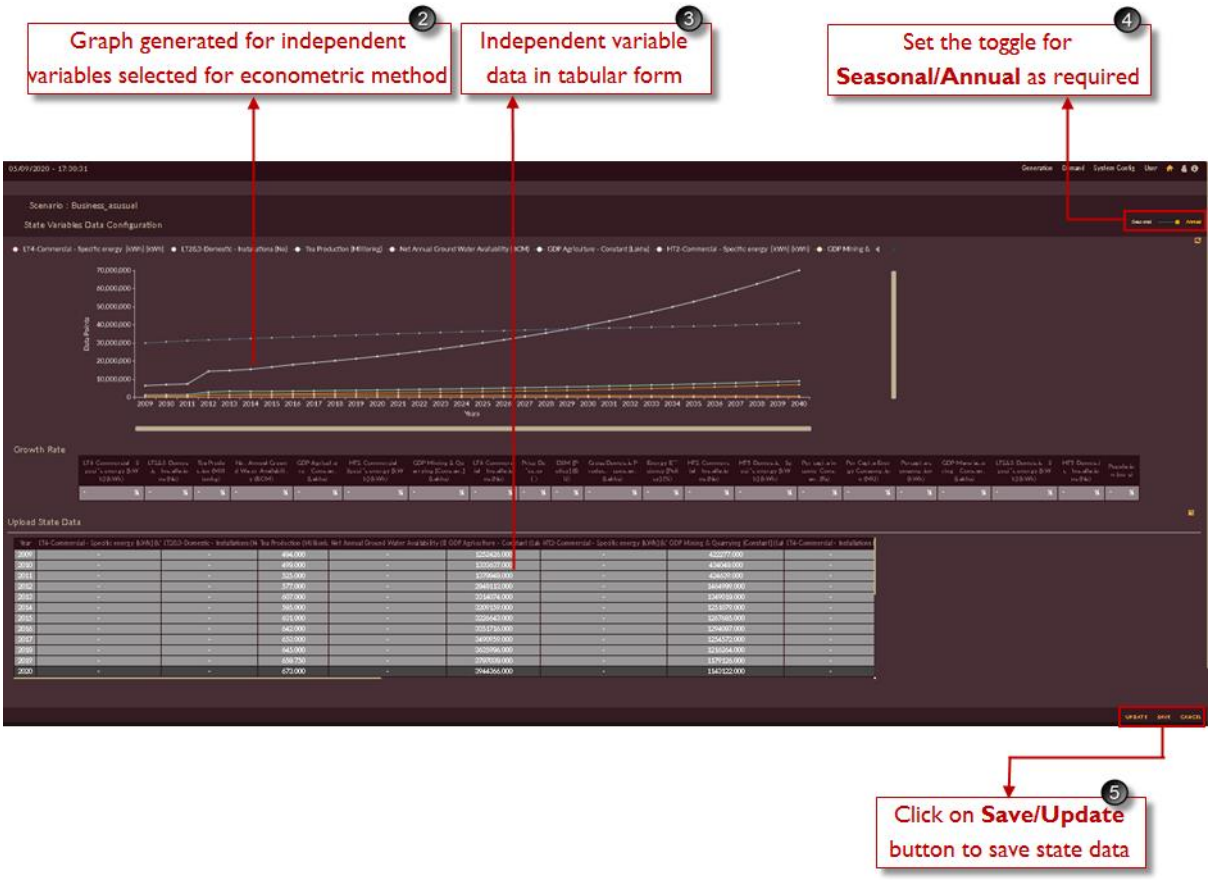


Figure 80. Edit/Save State Projection Data

5. Click on **Save** button to save the state data, **Update** button to update the changes made in state data and **Cancel** icon to discard the changes made in state data.

STEPS TO EDIT/CONFIGURE T & D LOSS DATA:

1. Click on **Manage Demand Forecast Data** icon and select **T & D Loss** from the drop-down list as shown in Figure 81.

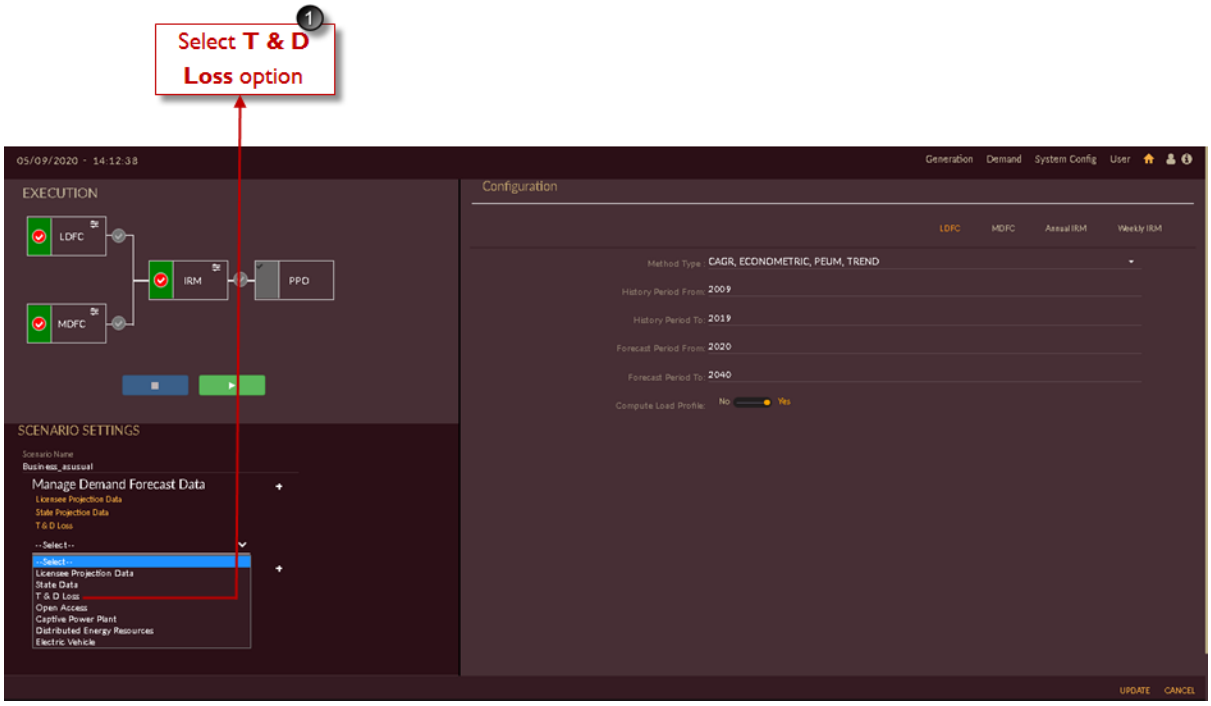


Figure 81. Manage T & D Loss Data

On clicking **T & D Loss f**rom the drop-down, the software navigates to the **Transmission & Distribution Lossess** page of **Business As Usual** senario as shown in Figure 82.

2. Select **Seasonal/Annual** option to view or edit T & D Loss data.
3. **Loss(%)** data configured in **STEPS TO CONFIGURE TRANSMISSION & DISTRIBUTION LOSSES INTO THE SOFTWARE**: section will be displayed in tabular form. You can edit T & D Loss data by doble clicking th row.
4. Click on **Refresh** icon to generate graph if Loss(%) data is modified.
5. Graph with respect to Loss(%) data will be generated.

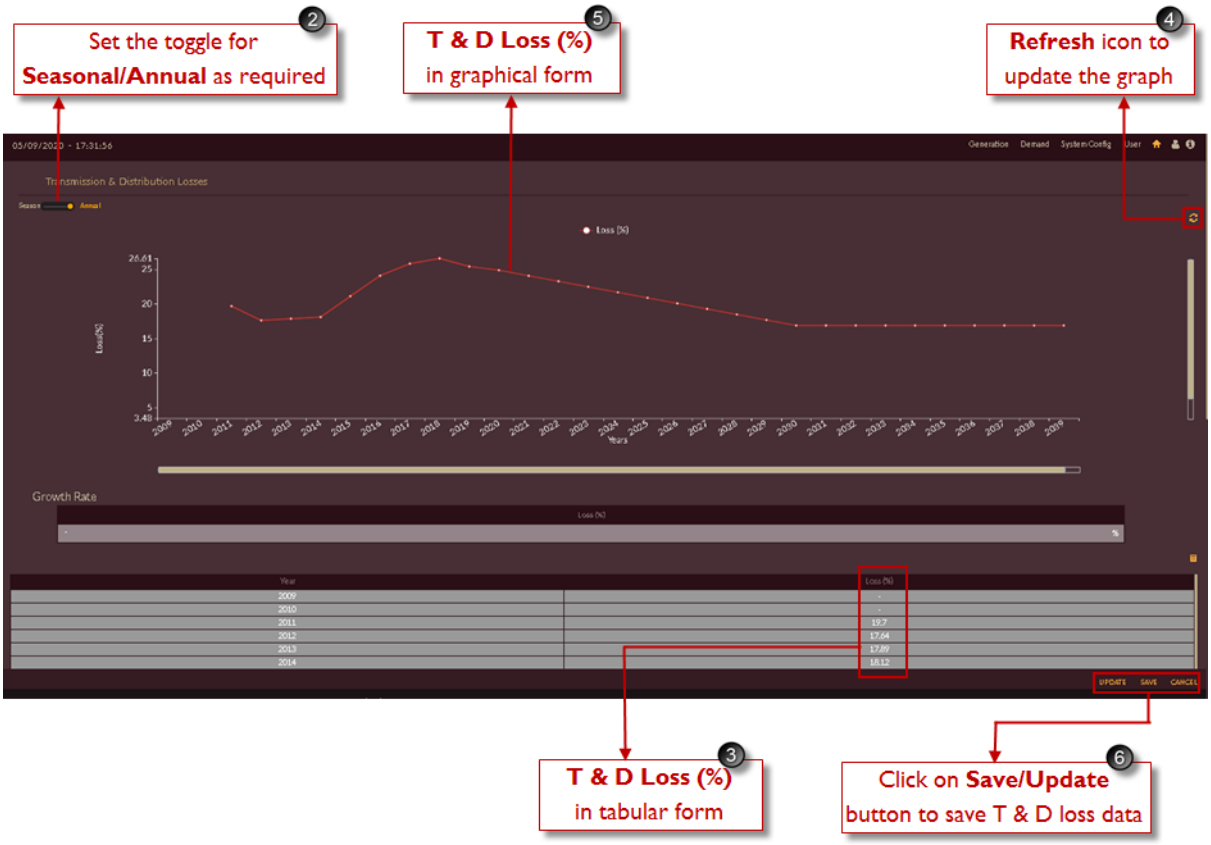


Figure 82. Edit/Save T & D Loss Data

6. Click on **Save** button to save the state data, **Update** button to update the changes made in state data and **Cancel** icon to discard the changes made in state data.

7. After saving all Licensee, State and T & D data into the Business As Usual (BAU) scenario user will see the page as shown in Figure 83.

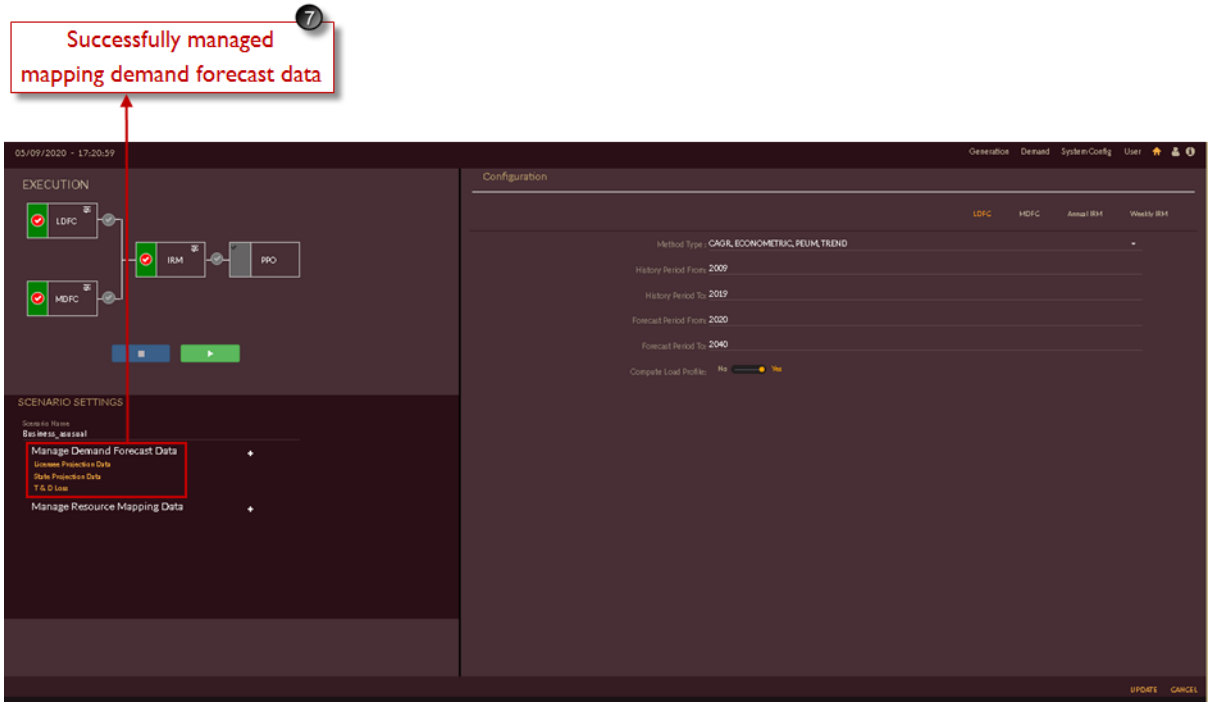


Figure 83. Finalized BAU Scenario

EXECUTE BAU SCENARIO

Now that all configurations are completed, we shall see how to execute the demand forecast (LDFC & MDFC).

This section gives you the steps to execute the scenario created.

1. Go to scenario list page as shown in Figure 84 and click on **Edit Scenario** icon for the scenario which you need to execute.

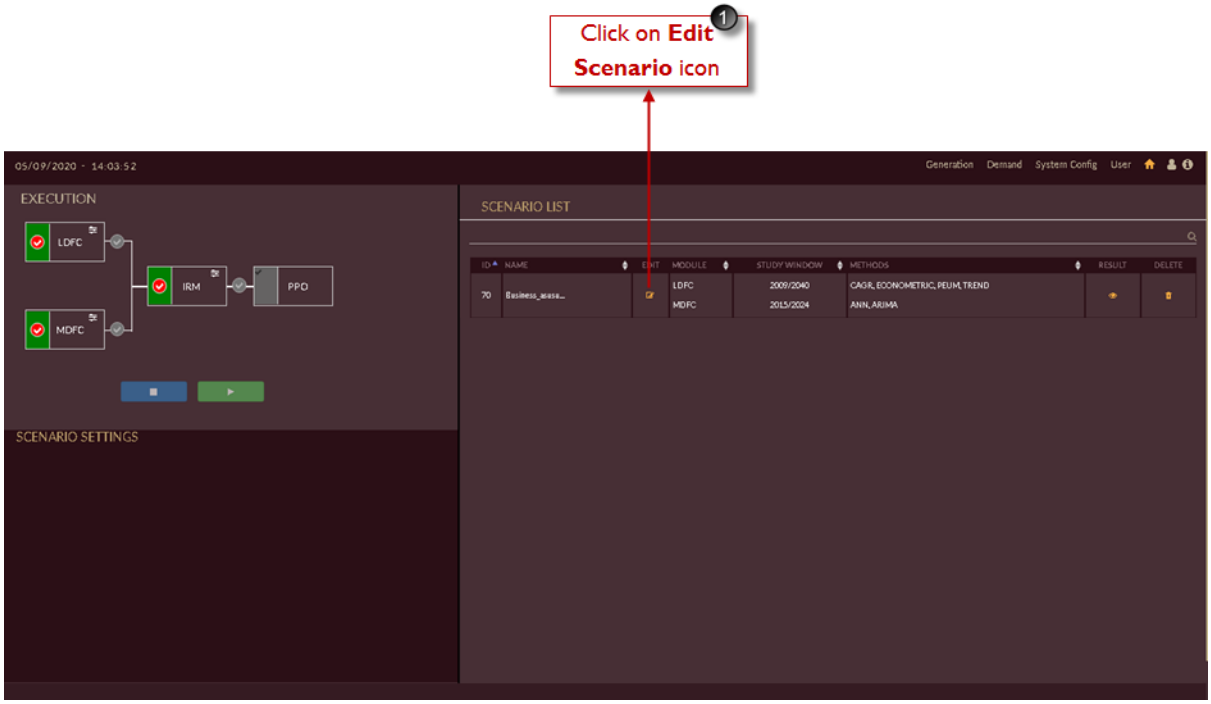


Figure 84. Select Scenario to be Executed

2. Select the method i.e, **LDFC function**  and **MDFC function**  by clicking the red  tick mark of respective methods.
3. Click on the **Execute**  icon on the left-side shown in Figure 85.
4. Orange line appears on the top of the software page indicating that scenario is getting executed.

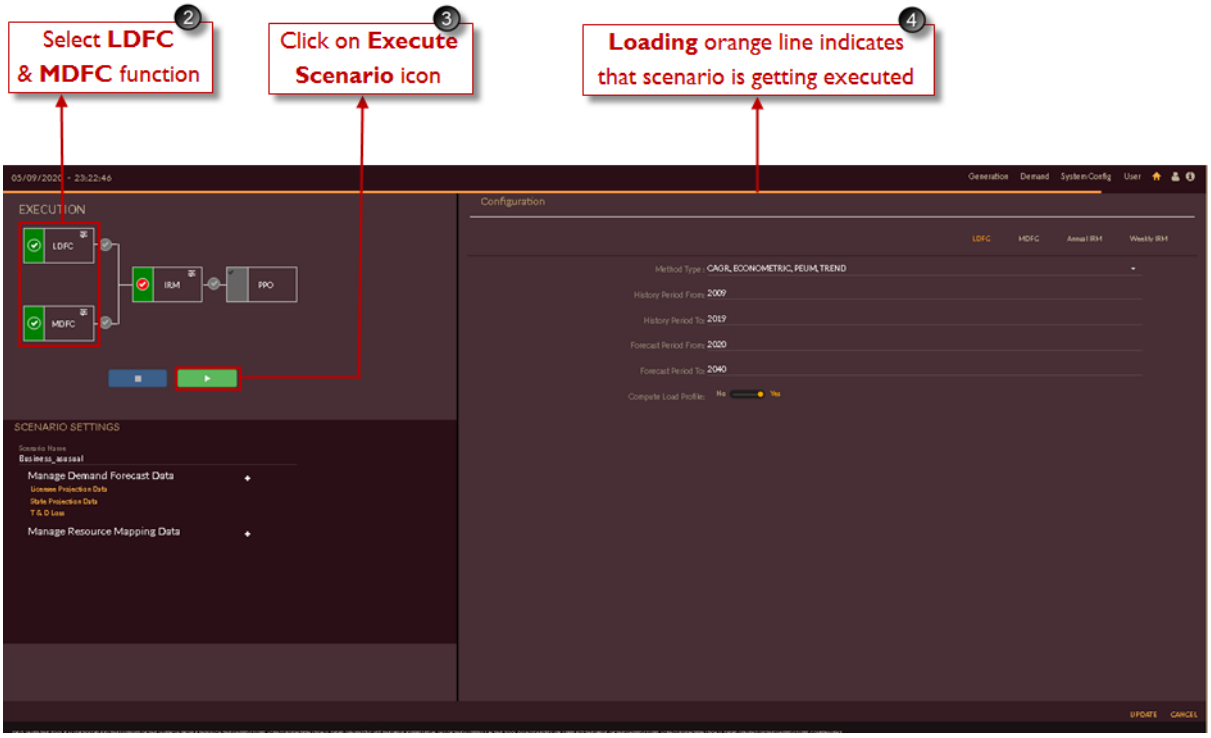
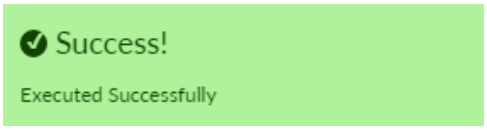


Figure 85. Execution of Demand Forecast

The "Executed Successfully" message appears.



Upon successful execution of the scenario, you're navigated to the results page as shown in Figure 86.

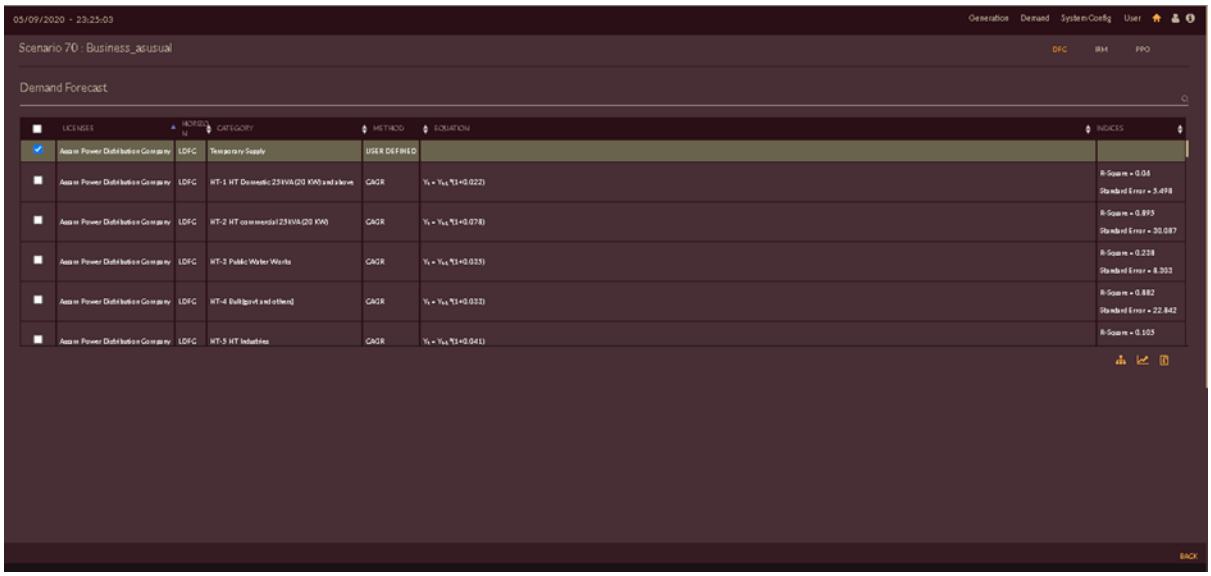


Figure 86. Result Page

DOWNLOAD/EXPORT/VIEW BAU SCENARIO RESULTS

This section gives the steps to view, export and download results of demand profile that is executed.

STEPS TO VIEW & EXPORT BAU-DFC RESULTS:

Login to the software. The **Dashboard/Home** page appears. The **Scenario List** appears on the right of the home page.

1. Click on the **View Result**  icon on the scenario that you wish to view. In this example, we see the results of the scenario 70, Business as usual.

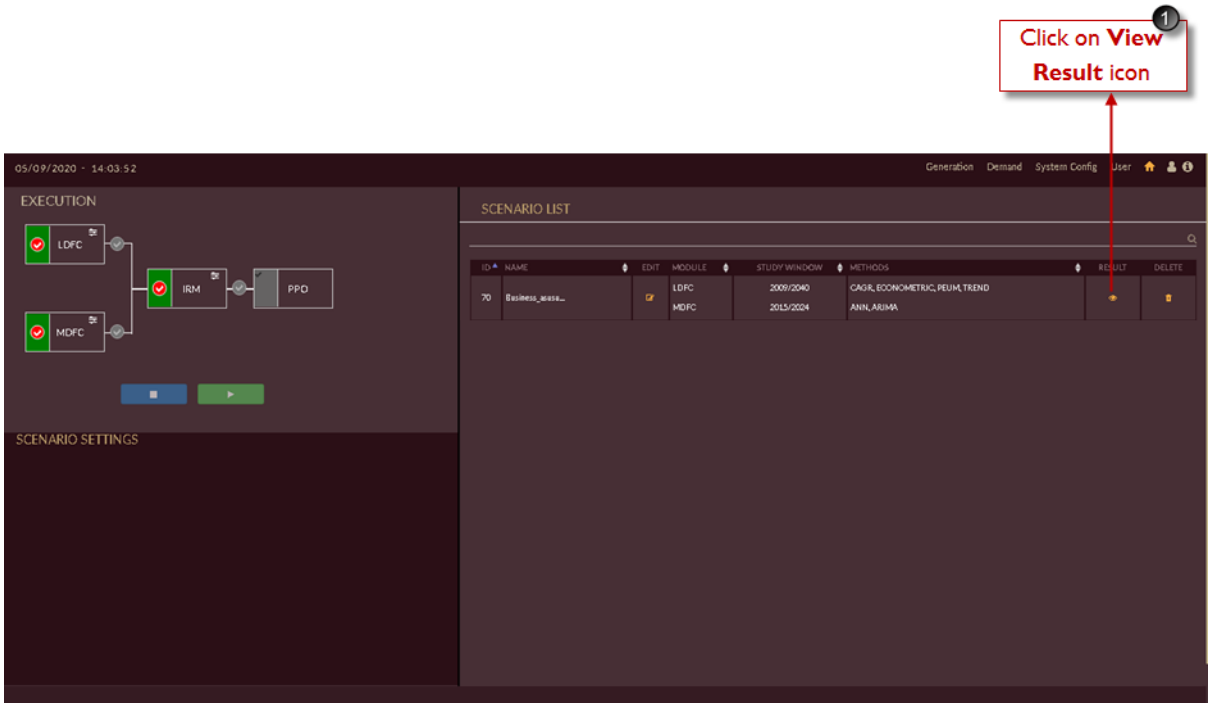


Figure 87. View the Scenario

Once you click **View**  icon, the result page of selected scenario, Business As Usual will open as shown in Figure 88.

2. In the result page LDFC methods will be pre-selected by software based on best R^2 value.

3. Click on **Chart/Graph**  icon to view results in graphical format.

Once you click  icon, the result page will appear in the form of graphical rpresentation as shown in Figure 89. Move the **Graph or Table**  data slider to Table. The same data appears as table.

4. Click on **Consolidate**  icon to view results in consolidated format.

Figure 88. Result Page for Viewing

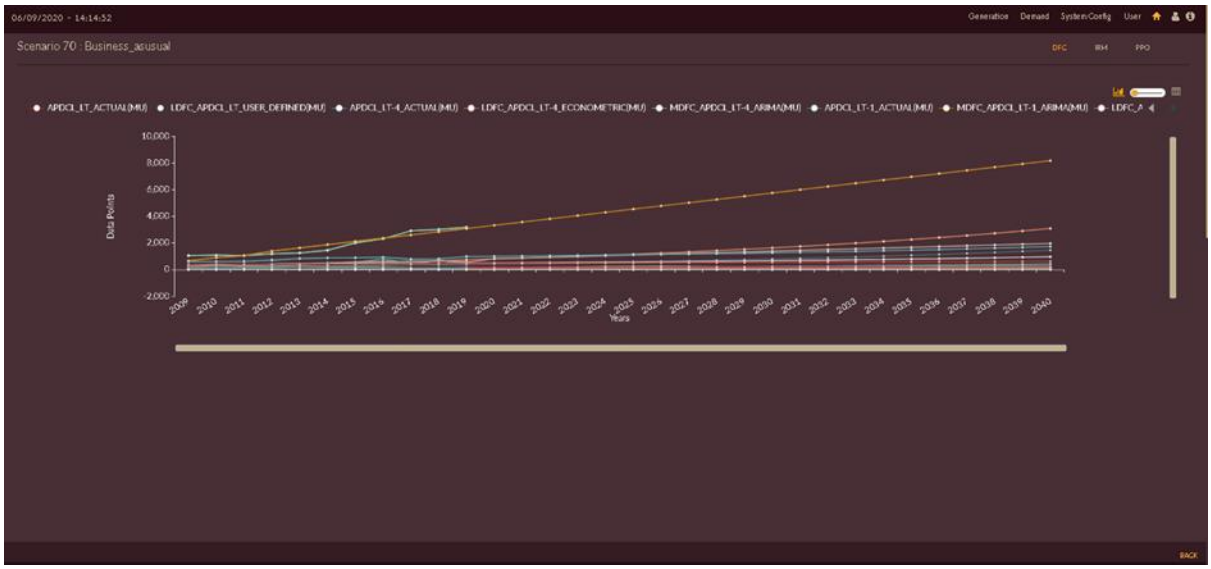
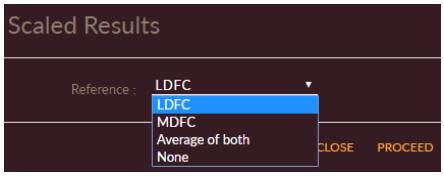


Figure 89. Results in Graphical Form

Once you click **Consolidate** icon, the drop-down appears as shown in Figure 90.

5. The drop-down has following options



When LDFC is selected, the results of MDFC and Average of both are scaled to match the results of LDFC. Whereas when MDFC is selected, the values of LDFC and Average of both get scaled to match with the MDFC results.

In this example, LDFC is selected. Click on **Proceed** PROCEED icon to generate the consolidated result. The **Consolidated** results page appears.

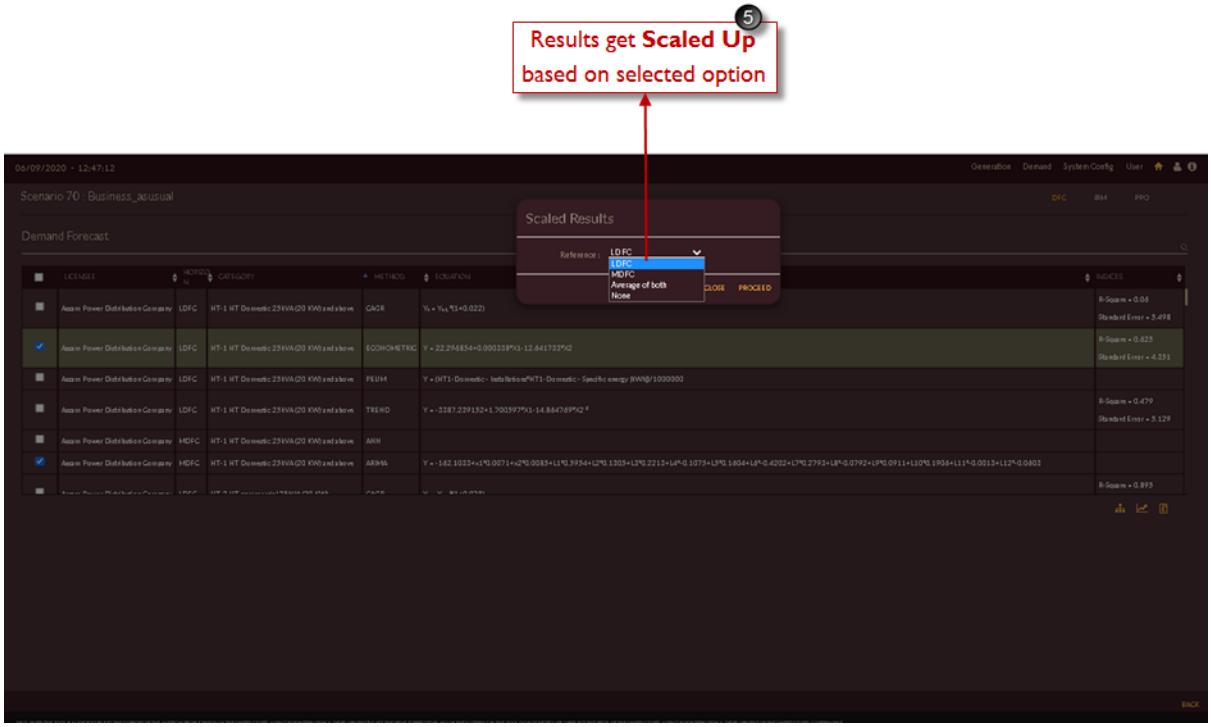


Figure 90. Consolidating Demand Results

Once you click on **Proceed** PROCEED icon, the "Consolidated Results" page appears in a few seconds as shown in Figure 91.

6. By default, the slider will be set on LDFC LDFC MDFC option.
7. By default, the **State** results are displayed.
8. Click on the **Download PDF Report** icon to download the PDF report file of the consolidated report on LDFC & MDFC.

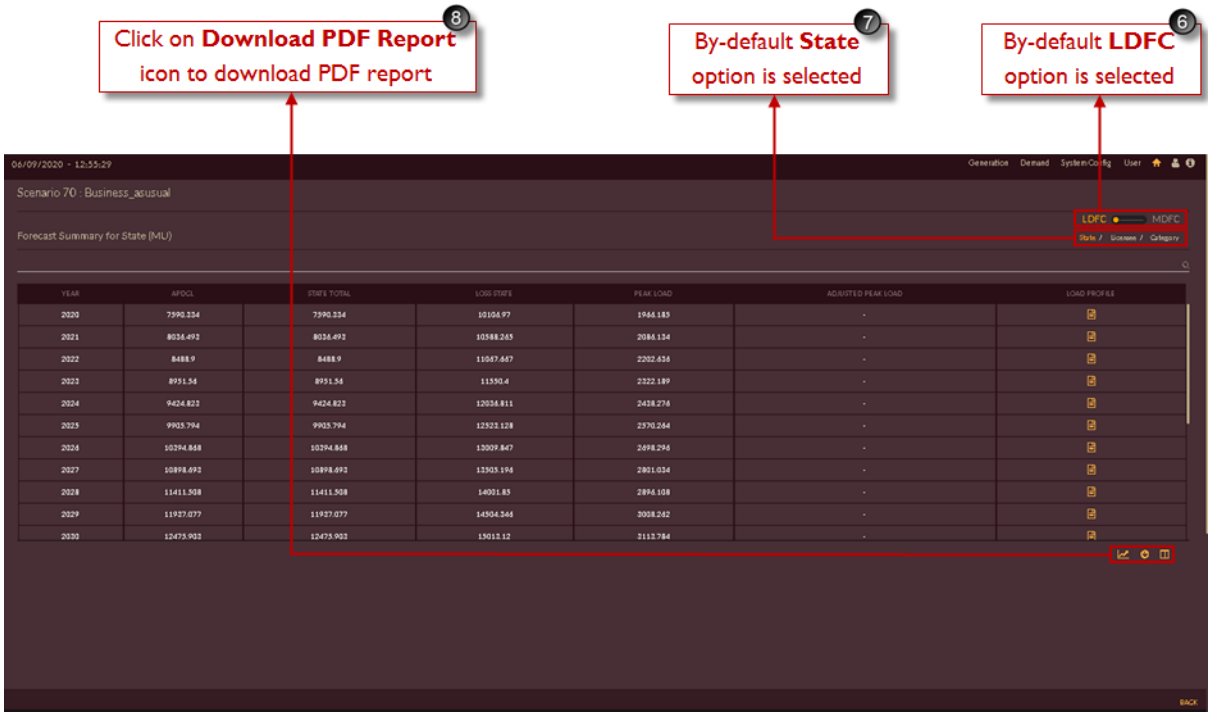


Figure 91. Consolidated LDFC State Results

Figure 92 shows consolidated MDFC state results.

9. Set the slider to **MDFC**  to view medium forecasted results seasonally or monthly.

Figure 92. Consolidated MDFC State Results

Figure 93 shows consolidated LDFC licensee results.

10. If you need to view demand results for each licensee you have to click on **Licensee** State / Licensee / Category tab.

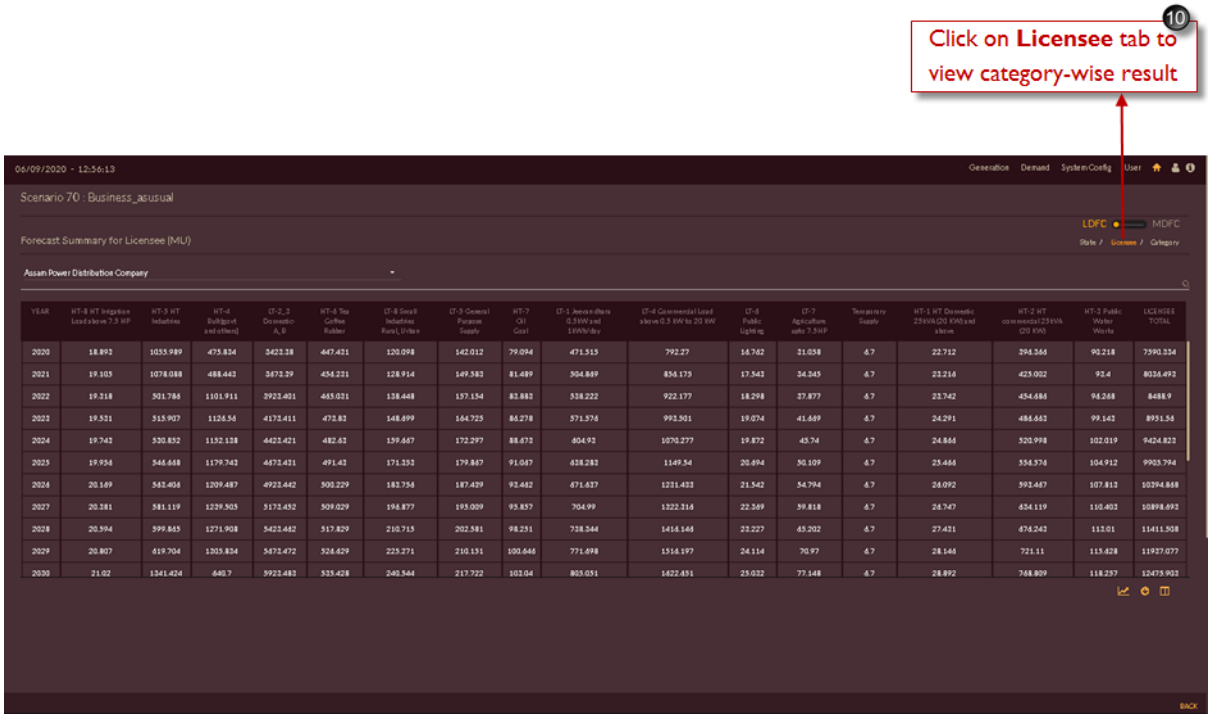


Figure 93. Consolidated LDFC Licensee Results

Figure 94 shows consolidated LDFC category results.

11. To view demand results for each category you have to click on **Category** State / Licensee / Category tab.

    Here you can select any category from the drop-down list and can view the results in detail.

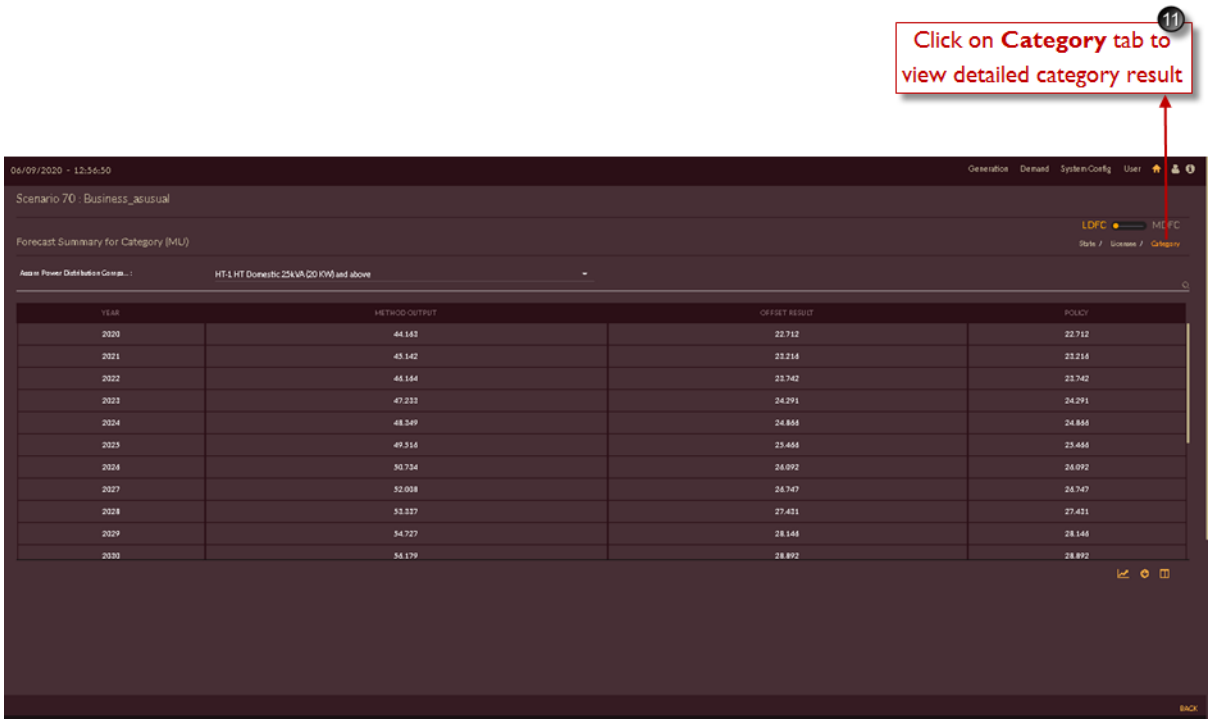


Figure 94. Consolidated LDFC Category Results

STEPS TO DOWNLOAD BAU-DFC RESULTS:

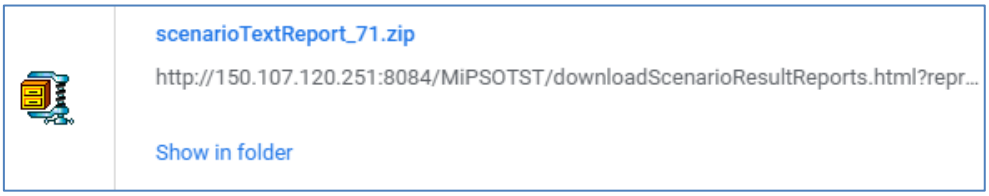
This section gives you the steps to download results.

Repeat steps from 1 to 5 from **STEPS TO VIEW & EXPORT BAU-DFC RESULTS**:.

1. Click on the **Download PDF** icon to download the PDF report file of the consolidated report on LDFC & MDFC. PDF report will be downloaded with scenario name. First page of PDF report for Business as usual scenario is shown in Figure 95.

Figure 95. First page of Business as Usual PDF Report

2. Click on **Download Text Reports** icon. The **Scenario Text Reports** get downloaded.



3. Click on **Download Excel Reports** icon.

The **Text Reports** get downloaded. A snapshot of the report is given:

1	Scenario Result					
2		er Distribution Corporati				
3		Jeevan dhara	Licensee	State		
4	Year	Energy Sales	Sum	Sum		
5	2009	-26.607	-16.413	33.61	-9.41	-9.41
6	2010	46.859	58.547	96.57	201.98	201.98
7	2011	65.332	208.099	321.5	594.9	594.9
8	2012	91.087	307.968	349.2	748.24	748.24
9	2013	126.994	396.182	397.1	920.29	920.29
10	2014	177.056	445.636	472.7	1095.4	1095.4
11	2015	246.854	494.861	537.6	1279.4	1279.4
12	2016	344.167	544.675	590.9	1479.7	1479.7
13	2017	479.841	518.533	632.5	1630.9	1630.9
14	2018	662.418	669	764.8	2096.2	2096.2
15	2019	680.698	827.038	932.7	2440.5	2440.5
16	2020	687.322	888.975	1300	2876.7	2876.7
17	2021	682.291	950.572	1813	3445.9	3445.9
18	2022	665.605	1019.22	2528	4212.6	4212.6
19	2023	637.262	1088.97	3524	5250.5	5250.5
20	2024	597.264	1159.82	4914	6670.7	6670.7
21	2025	545.611	1231.81	6851	8628	8628
22	2026	482.302	1304.94	9551	11338	11338
23	2027	407.337	1379.24	13316	15103	15103
24	2028	320.717	1454.73	18566	20341	20341
25	2029	222.441	1531.42	25885	27638	27638
26	2030	112.509	1609.34	36089	37810	37810
27						

Figure 96. Text Report Output

***Note**: For carrying out Integrated Resources Mapping – IRM studies by taking **demand** results from BAU scenarios as input for IRM you have to download **Load Profiles** for study years of MDFC and LDFC seen in consolidated results in Figure 91 and Figure 92.*

2.1.4.2 IMPACT OF DRIVERS & REPORT

BAU-Business As Usual is the scenario for performing both Long term (LDFC) and Medium term (MDFC) demand forecast studies for defined period without including the impacts of inputs given to drivers like OA, CPP, DER and EV.

Now let us see the same scenario with the impact of drivers configured in the **DRIVERS** section.

The drivers are seen to have both positive and negative impacts on the demand experienced by the utility. The drivers CPP, OA, DERs have negative impact as the consumption is routed to CPP, DER and OA sources thereby reducing the power consumption from the utility while the charging units for EVs and operation of EVs need more power, it positively impacts the power consumption from the utility. To study the impact of drivers on our DISCOM load, let us create a new scenario named "**Scenario with Drivers**".

CREATE SCENARIO WITH DRIVERS

To create the scenario, follow the same steps shown in **CREATE BAU SCENARIO** section.

1. Set scenario name as "**Scenario with Drivers**" as shown in Figure 97.

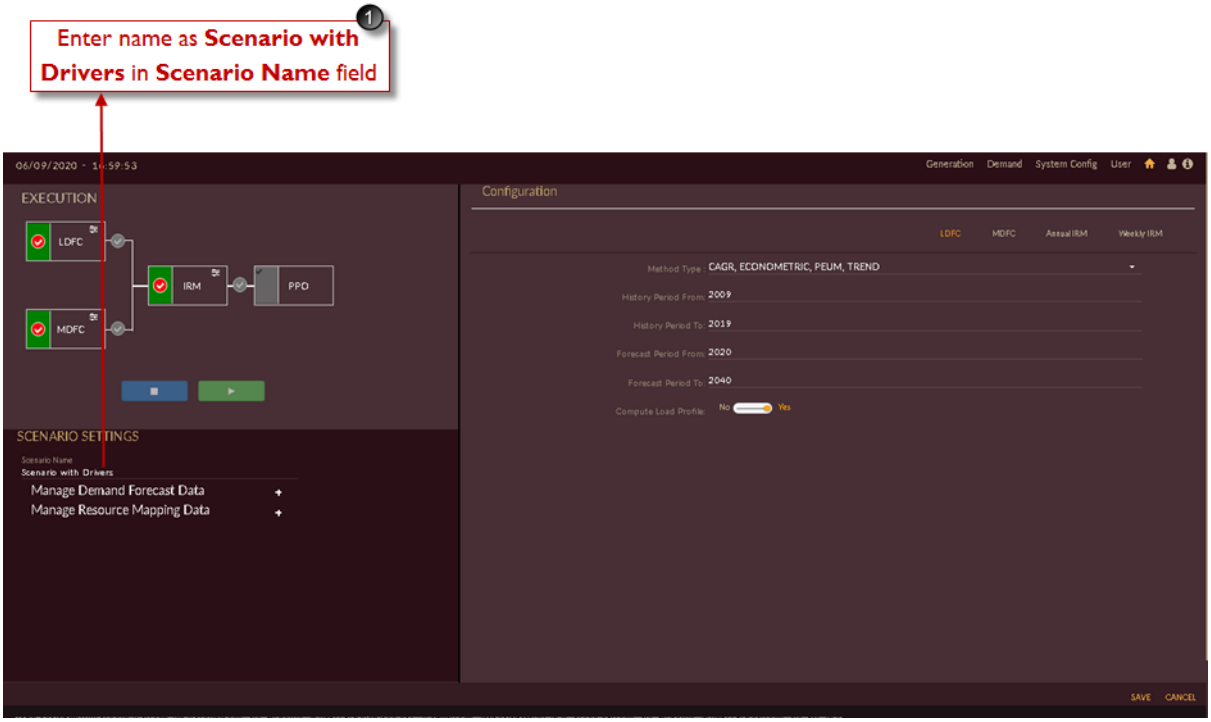


Figure 97. Creating Scenario with Drivers

2. Once scenario with drivers is created and saved, it will reflect in scenario list page as shown in Figure 98.

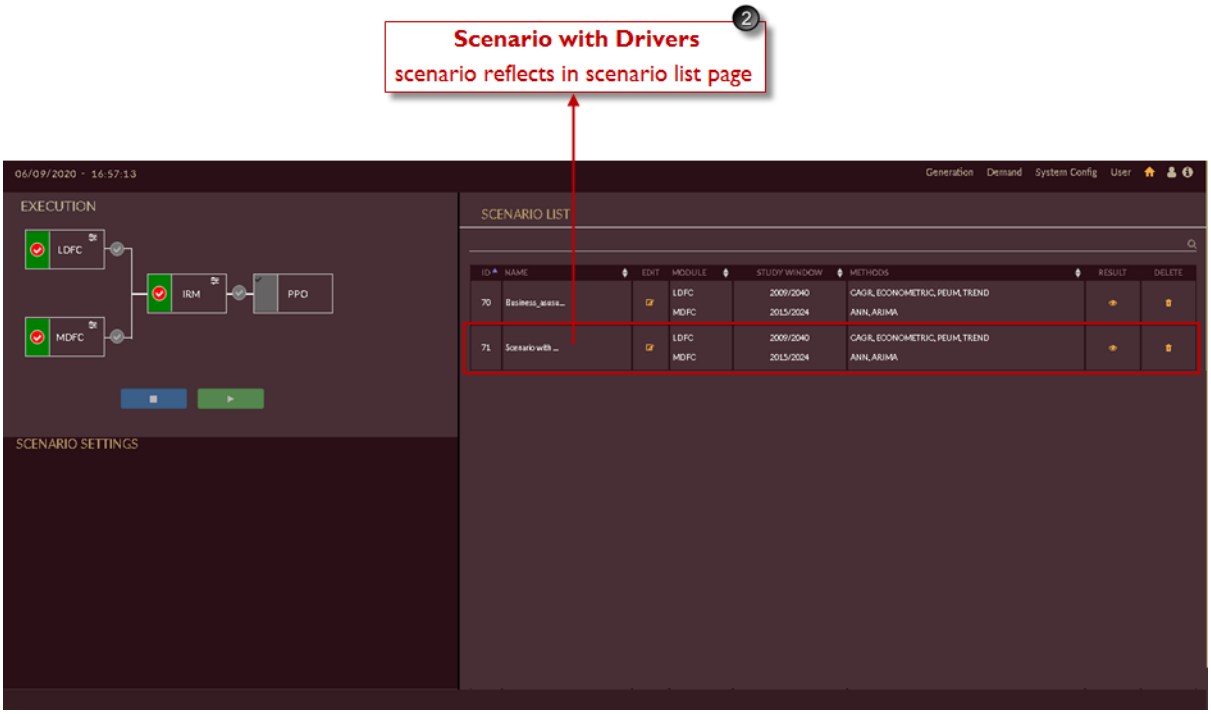


Figure 98. Scenario with Drivers in Scenario List

EDIT SCENARIO WITH DRIVERS

As soon as the scenario is created, it gets listed in the list of scenarios on the homepage. However, the data required for the scenario is yet to be configured. You have to edit the data to execute the scenario.

User has to select the manage data from drop-down.

The drop-down has following list:

- Licensee projection data
- State data
- T & D loss data
- Open access
- Captive power plant
- Distributed energy resources
- Electric vehicle

- User has to follow same steps as shown in **EDIT BAU SCENARIO** section.
- Follow **STEPS TO EDIT/CONFIGURE LICENSEE PROJECTION DATA** section to manage licensee data.
- Follow **STEPS TO EDIT/CONFIGURE STATE DATA**: section to manage state data.
- Follow **STEPS TO EDIT/CONFIGURE T & D LOSS DATA**: section to manage T & D loss data.

Now let us see how to manage Drivers data into the scenario.

STEPS TO EDIT OPEN ACCESS DATA:

1. Click on **Manage Demand Forecast Data** icon and select **Open Access** from the drop-down list as shown in Figure 99.

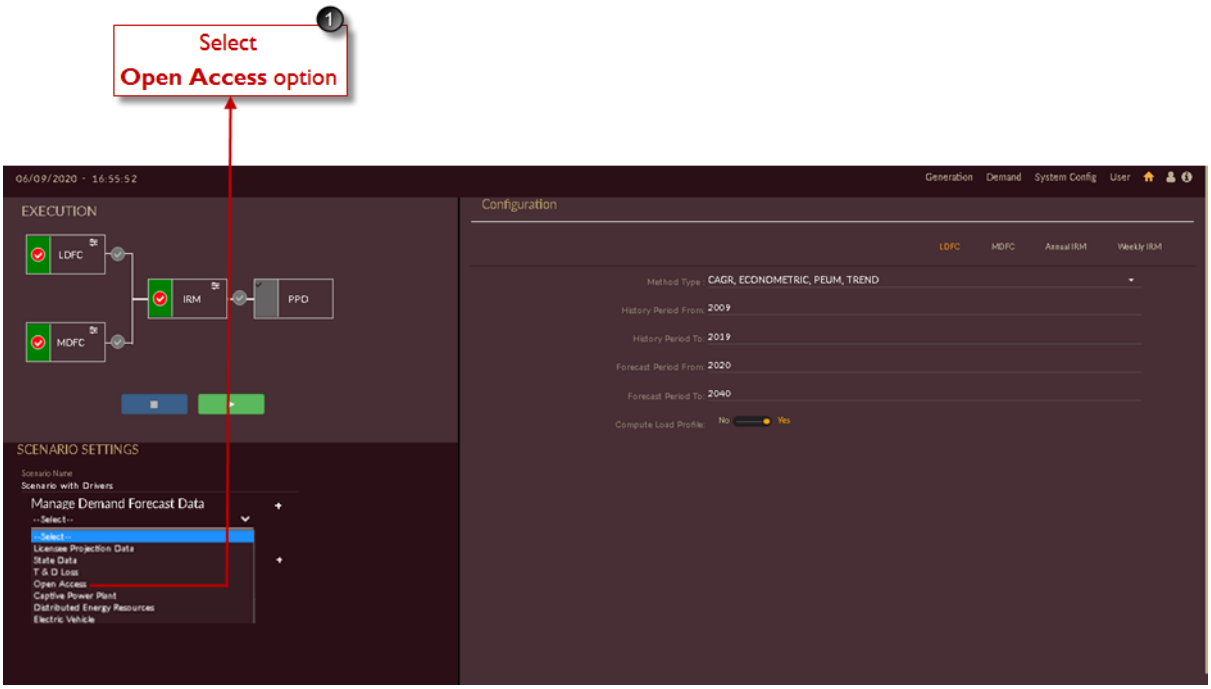


Figure 99. Manage Open Access Data

Once you click **Open Access**, you will be navigated to the **Open Access Data Configuration** page of **Scenario with Drivers** senario as shown in Figure 100.

2. Open access data configured in **CONFIGURING OPEN ACCESS (OA)** section will reflect in the table. Double-click on the rows in the table to edit the Open Acceess energy shares.
3. Graph for the respective Open access energy shares is generated.

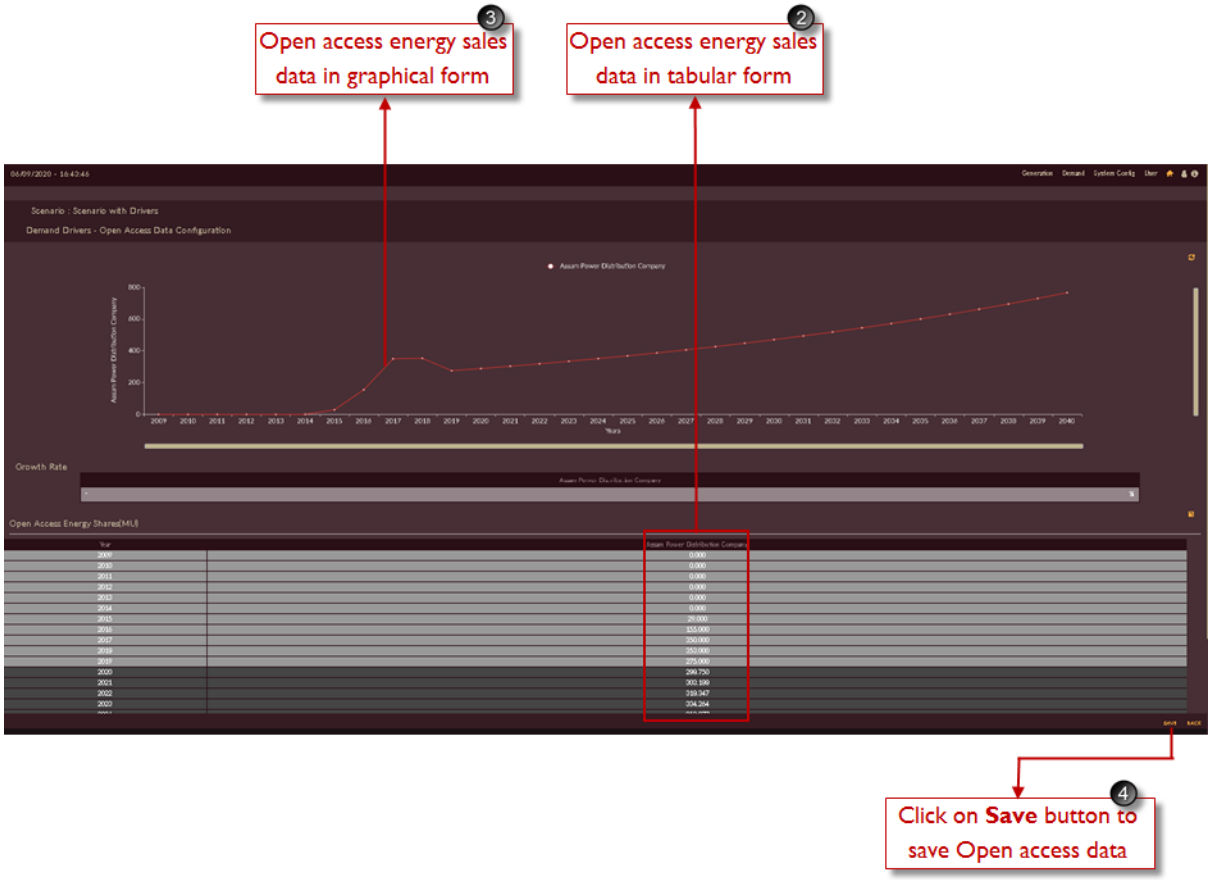


Figure 100. Edit/Save Open Access Data

4. Click on **Save** icon to save the open access energy sales data.

STEPS TO EDIT CAPTIVE POWER PLANT DATA:

1. Click on **Manage Demand Forecast Data** icon and select **Captive Power Plant** from the drop-down list as shown in Figure 101.

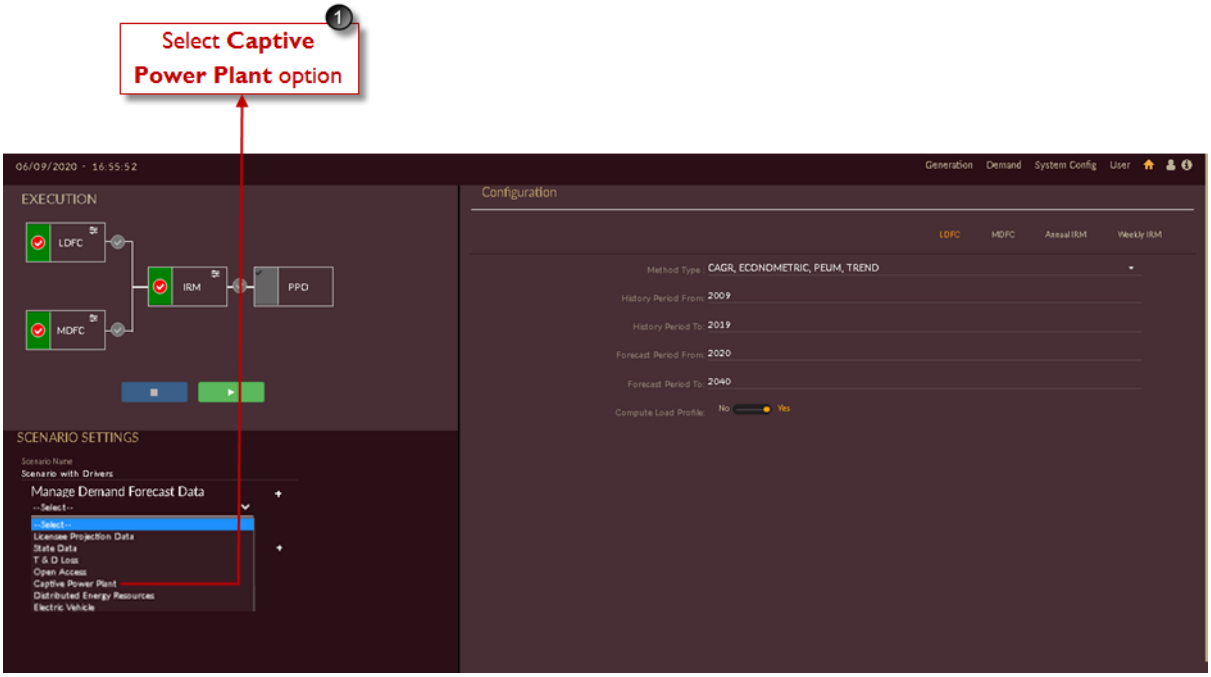


Figure 101. Manage Captive Power Plant Data

Once you click **Captive Power Plant**, you will be navigated to the **Captive Power Plant Data Configuration** page of **Scenario with Drivers** senario as shown in Figure 102.

2. Captive power plant data configured in **CONFIGURING CAPTIVE POWER PROCUREMENT (CPP)** section will reflect in the table. Double-click on the rows to enter /edit the captive power plant energy shares by double clicking the row.
3. The respective graph for the captive power plant energy shares is generated.

   Note: We have considered imaginary **CPP** data for scenario with drivers due unabilability of CPP data for Assam state.

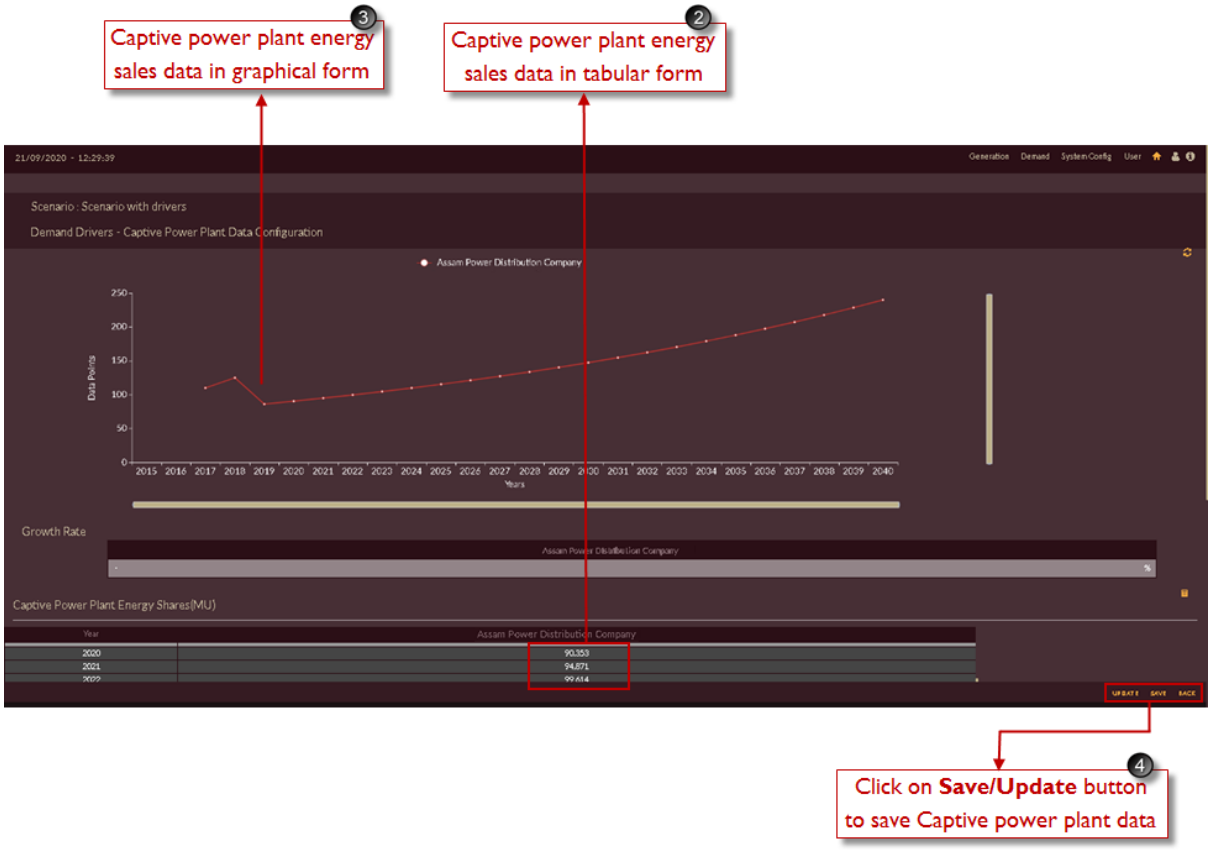


Figure 102. Edit /Save Captive Power Plant Data

4. Click on **Save** button to save, **Update** button to update save the changes made and **Back** icon to discard the changes made in captive power plant data respectively

STEPS TO EDIT DISTRIBUTED ENERGY RESOURCES DATA:

1. Click on **Manage Demand Forecast Data** icon and select **Distribued Energy Resources** from the drop-down list as shown in Figure 103.

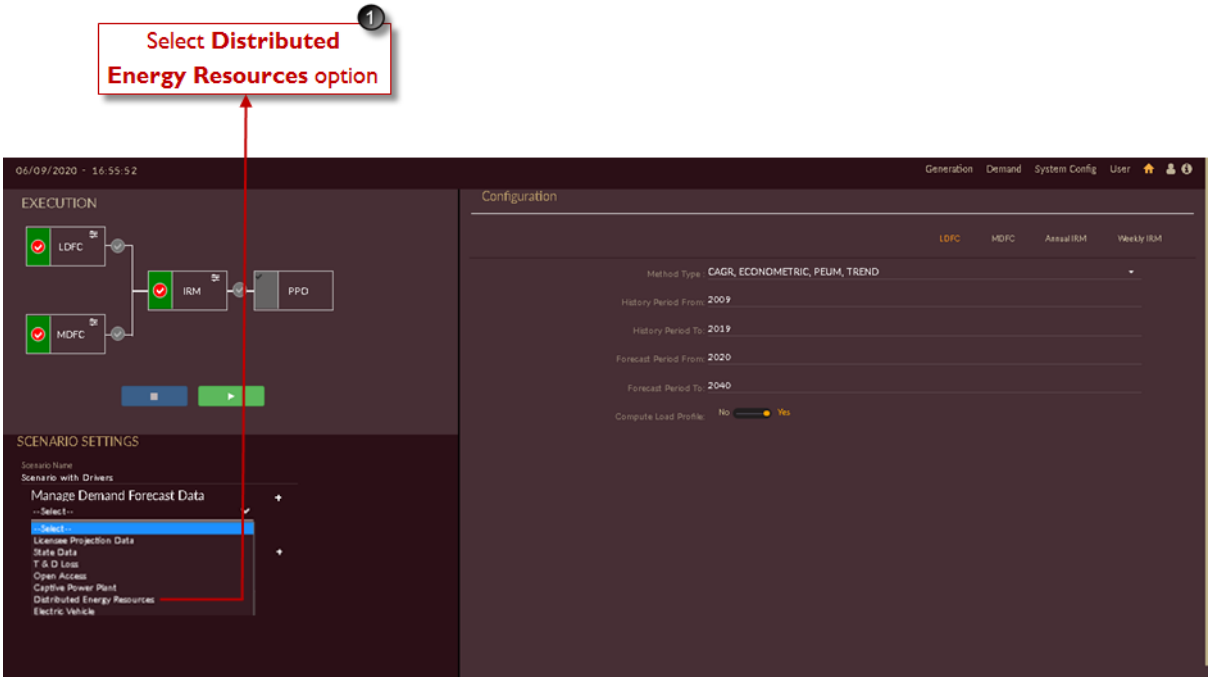


Figure 103. Manage Distributed Energy Resources Data

Once you click on the **Distributed Energy Resources**, you are navigated to the **Distributed Energy Resources** page of **Scenario with Drivers** senario as shown in Figure 104.

2. Click on **DER Specification** icon.
3. The **installed capacity [PV(IC)]** and **capacity utilisation factor [PV(CUF)]** configured **STEPS TO CONFIGURE DER SPECIFICATION** section will reflect in the table. Double-click on the row ad edit the IC & CUF data. .

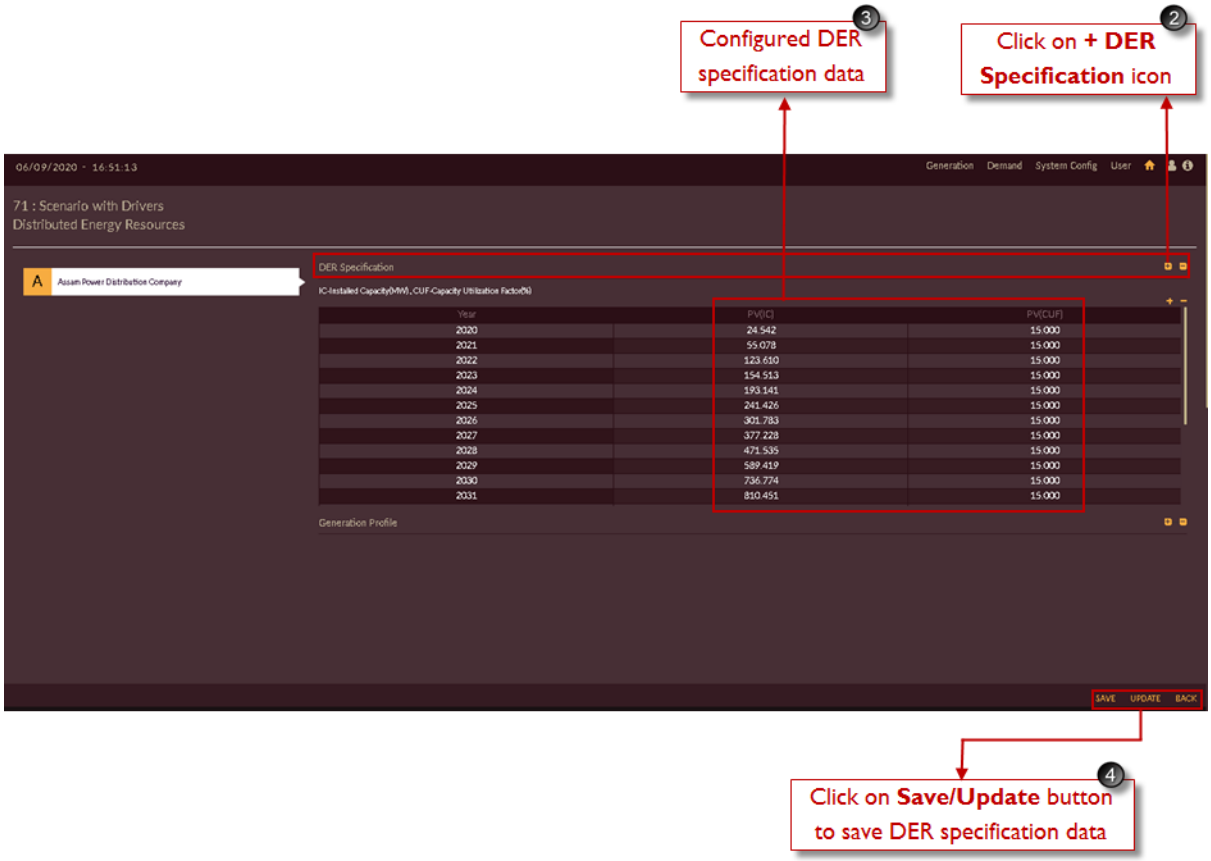


Figure 104. Edit/Save DER Specification Data

4. Click on **Save** button to save the DER Specification data, **Update** button to update the changes and **Back** icon to discard the changes made in DER Specification data.
5. Click on **Generation Profile** icon, the generation profile page appears as shown in Figure 105.
6. Hourly **PV** profile will be tabulated in the table.

   (Since we have not configured **Generation profile** data in **STEPS TO CONFIGURE GENERATION PROFILE** section here it is diplaying as '**0**')

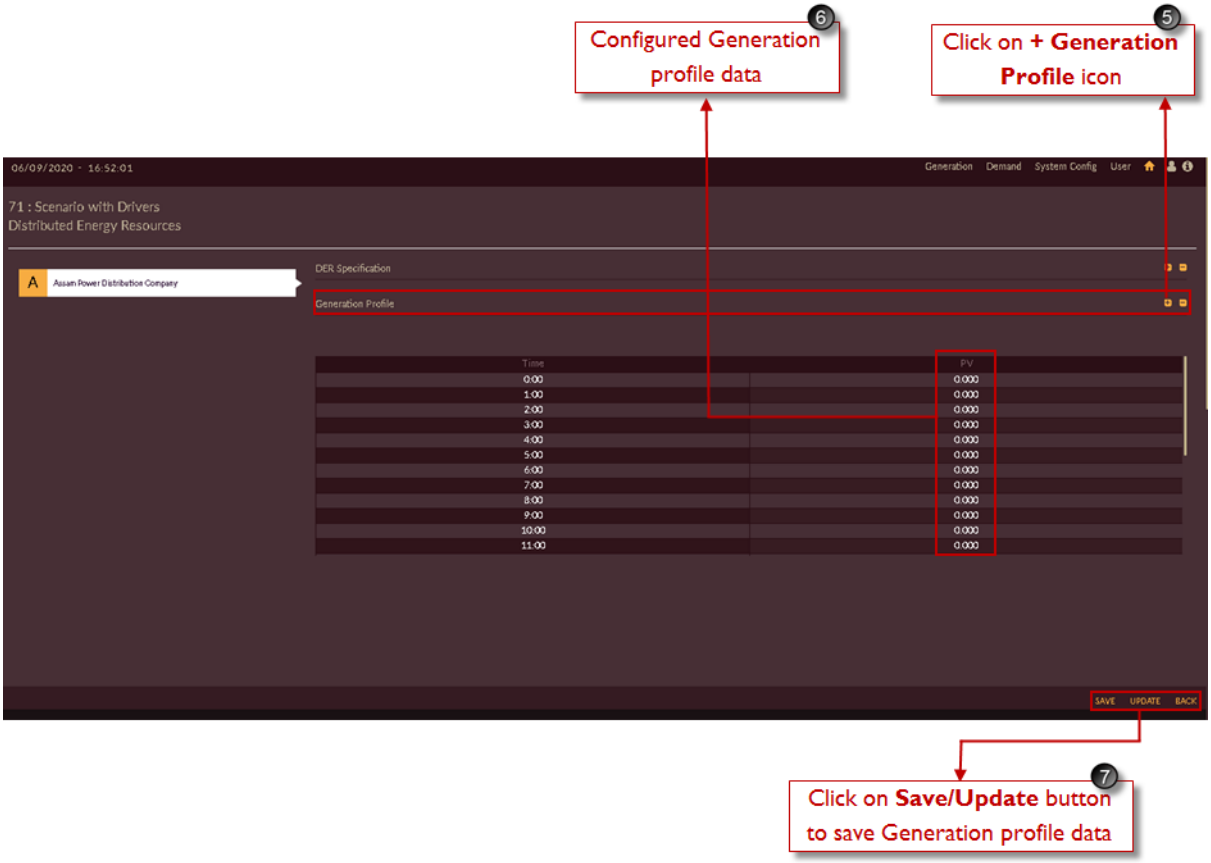


Figure 105. Edit/Save Generation Profile Data

7. Click on **Save** button to save the generation profile data, **Update** button to update the changes and **Back** icon to discard the changes made in generation profile data.

STEPS TO EDIT ELECTRIC VEHICLE DATA:

1. Click on **Manage Demand Forecast Data** icon and select **Electric Vehicle** from the drop-down list as shown in Figure 106.

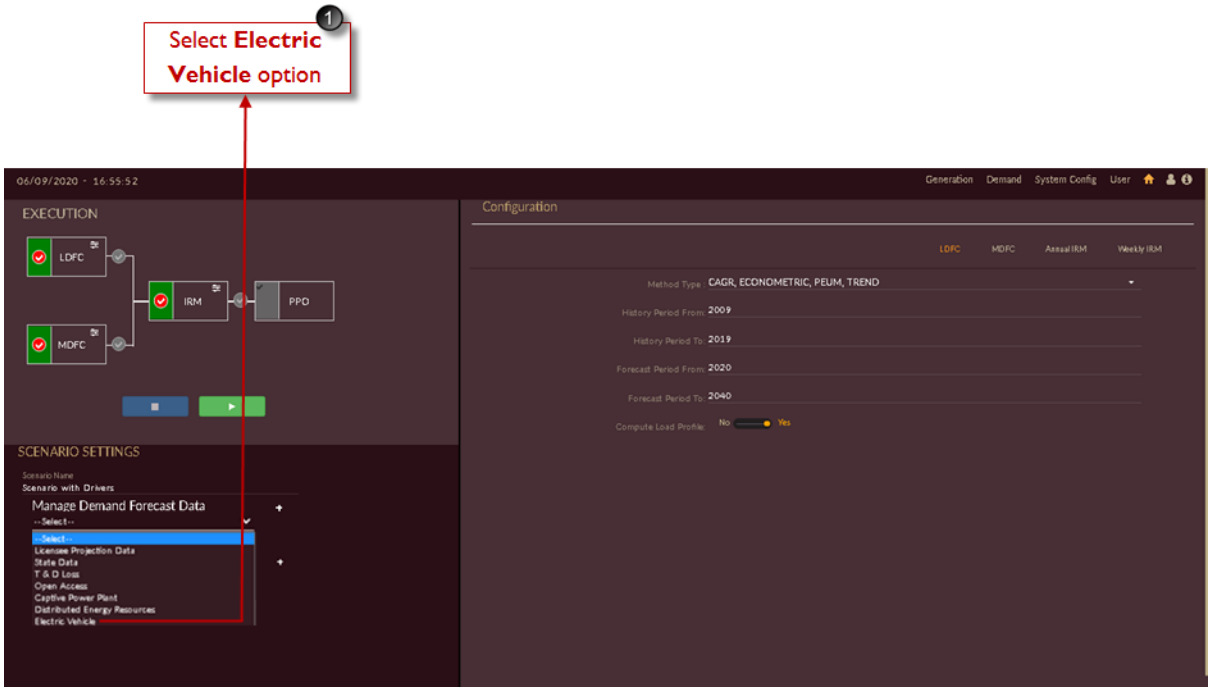


Figure 106. Manage Electric Vehicle Data

Once you click **Electric Vehicle**, you are navigated to the **Electric Vehicle** page of **Scenario with Drivers** senario as shown in Figure 107.

2. Click on the **Electric Vehicle Specifications** icon.
3. Table will be displayed in which data configured in **STEPS TO CONFIGURE ELECTRIC VEHICLE SPECIFICATIONS** section for **EV Category**. You could make changes in the data if required or leave the data that is already configured.

Figure 107. Edit/Save Eectric Vehicle Specifications

4. Click on the **Save** button to save the Electric Vehicle Specifications data.
5. Click on **Count** icon.
6. Table will be displayed in which data configured in **STEPS TO CONFIGURE EV COUNT** section for **EV Count**. Year on year, an increase in the adoption of EVs is expected to rise and change. The changes could be entered using this table.

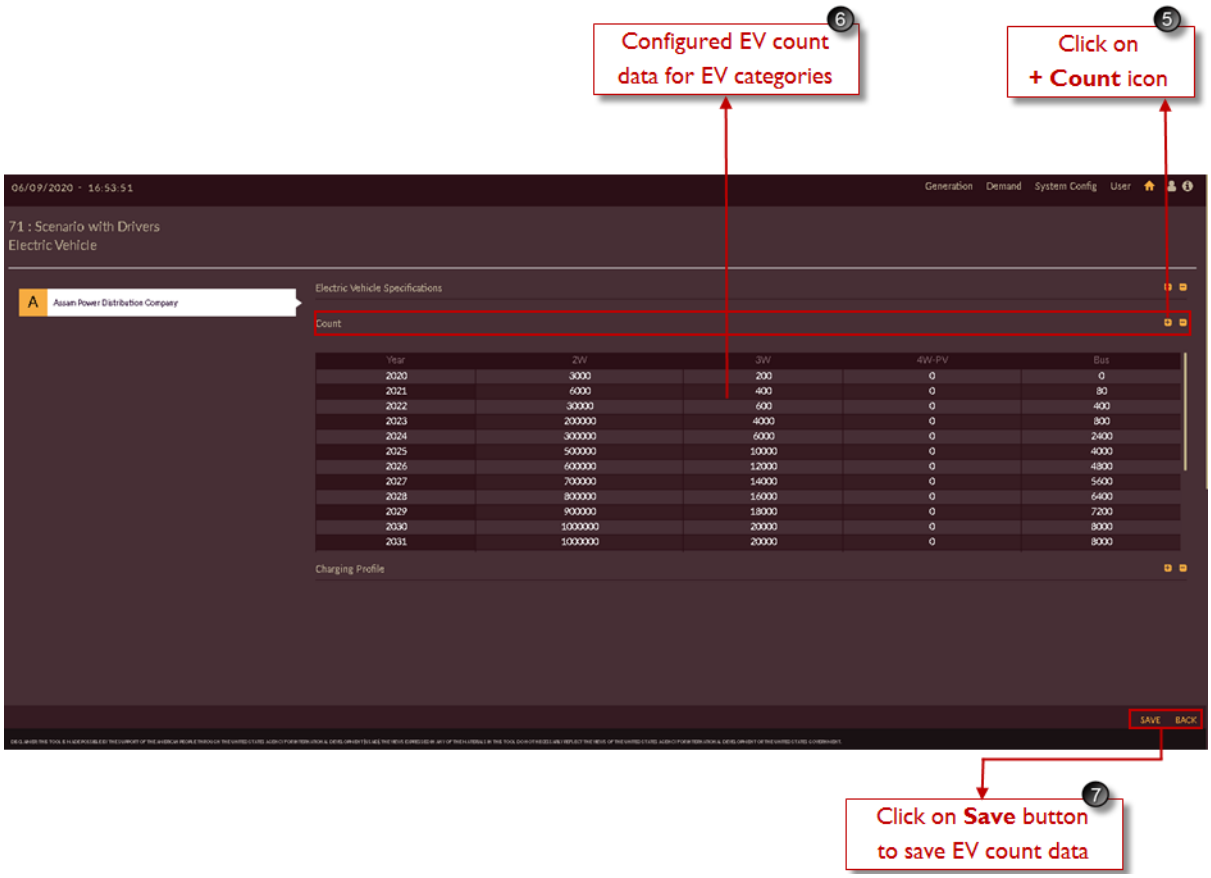


Figure 108. Edit/Save Electric Vehicle Count

7. Click on **Save** button to save the Electric Vehicle Count data.
8. Click on **Charging Profile**  icon.
9. Table will be displayed in which data configured in **STEPS TO CONFIGURE EV CHARGING PROFILE** section for **EV Charging Profile**. Make the necessary changes to the values in this table if any is required.

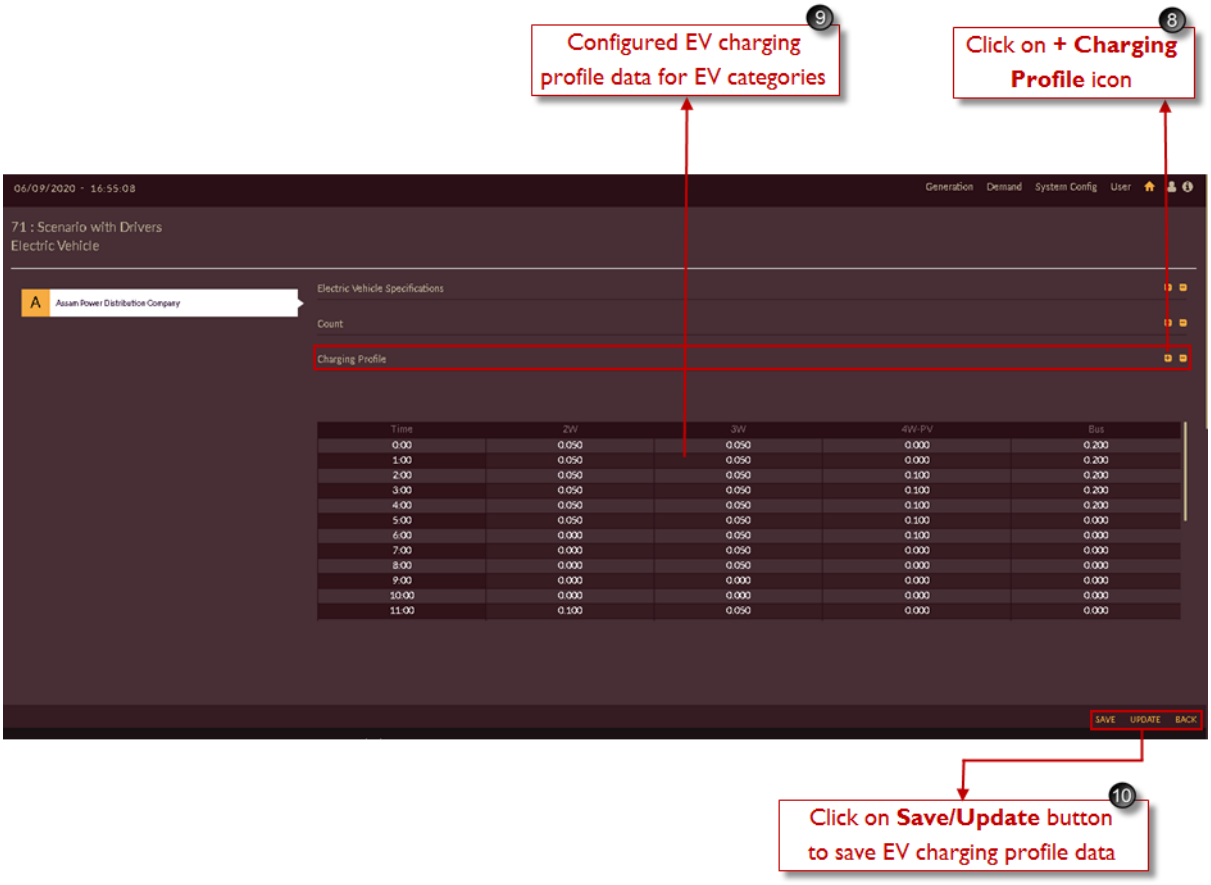


Figure 109. Edit/Save Electric Vehicle Charging Profile

10. Click on **Save** button to save the EV chargingprofile data, **Update** button to update the changes and **Back** icon to discard the changes made in EV charging profile data.

11. After saving all the parameters such as Licensee, State, T & D Loss, Open Access, Captive Power Plant, Distributed Energy Resources and Electric Vehicle data into the Scenario with Drivers you will see the page as shown in Figure 110.

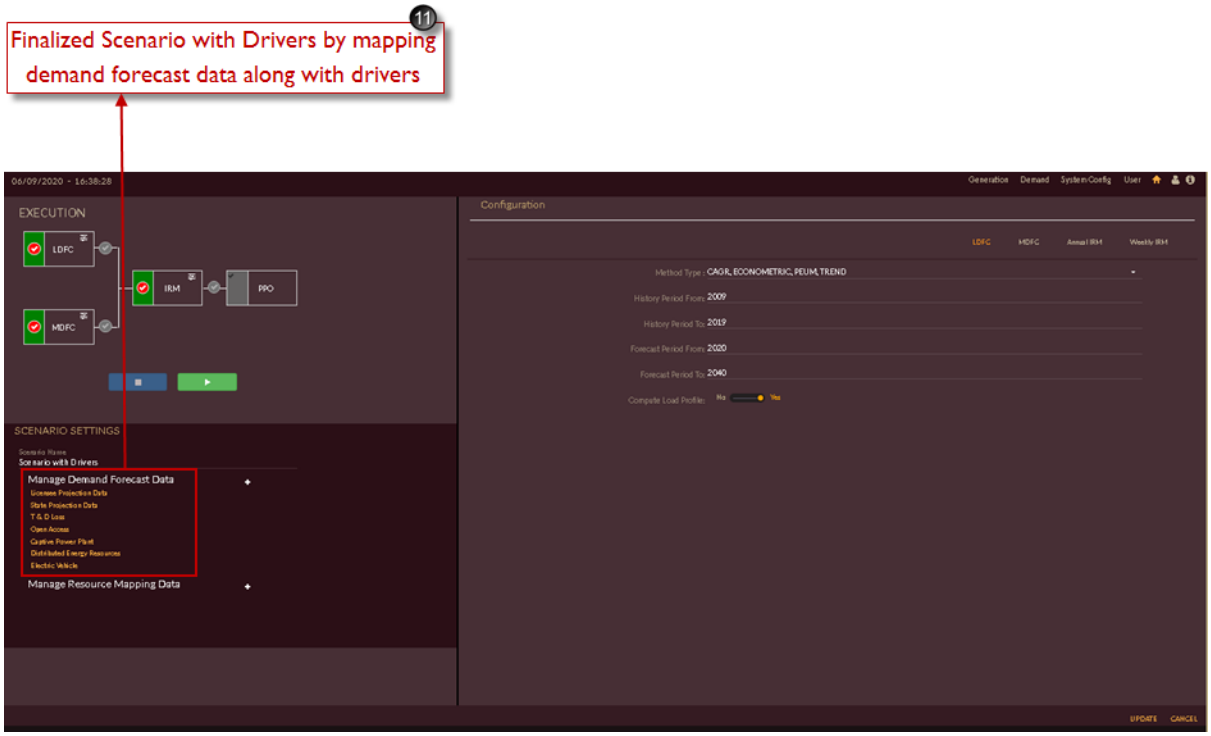


Figure 110. Finalized Scenario with Drivers

EXECUTE SCENARIO WITH DRIVERS

Once the scenario is built and finalized, you can execute the demand forecast (LDFC & MDFC) to study the impact (positive and negative) of drivers on the demand forecasted

For execution of **'Scenario with Drivers'** follow the same steps described in **EXECUTE BAU SCENARIO** section.

DOWNLOAD/EXPORT/VIEW SCENARIO RESULTS

To view/export results and download reports, PDF's, text files you can follow same steps described in **DOWNLOAD/EXPORT/VIEW BAU SCENARIO RESULTS** section.

2.1.5 Probabilistic Analysis & Report

This section gives you the steps to compute the results using the probabilistic approach to address the degree of variations expected in the values of the independent variables that participate in the demand forecast.

The historic data are used and various methods are used on the samples to predict the forecast values. Now, there is a level of uncertainty expected while considering the projected data of the independent variables which impact the categories and the expected demand for any time horizon.

STUDYING VARIATIONS IN DEMAND FORECAST

To eradicate the uncertainty, the probabilistic approach allows variations in the values of the independent variables that participate in the demand forecast. This module provides the features to compute the variables with variations that might be seen in these values. Again, the percentage of variations is observed from a probabilistic view which may or may not resonate with the actuals in the future.

SELECTING DATASET FOR PROBABILITY ANALYSIS

This section gives information on how to select the data to perform the probabilistic analysis to study the variations that independent variables could bring in.

We have created two study scenarios i.e. **Business As Usual** and **Scenario with Drivers**.

Let us see steps to execute probabilistic analysis for **Business As Usual** scenario (same steps holds good for **Scenario with Drivers**.)

1. Click on the **View Results** icon on the Scenarios list table. We have shown for Business as Usual scenario in Figure 111.

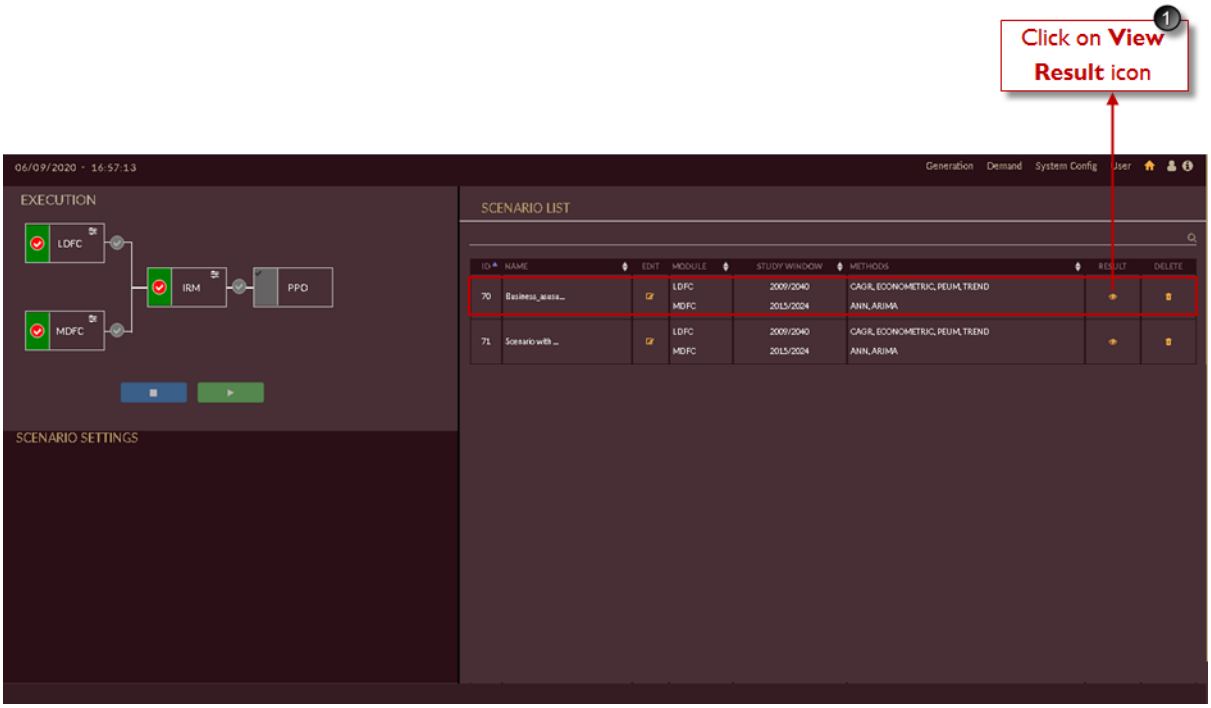


Figure 111. First Step to Run Probabilistic Analysis

Once you click on the **View Results** icon, the demand forecast results page appears as shown in Figure 112.

2. Select the categories and method from the list to participate in the studies.
3. Click on **Consolidate** icon.

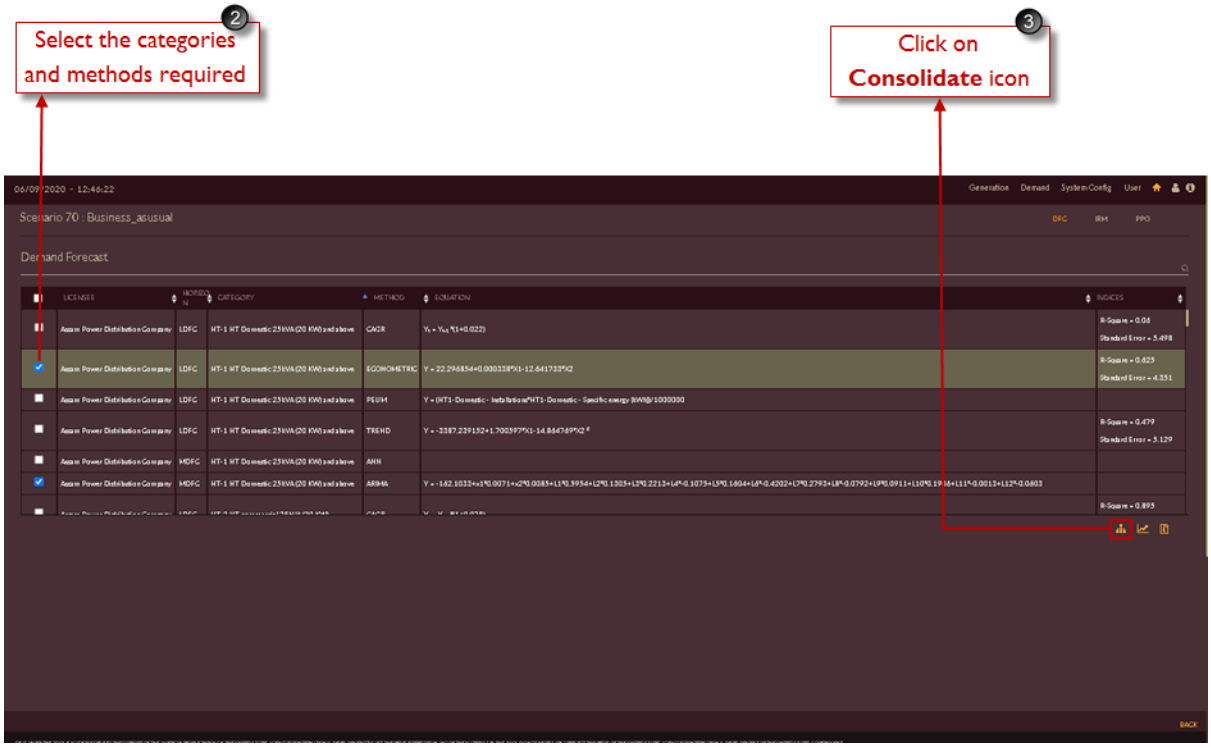


Figure 112. Selecting the Categories to Participate in Forecast Studies and Consolidate

Once you click on the **Consolidate** icon, the scaling the results page will appear as shown in Figure 113.

4. Select suitable **Scaled up reference method** from the drop-down.

When LDFC is selected, the results of MDFC and Average of both are scaled to match the results of LDFC. Whereas when MDFC is selected, the values of LDFC and Average of both get scaled to match with the MDFC results.

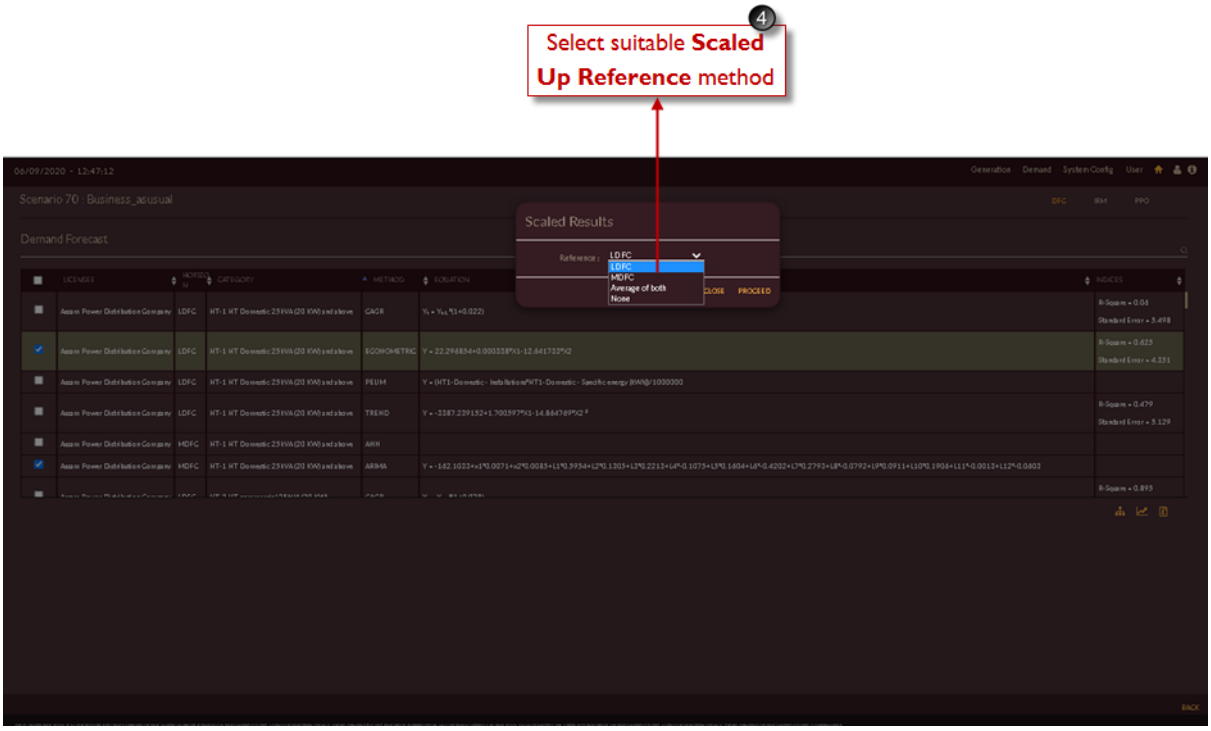


Figure 113. Scaling of the Results

In this example, LDFC is selected. Click on Proceed PROCEED icon to generate the consolidated result. The Consolidated results page appears as shown in Figure 114.

5. Click on **Probabilistic analysis** icon.

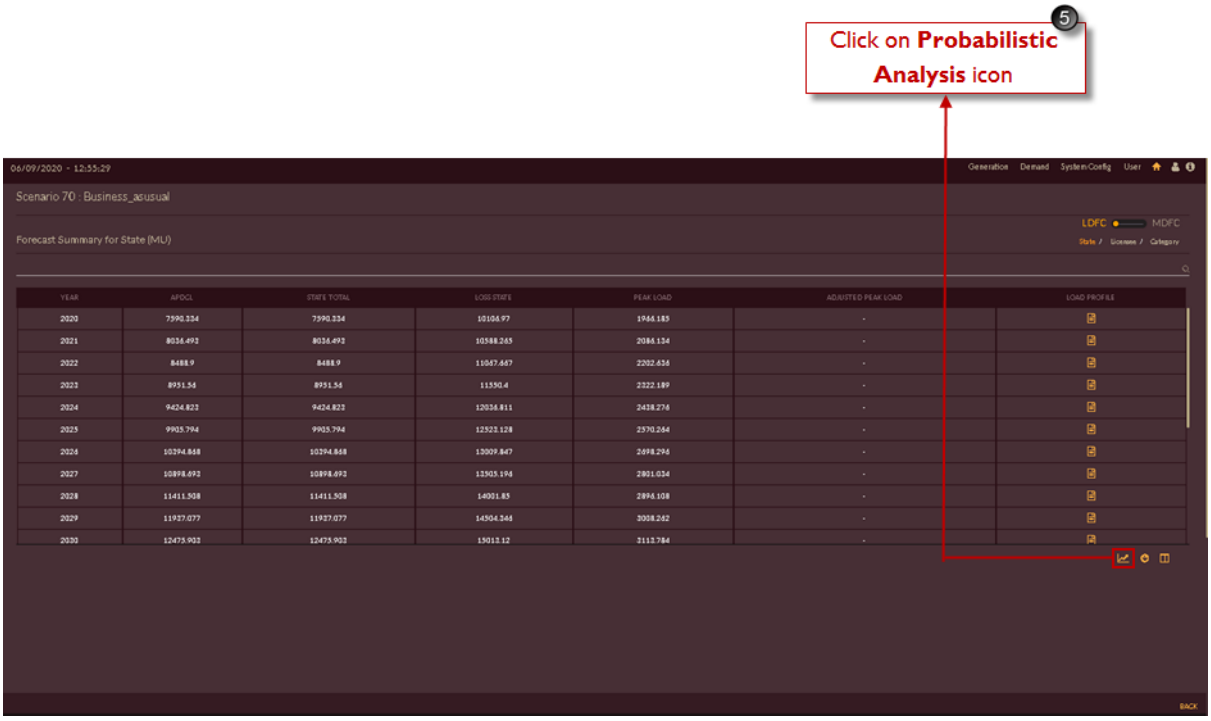


Figure 114. Consolidated Results Page

Once you click **Probabilistic analysis** icon page will navigate to **Business As Usual** scenario **Probabilistic analysis** page as shown in Figure 115.

6. Select the reference year from the drop-down for which analysis to be done.
7. Fill the **Standard Deviation (%)** values for respective independent variables.
8. Required **No. Of Samples** to be entered.

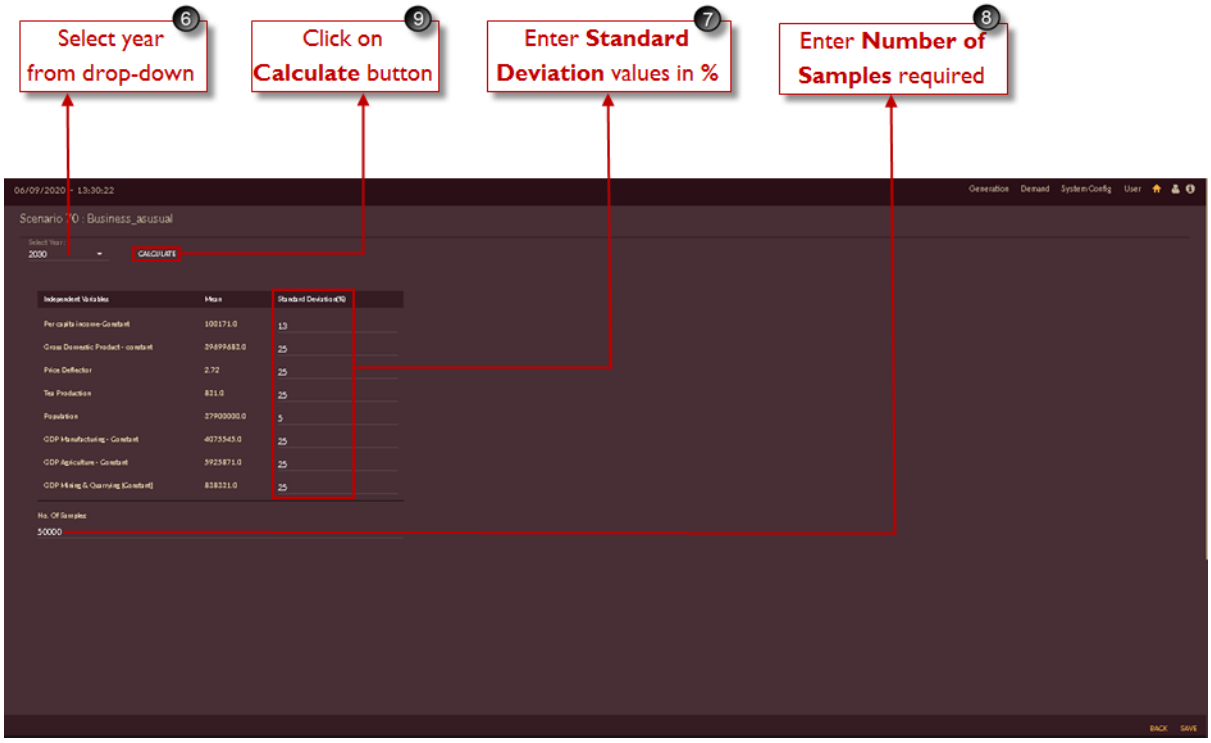


Figure 115. Probabilistic Analysis Page

9. Click on the **CALCULATE** icon.
10. The respective graph appears on the page as shown in Figure 116.

Figure 116. Graphical Representation of Probabilistic Analysis

11. Move the **Graph or Table**  data slider to Table. The same data appears as table.

12. Table contains the values like **Maximum Deviation**, **Mean** and **Minimum Deviation**.

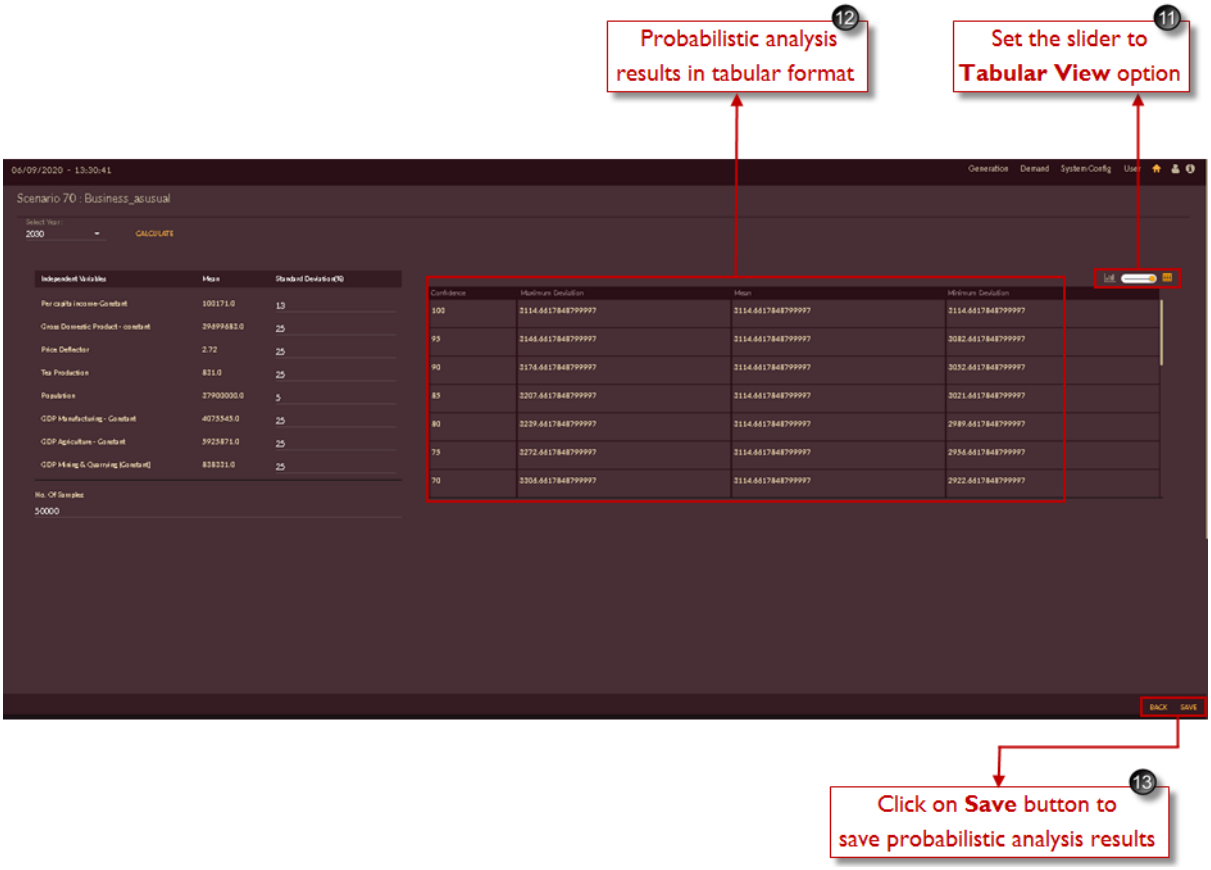


Figure 117. Tabular Representation of Probabilistic Analysis

13. Click on **SAVE** SAVE button to save the data and **Back** icon to discard.

DOWNLOAD/ VIEW PROBABILISTIC RESULTS

After executing and saving the probabilistic analysis results it will be saved in respective scenario, let us see how to download it.

Steps to download:

14. Go to consolidated results page, click on **Download PDF** icon. PDF report will be downloaded and user will observe the probabilistic analysis curve for independent variables as shown in Figure 119 in Probabilistic analysis section in PDF report.

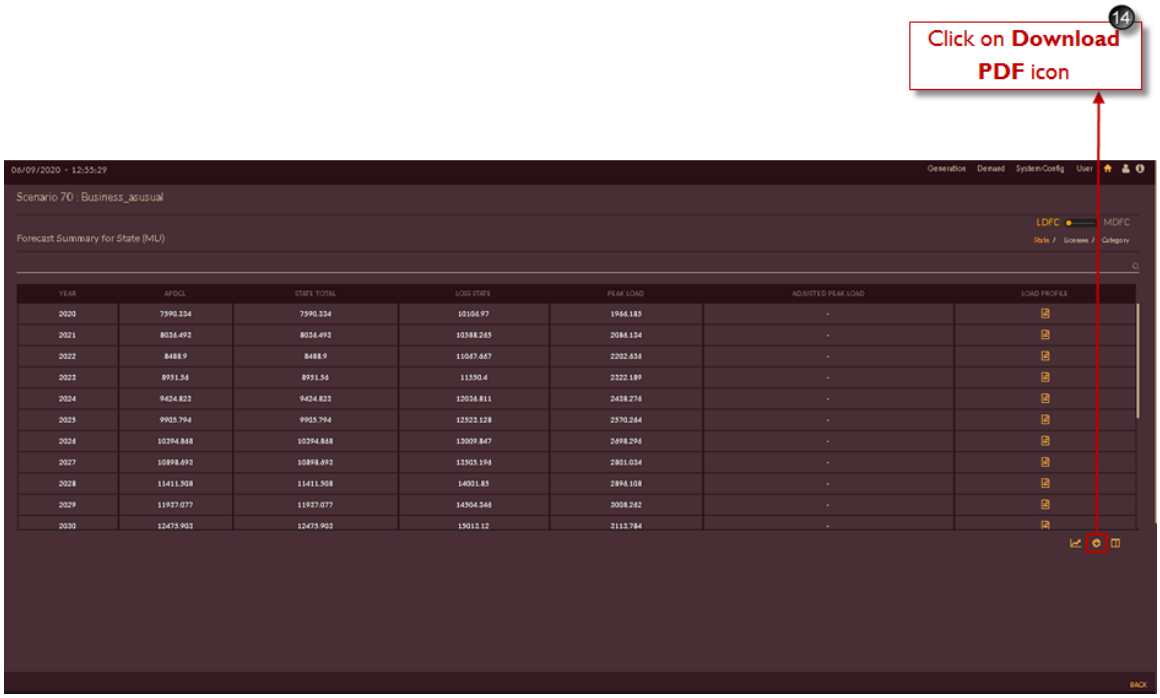


Figure 118. Downloading PDF Report

5. PROBABILISTIC APPROACH

5.1 INTRODUCTION

Assessment of the risks of deviation of the demand from the forecasted value in the future years is an important process. Risk assessment relies on a probabilistic approach which estimates the deviation in the forecasted demand by considering the variations in the expected values of econometric variables. For each category, the econometric variables that could influence the demand are identified. For instance, for the HT-1 HT Domestic 25kVA (20 KW) and above category, Per capita income-Constant, are identified as the influencing econometric parameters.
The exact values for of these econometric variables in the future years cannot be ascertained. Yet, for the purpose of forecasting demand by econometric method, values are logically estimated and assigned for each of the econometric variables for each future year under study. For the year 2030 , Per capita income-Constant will be 100171.0. Considering estimated values for all participating econometric variables, the energy sales is forecasted for each category.
However, it is possible that the value of these econometric variables may vary from the estimated value. The risk of deviation in these econometric variables and its impact on the forecasted energy sales, as seen by the Utility, is captured through probabilistic approach. The probabilistic analysis will help to understand various scenarios that can be expected with predictable variations in econometric variables. Hence, various possible scenarios are analyzed using sensitivity studies considering the impact of econometric variables on energy sales at category level and thereby at Utility level. The detailed approach used for probabilistic method is presented in next section.

5.2 APPROACH

Probabilistic methods are generally categorized into two types. They are

1. Analytical methods

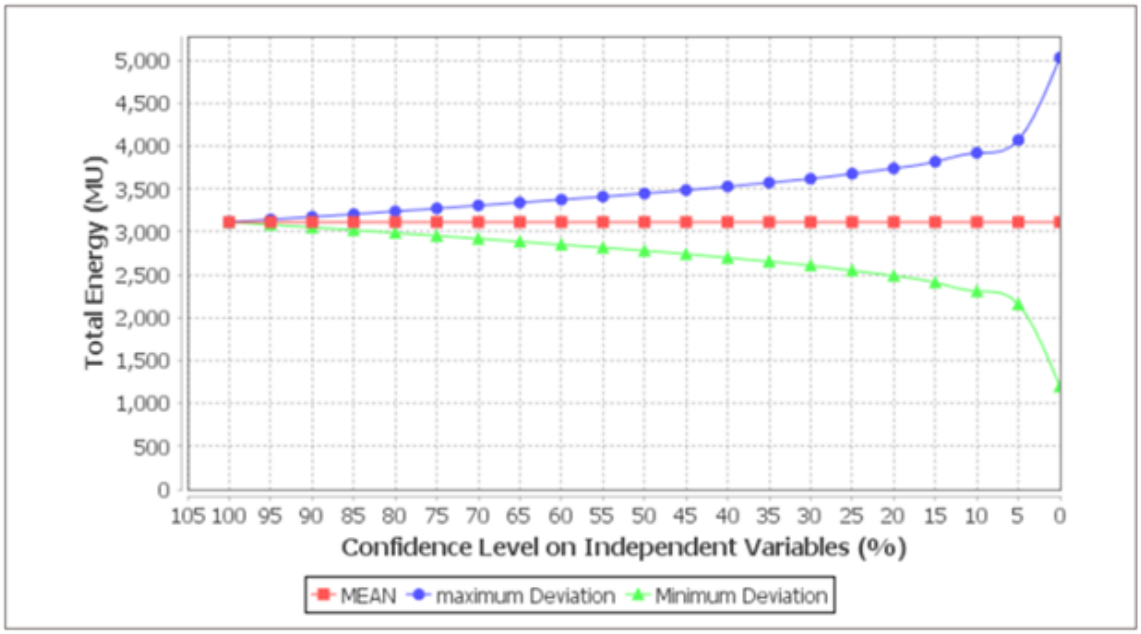
2. Monte-Carlo methods

Analytical methods consider the probability of events or variations in terms of statistical equations and hence it has its inherent limitations to model most of the events in the power system. However, Monte-Carlo simulation methods will use large number of iterations to replicate the behavior of event changes and produce the behavior of the system. The only downside of the Monte-Carlo simulation is computational time. However, this limitation has been overcome by the present-day computational facilities. Hence, in this section, various scenarios are developed for the future year demand projection using Monte-Carlo simulation. The main objective of Monte-Carlo simulation is generation of large number of stochastic samples to replicate the system behavior, in this case, energy sales.
Monte-Carlo simulation is carried out by generating stochastic samples, about one lakh samples for each econometric variable. Further, the curve fitting equation developed in the econometric method for each category is used to project the energy sales for respective category energy under first iteration. The iterations are repeated with next set of stochastic samples for respective econometric variables. The process is continued for about one lakh iterations to capture the maximum possible combinations of variations in econometric variables. The probabilistic analysis includes the following steps:

1. For each econometric variable, the maximum possible variation/deviation range is estimated.

2. Based on the estimated variation, a standard deviation is evaluated for each econometric variable.

3. Considering the projected value as mean and with the estimated standard deviation, 1 Lakh stochastic samples are generated using Monte-Carlo simulation method for each econometric variable. The mean and standard deviation considered for all the participating econometric variables are presented in Table 1 for FY 2030



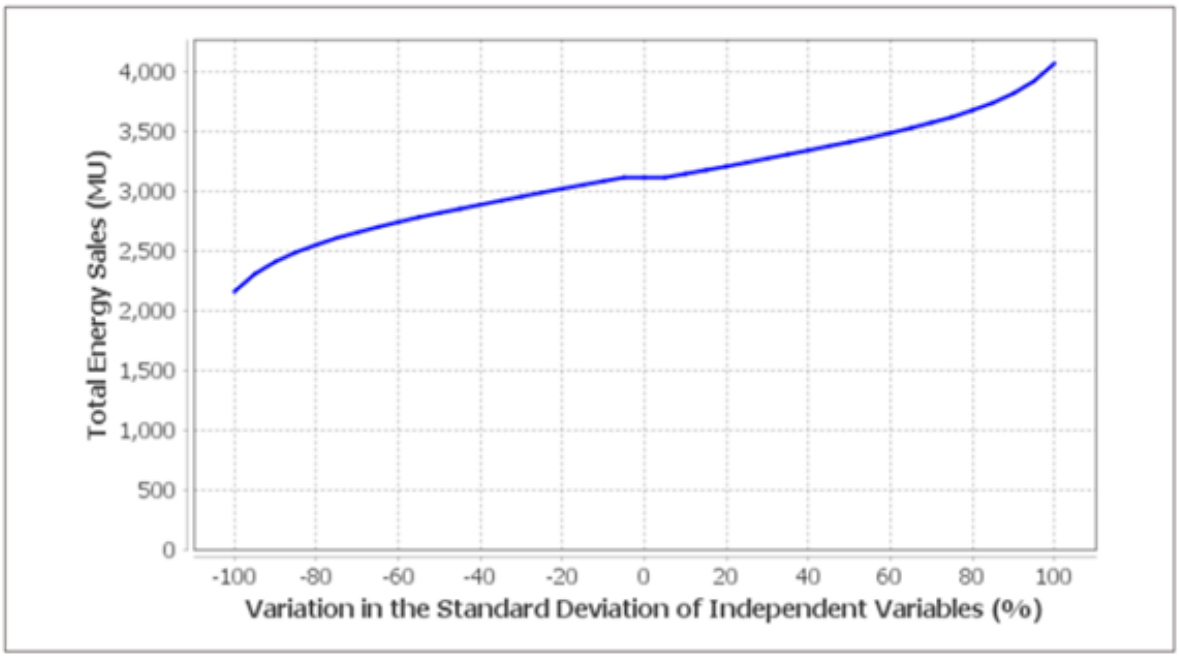


Figure 119. Probabilistic Curve Reflected in PDF Report

Probabilistic analysis is part which is printed last section of DFC PDF reports i.e. in Business as Usual and Scenario with Drivers.

2.2 MODULE 2: INTEGRATED RESOURCE MAPPING

2.2.1 Introduction

Integrated Resource Mapping is the second component in DISCOM-REPOSE software using which we can perform generation resource mapping to meet the forecasted demand.

Once you login to the software, you will see the page as shown in Figure 120.

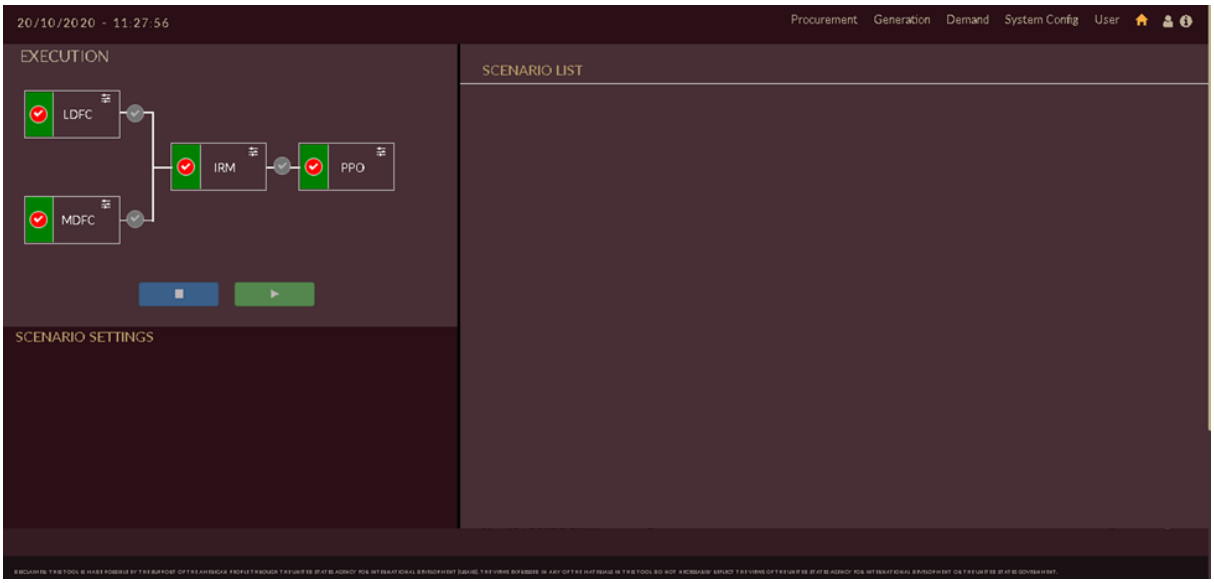


Figure 120. DISCOM – REPOSE Home page

Let us see what input parameters are required, how to model the database and how to obtain the results in next sections.

Note: We have considered Assam state's database as an example for this scenario.

2.2.2 Input Parameters

For performing integrated resource mapping, we have to collect the following data which will be considered as input for the studies.

Inputs to be considered are the following:

- Library data,
  - Generation profiles for renewable and hydro plants.
  - Emission characteristics, Fuel contract, Cost characteristics.
- Plant data,
  - Thermal plant details,
  - Hydro plant details
  - Renewable plant details

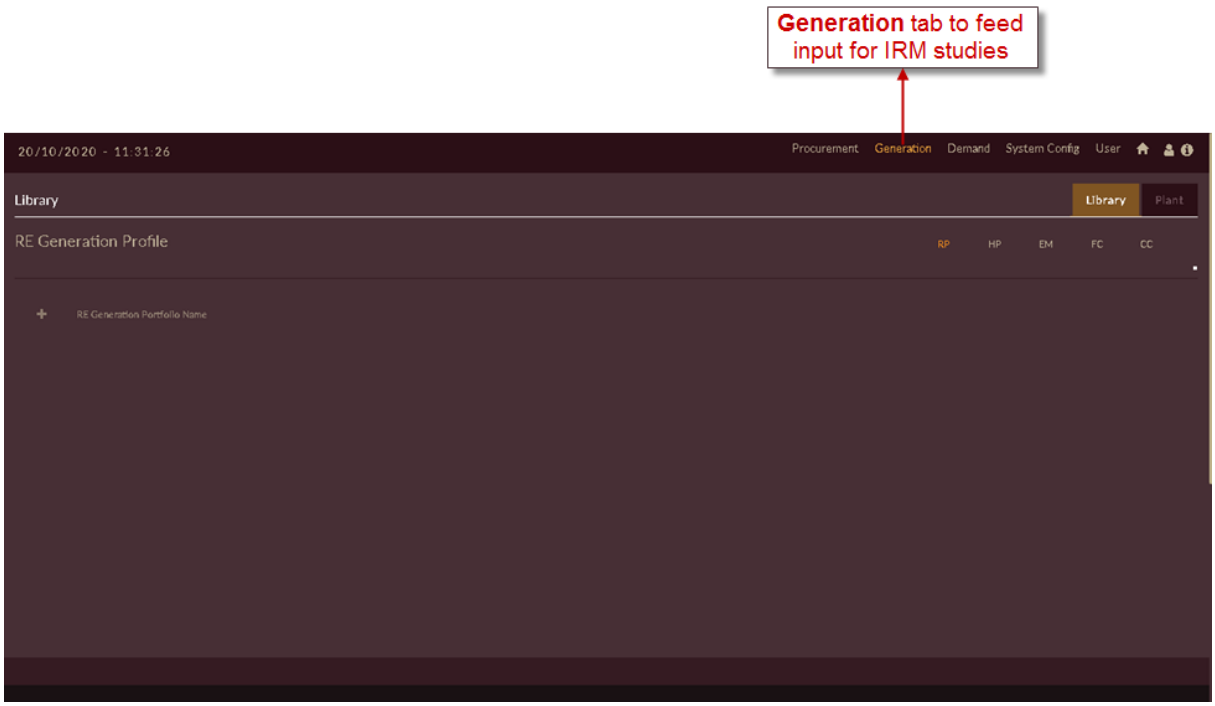


Figure 121. Generation Page

The sequence to be followed to feed input data for IRM studies is given as follows

1. Configure the Cost characteristics data under Library tab.
2. Configure the Fuel contract data under Library tab.
3. Add the Emission characteristics data under Library tab.
4. Add and configure the plant details under Plant tab. i.e. Renewable, Hydro & Thermal plant details
5. Add the Hydro generation profiles under Library tab
6. Add the RE generation profiles under Library tab.

Let us consider the sample library input data of Assam shown in Table 6 and Table 7 and learn how to upload and execute the integrated resource mapping scenario

Table 6. Sample Cost Characteristics Data		
PLANT/UNIT	**COST**	
LTPS	**Fixed & Variable**	
	Fixed cost (INR/MWh)	Variable cost (INR/MWh)
	1980	3340
KLHEP	**Cost Coordinates**	
	Generation (MW)	Cost (INR)
	2.5	7550
	50	151000

Table 7. Sample Fuel Contract Data			
PLANT/UNIT	**START DATE**	**END DATE**	**FUEL QUANTITY (TONNES)**
LTPS_5_6	01/04/2020	31/03/2021	43800.000
	01/04/2021	31/03/2022	43800.000
	01/04/2022	31/03/2023	43800.000
BGTPP	01/04/2020	31/03/2021	2523456.408
	01/04/2021	31/03/2022	2523456.408
	01/04/2022	31/03/2023	2523456.408

2.2.2.1 COST CHARACTERISTICS

This section helps you to configure cost characteristics for available power generation plants and units. Follow below steps to configure cost characteristics library,

1. Click on **Generation** tab. The **Generation** tab appears as shown in Figure 122.
2. By default, **Library** tab will be selected.
3. Click on **Cost Characteristics** tab.
4. Click on **Add Cost Characteristics Library** icon to add new cost library for power plant/unit.

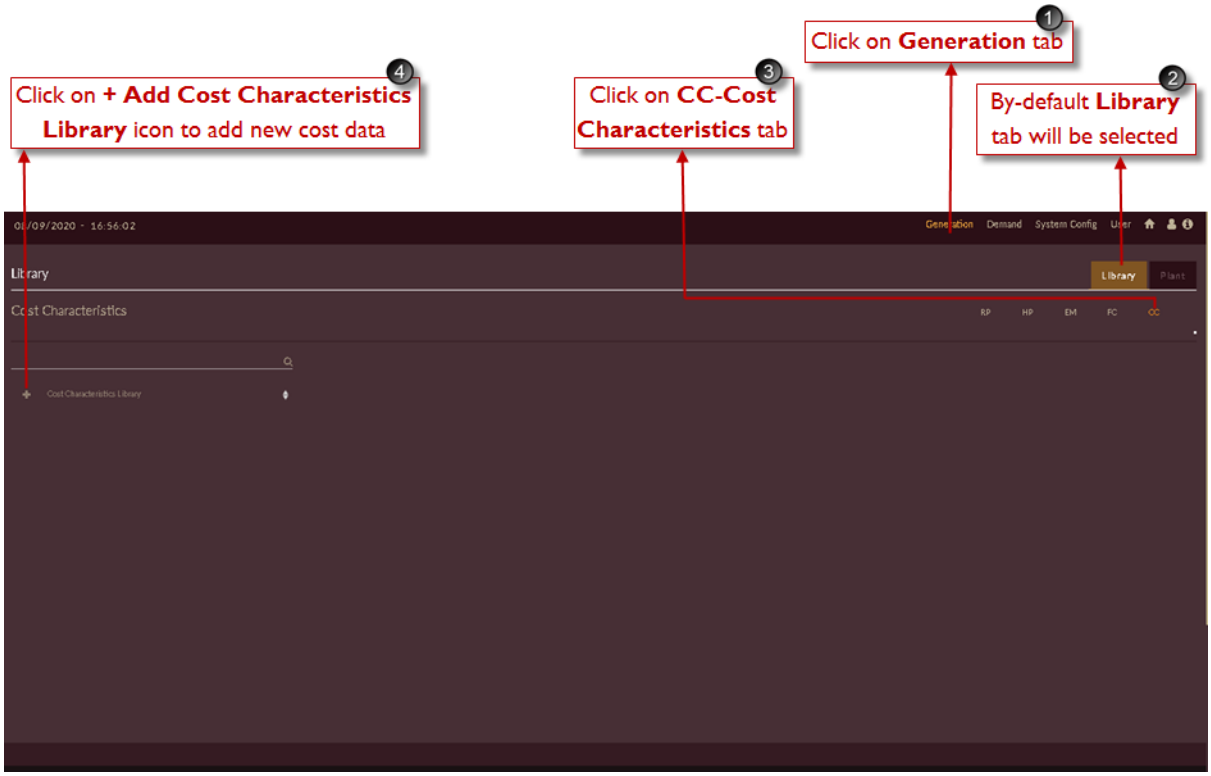
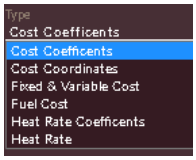


Figure 122. Steps to Add Cost Characteristics Library

Once you click on **Add Cost Characteristics Library** icon, an empty record appears as shown in Figure 123.

5. Enter appropriate cost library name in **Name** field.
6. Select cost characteristics **Type** from the "Type "drop-down based on data of cost available for the plant/unit.



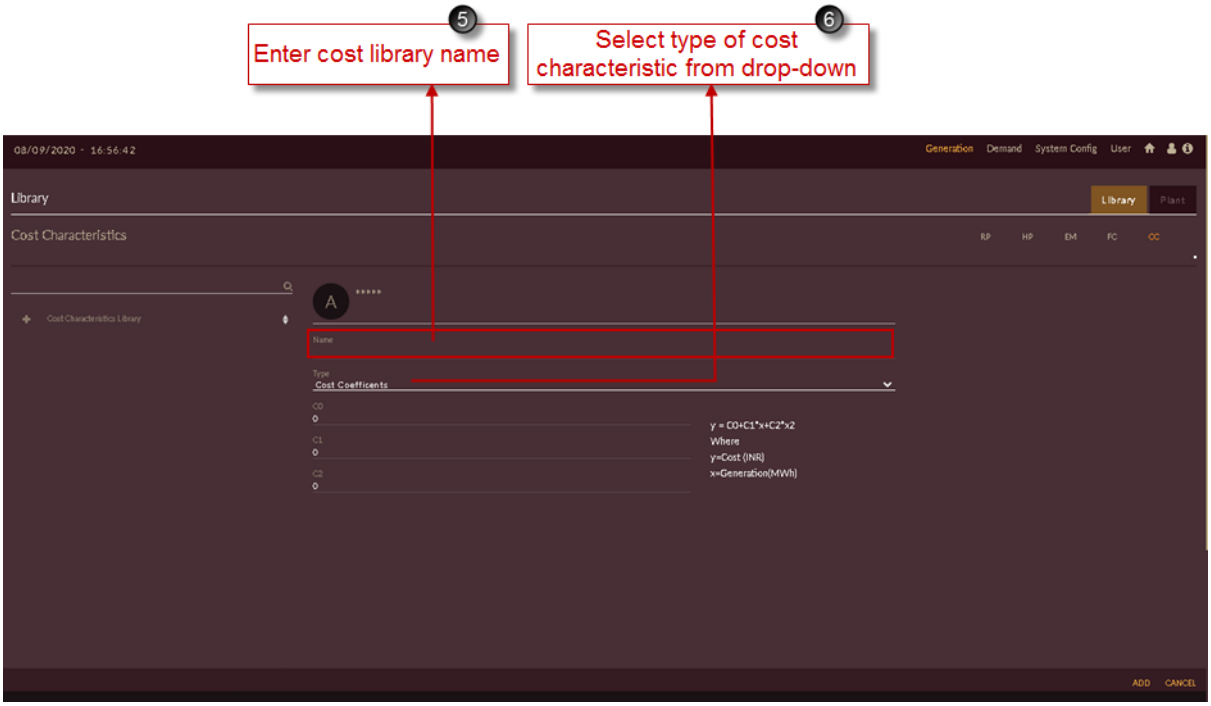


Figure 123. Cost Characteristics Empty Record

Figure 124 shows the sample data of cost entered for LTPS plant by selecting Fixed & Variable Cost type (Refer Table 6 for sample cost data).

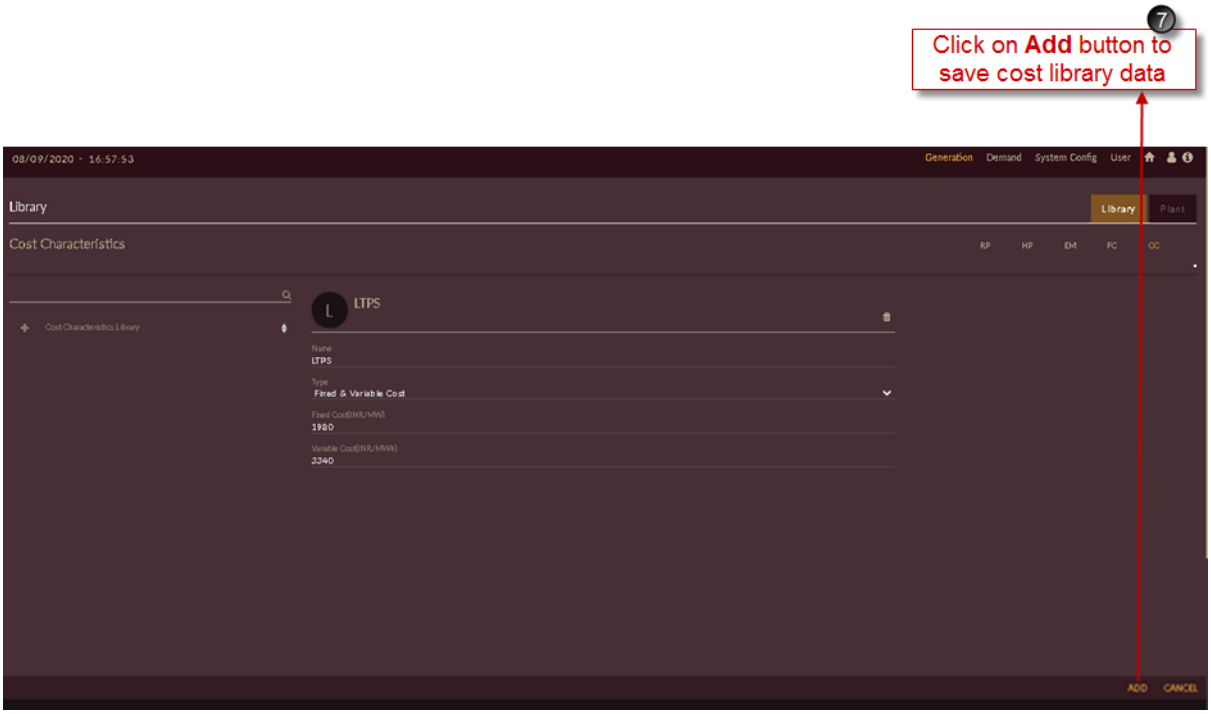
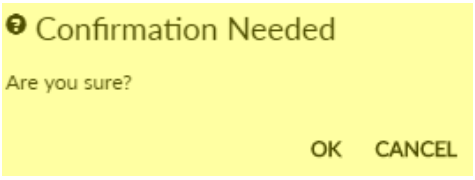


Figure 124. Sample Cost Library

7. Click on the **ADD** ADD button. The "Are you sure?" confirmation pop-up appears.

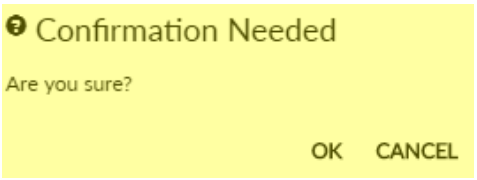


Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

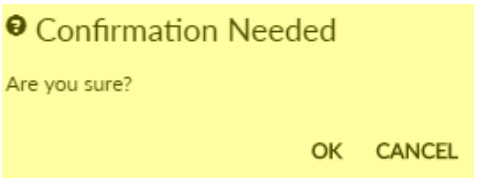
8. The list of successfully added cost library appears on left of the page.
9. You can change the cost data if required, click on **Update** UPDATE button to save the changes made.

   The "Are you sure?" confirmation message appears.

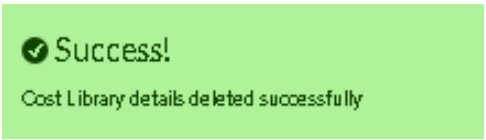


   Click on OK to confirm the changes. Click on CANCEL to discard the changes. The "Saved successfully" message appears.

10. Click on **Delete** icon to remove the record. The "Are you sure?" confirmation pop-up appears.



    Click on **OK**. The "Cost Library details deleted successfully" message appears. Click on **CANCEL** to discard the task.



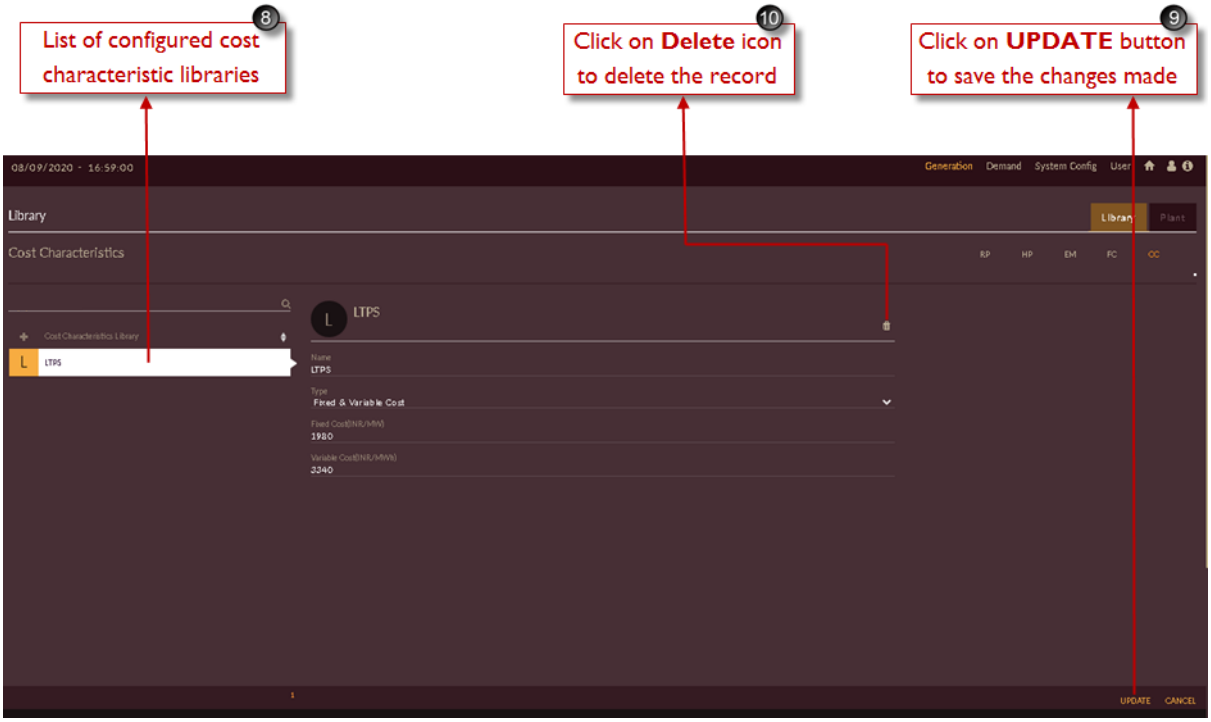


Figure 125. Updated Cost Library

Repeat the above steps to add different cost characteristics libraries for different plants/units. Figure 126 shows the sample cost library data for different **Cost Characteristics** type and list of various cost libraries created.

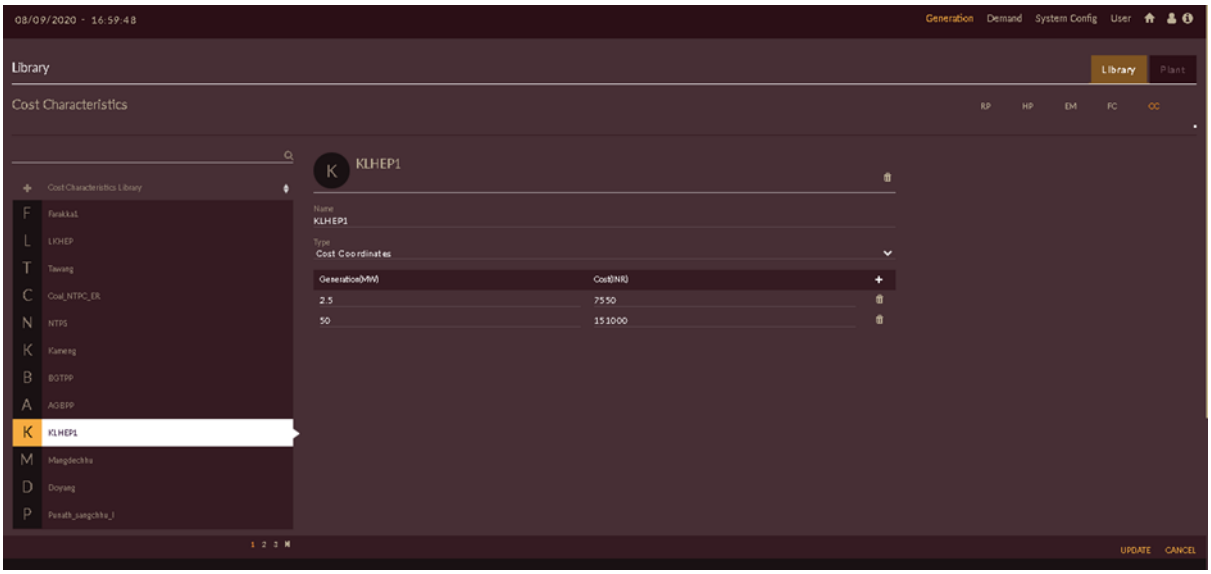


Figure 126. Sample Cost Library for Different Cost Type

2.2.2.2 FUEL CONTRACT

This section helps you to configure fuel contract for available power generation plants and units.

Follow the steps to configure fuel contract library:

1. Click on **Generation** tab. The **Generation** tab appears as shown in Figure 127
2. By default, the **Library** tab will be selected.
3. Click on **Fuel Contract** FC tab.
4. Click on **Add Fuel Contract Library** icon to add new fuel library for power plant/unit.

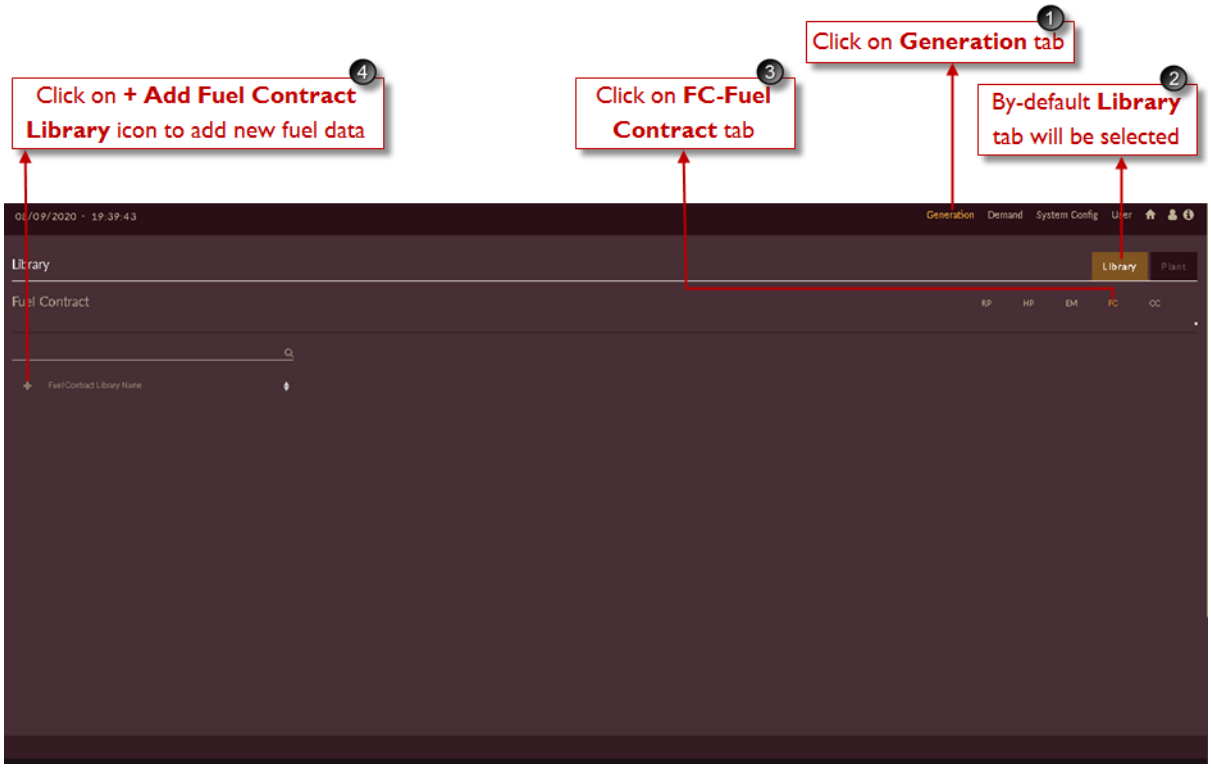


Figure 127. Steps to Add Fuel Contract Library

Once you click on **Add Fuel Contract Library** icon, an empty record appears as shown in Figure 128.

5. Enter an appropriate fuel library name in **Name** field.
6. Click on **Add** icon for adding rows to add fuel contract data for respective plant/unit.
7. Click on **Copy** icon to copy previously added fuel contract library data to newly adding fuel contract library if data is same.

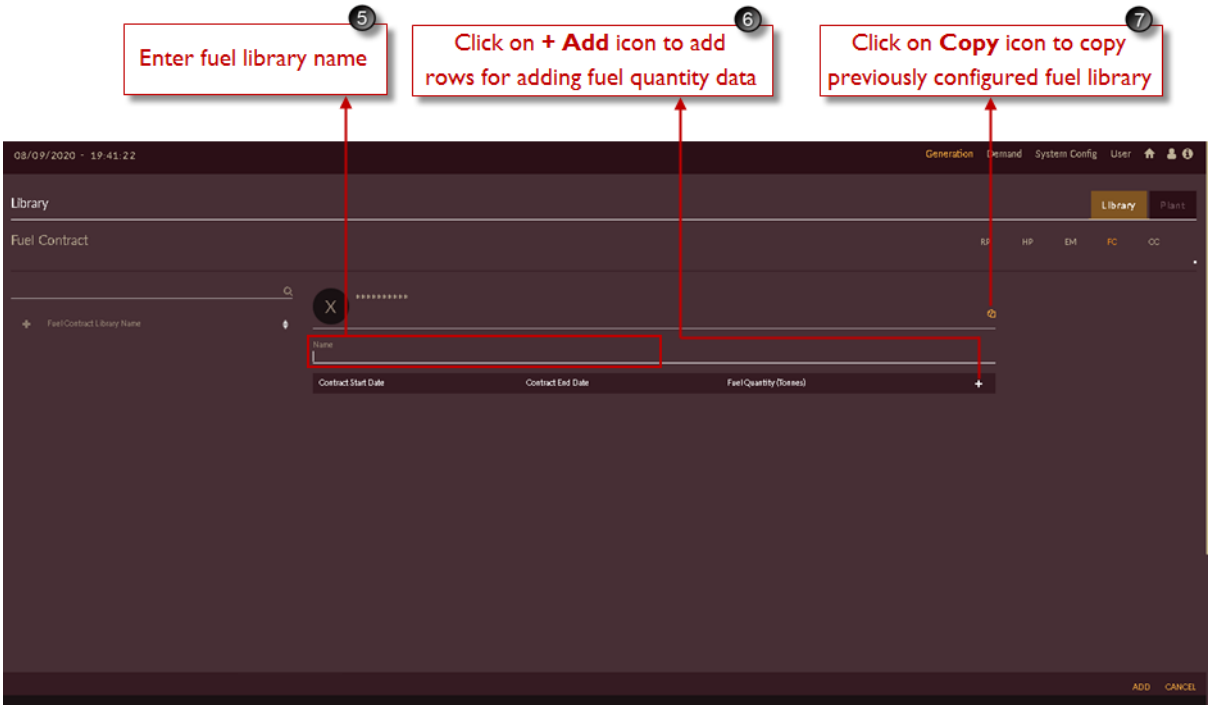


Figure 128. Fuel Contract Empty Record

8. Select the fuel contract period by selecting the **Contract Start date** and **Contract End date** from the calendar drop-down.
9. Enter the **Fuel Quantity** available in **Tonnes.**

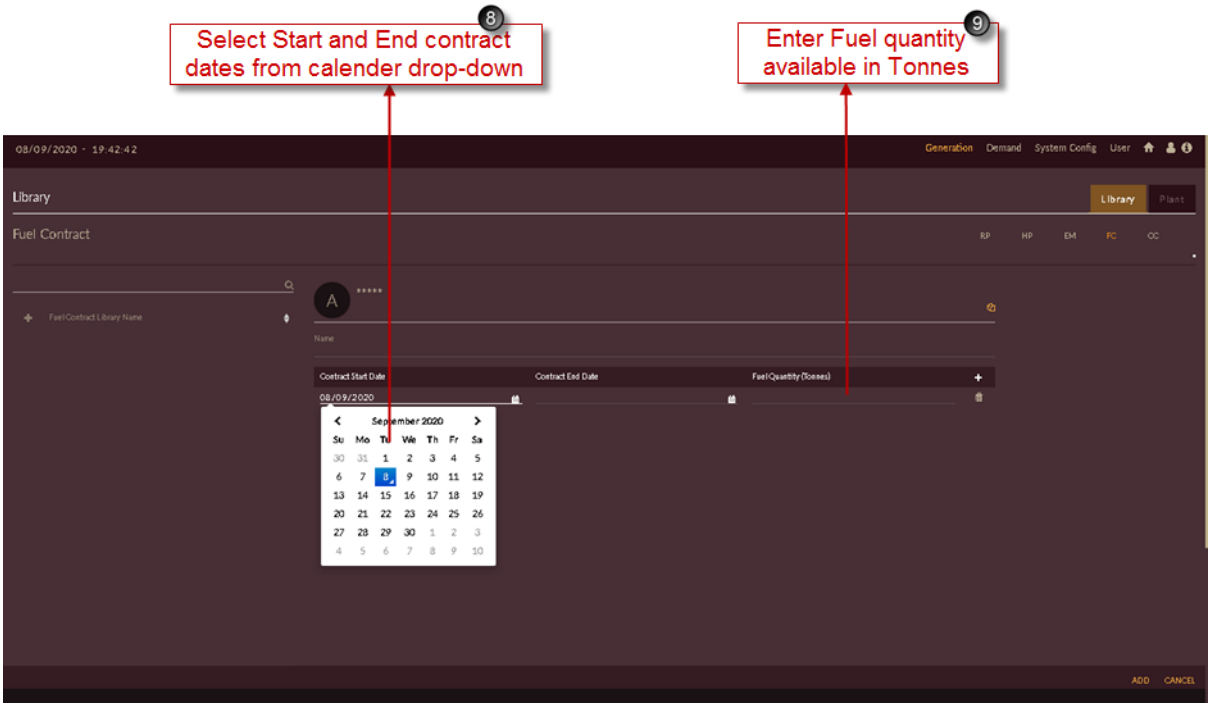


Figure 129. Addition of Multiple Rows

Figure 130 shows the sample data of fuel contract entered for LTPS_5_6 unit for certain period (Refer Table 7 for sample cost data).

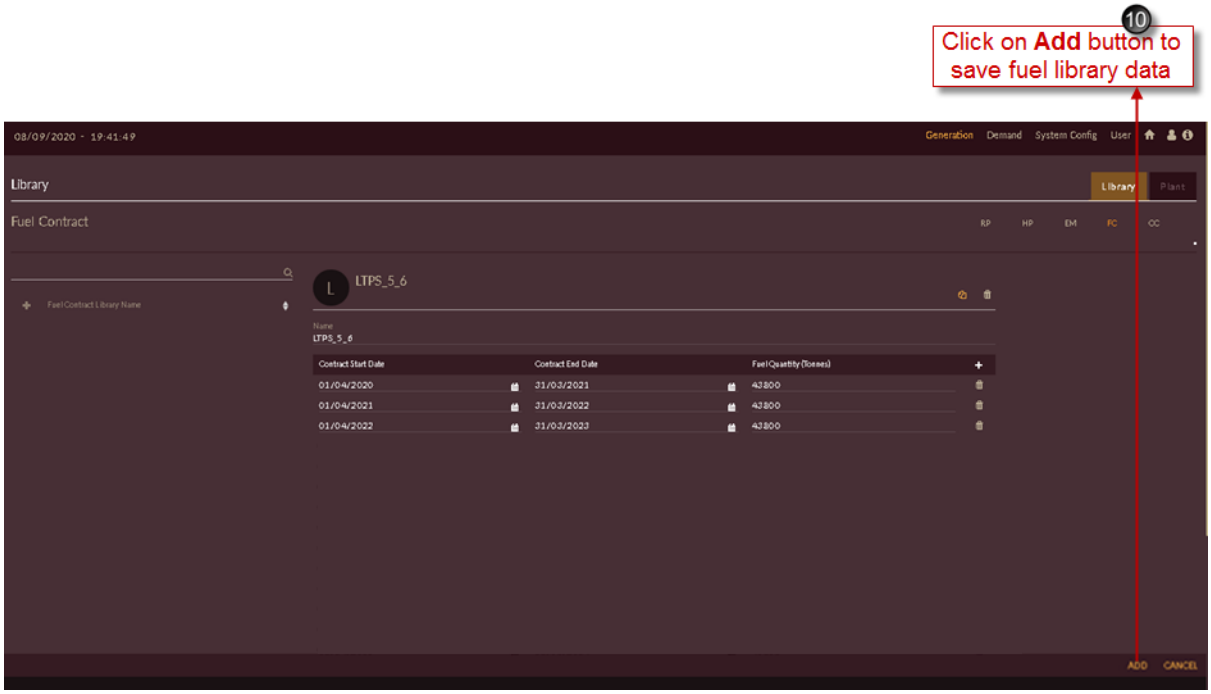
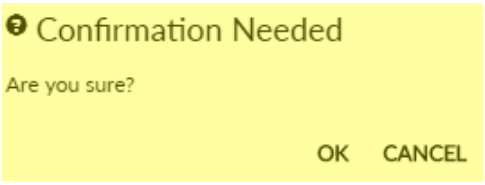


Figure 130. Sample Fuel Library

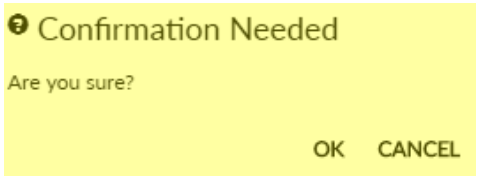
10. Click on the **ADD** ADD button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

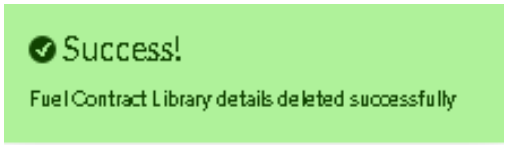
Click on **CANCEL** to discard the task.

11. The list of successfully added fuel contract library appears on left of the software page.
12. You can change the fuel data and also you can delete selected row by clicking on **Delete** icon of respective row.
13. Click on Update UPDATE button to save the changes made.
14. Click on **Delete** icon to remove the record. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Fuel Contract Library details deleted successfully" message appears.

Click on **CANCEL** to discard the task.



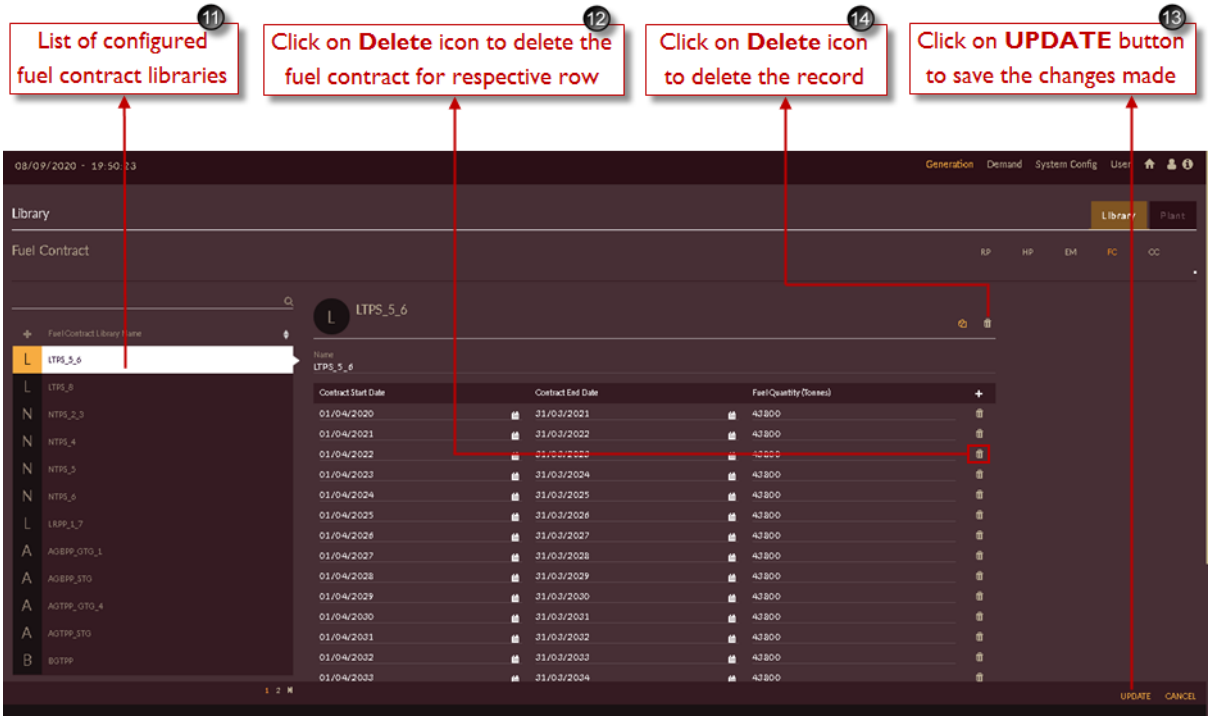


Figure 131. Updated Fuel Library

2.2.2.3 EMISSION CHARACTERISTICS

This section helps you to configure emission characteristics for available power generation plants and units.

Follow below steps to configure emission characteristics library,

1. Click on **Generation** tab. The **Generation** tab appears as shown in Figure 132.
2. By default, **Library** tab will be selected.
3. Click on **Emission Characteristics** EM tab.
4. Click on **Add Emission Library** icon to add new emission library for power plant/unit.

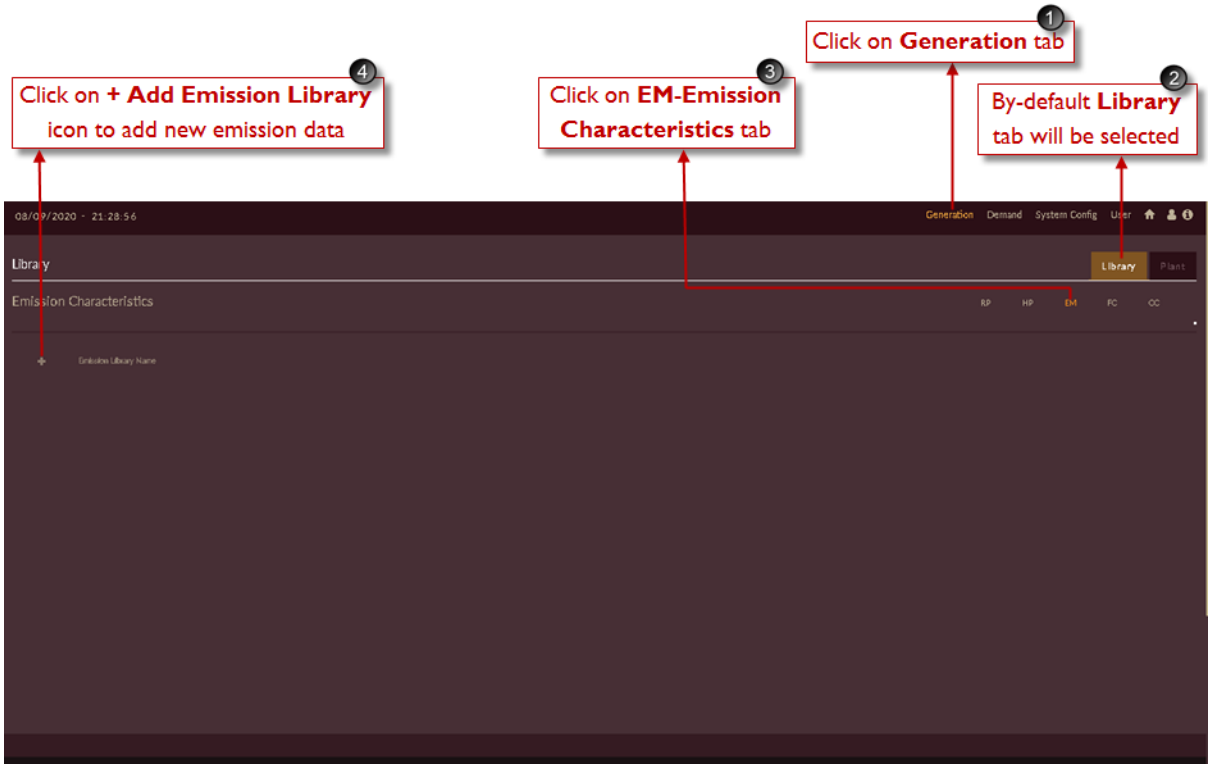


Figure 132. Steps to Add Emission Characteristics Library

Once you click on **Add Emission Library** icon, an empty record appears as shown in Figure 133.

5. Enter the appropriate emission library name in **Name** field.
6. Click on **Add** icon for adding rows to add emission library data for respective plant/unit.
7. Click on **Copy** icon to copy previously added emission characteristics library data to newly adding emission characteristics library if data is same.

Figure 133. Emission Library Empty Record

Figure 134 shows the sample data of emission characteristics entered for LTPS plant for certain generation.

8. Enter **Emission** in **mg/Nm^3** details data available for plants/units.

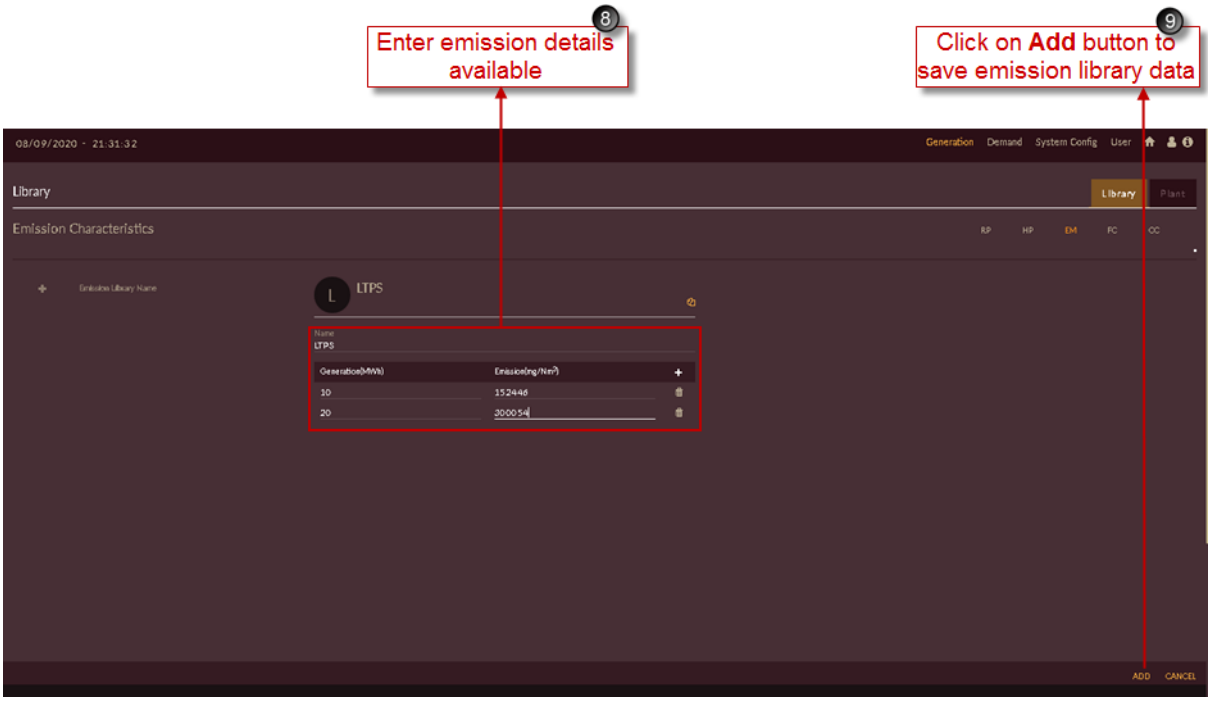
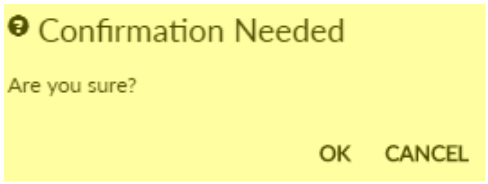


Figure 134. Sample Emission Library

Note: Emission data entered in Figure 134 are assumed and not the actual data**.** Actual values may vary.

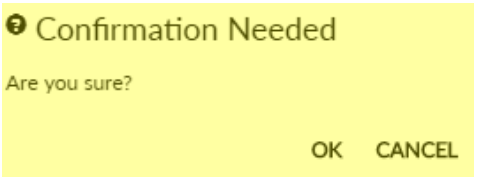
9. Click on the **ADD** ADD button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

10. The list of successfully added emission characteristics library appears on left of the software page.
11. You can change the emission data and also you can delete selected row if not required by clicking on Delete of respective row.
12. Click on Update UPDATE icon to save the changes made.
13. Click on **Delete** icon to remove the record. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Emission Library details deleted successfully" message appears.

Click on **CANCEL** to discard the task.

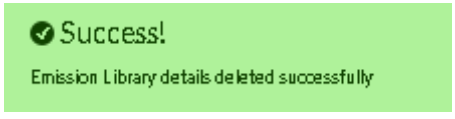


Figure 135. Updated Emission Library

2.2.2.4 RE PLANT

RE – Renewable plants are the plants which generate electricity from Solar, Wind, Biomass, Small hydro etc.

This section helps you to add available RE Plants in State required for carrying out Integrated Resource Mapping – IRM studies.

STEPS TO ADD RE PLANTS:

1. Click on **Generation** tab. The **Generation** tab appears.
2. Click on **Plant** tab. The Plant tab appears as shown in Figure 136
3. By default, **RE Plant** RE tab will be selected.
4. Click on **Add RE Plant** icon for configuring new RE Plant into the software.

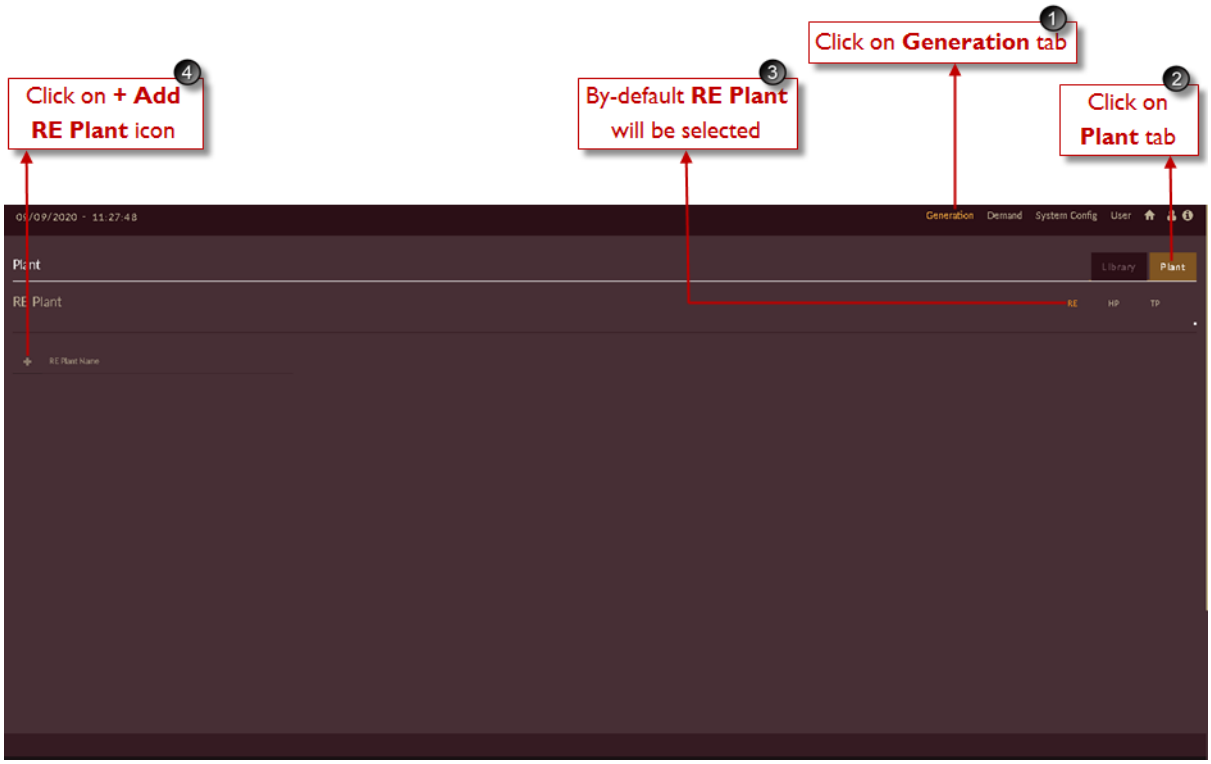


Figure 136. Steps to Add RE Plant

Once you click on **Add RE Plant**, a blank record appears for adding plant information as shown in Figure 137

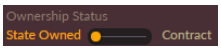
5. Fill the correct plant information available for respective State/Region. Plant information like;
   1. Enter plant name in **Name** field.
   2. Enter suitable plant code in **Code** field.
   3. Select **Plant Type** from the drop-down i.e. PV, Wind, Small Hydro, Bio mass or Other.

   4. Select **Type** for which category the RE plant belongs to from the drop-down i.e. State, IPP or CGS.

   5. Enter **Installed Capacity** of the plant in **MW.**
   6. Enter **Maximum Generation** of the plant in **MW.**
   7. Enter **Uncertainty** of RE plant in percentage **(%).**

8. Enter **Feed In Tarrif** in **INR/MWh.**
9. Choose **Date Of Commissioning** and **Date Of Retirement** of the plant.

[Note: * marked field are mandatory to fill.]

6. The **Ownership Status** of RE plant can be set as **State Owned/Contract** by using 

toggle icon. RE plant can be made as must run plant or not if required by setting **Off/On** 

toggle icon.

[Note: When Ownership is set as contract the feed in tariff field will be disabled as it will not participate for contracted RE plant.]

7. RE plant can be made in-service or out-of-service if required by setting **Out Of Service/In Service** 

toggle icon.
8. Click on **Copy From**  icon to copy plant information from previously added RE plant if data is same.

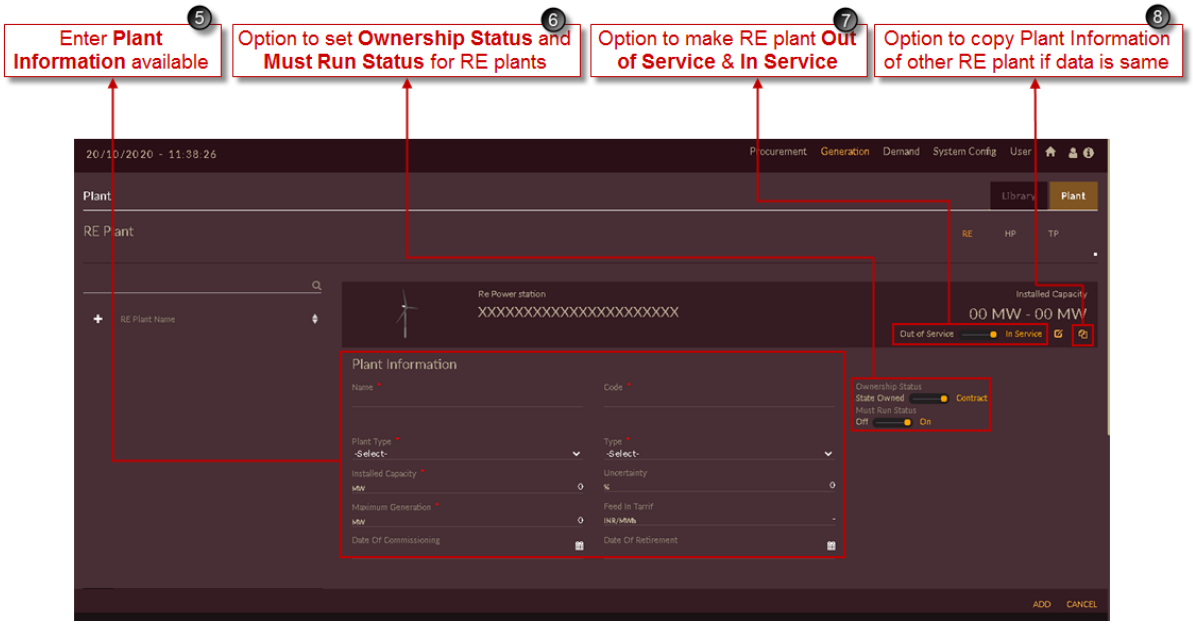


Figure 137. Blank Record for Adding RE Plant

9. Figure 138 shows the sample RE plant data entered for **NVVN Solar** plant of Assam state.

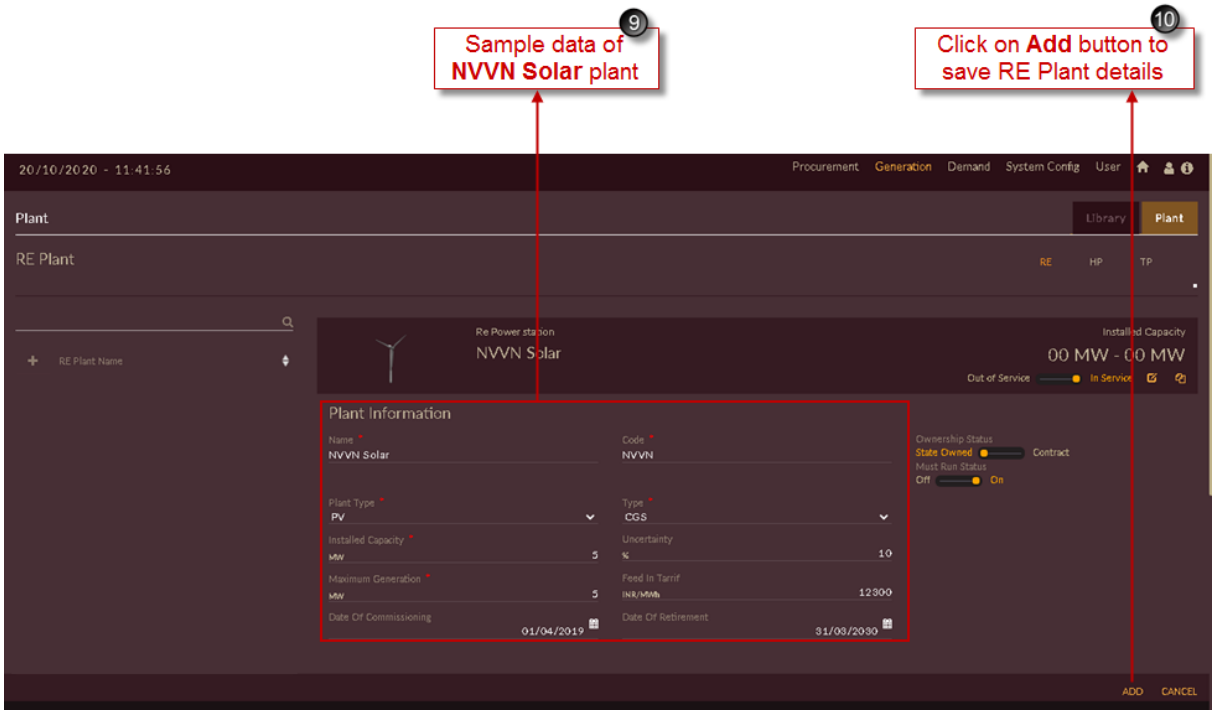
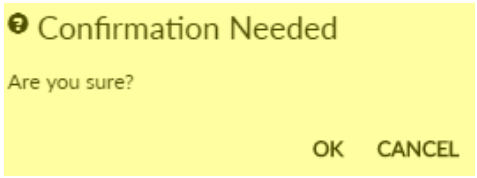


Figure 138. Sample RE Plant Data

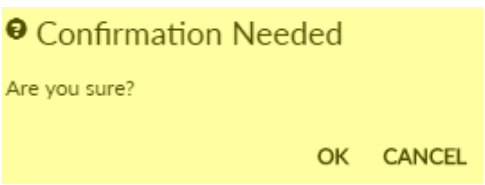
10. After entering the plant information, click on **Add** button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

11. Configured RE plant list will appear on left of the page as shown in Figure 139.
12. You can select the configured plant, and can make changes if required. Click on Update UPDATE button to save the changes made.
13. Click on Delete icon to remove the record. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Deleted successfully" message appears.

Click on **CANCEL** to discard the task.

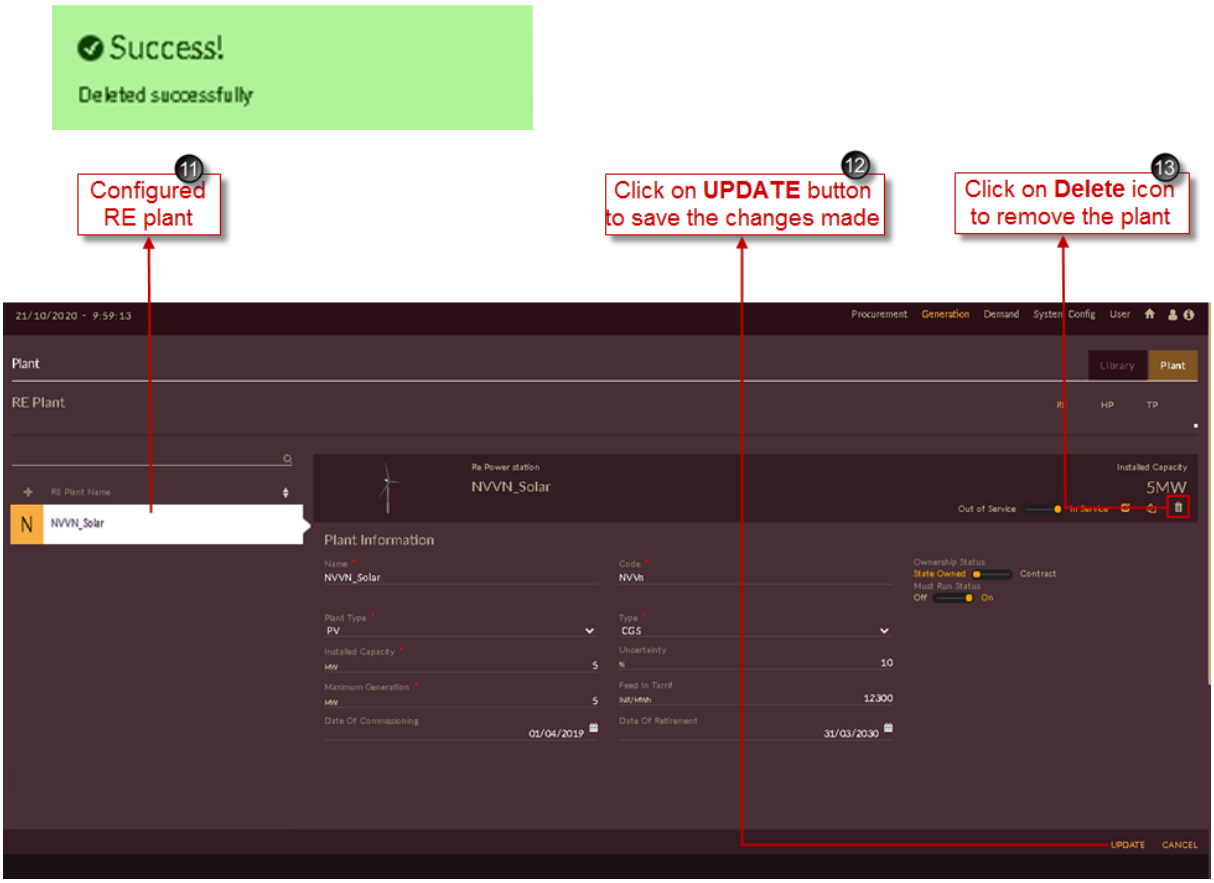


Figure 139. Updated RE Plant

Repeat above steps to add and update new RE plants into the software.

14. Once all the RE plants are added and configured the final RE page will appear as shown in Figure 140. List of all the RE plants will appear on left of the applicication page.

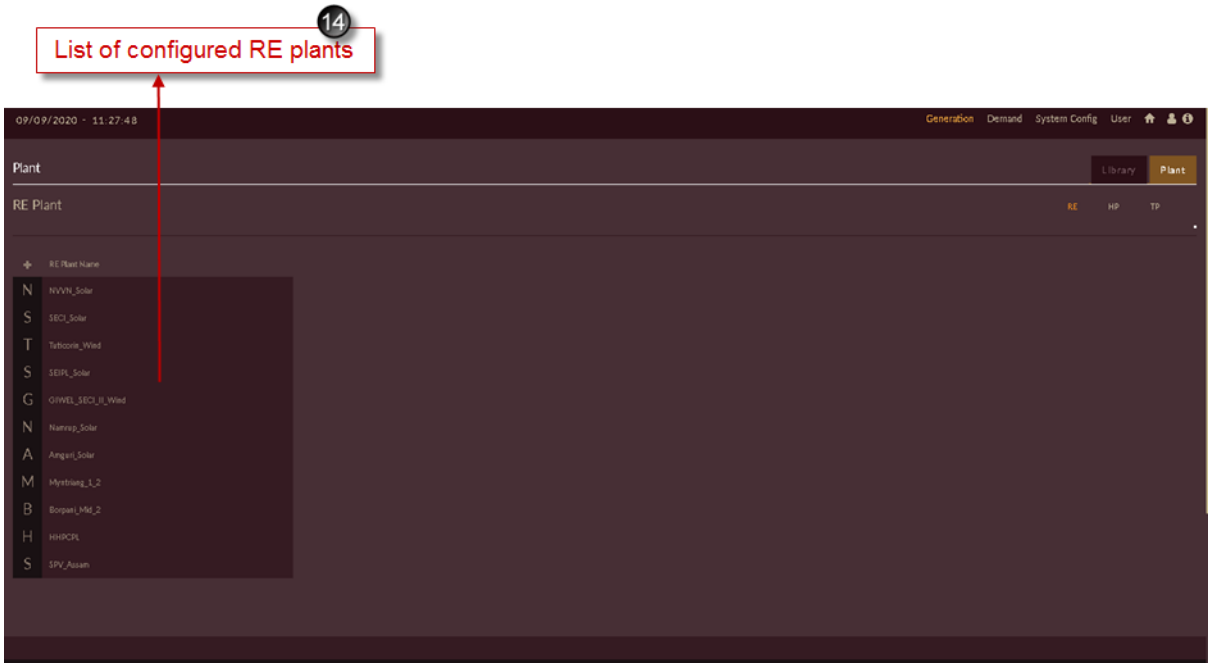


Figure 140. List of Configured RE Plants

STEPS TO IMPORT HISTORICAL GENEATION PROFILE FOR RE PLANTS:

1. Select the plant from the configured list for which you need to upload generation profile. Here NVVN solar plant is selected.
2. Click on **Upload Historical Generation Profile** icon.

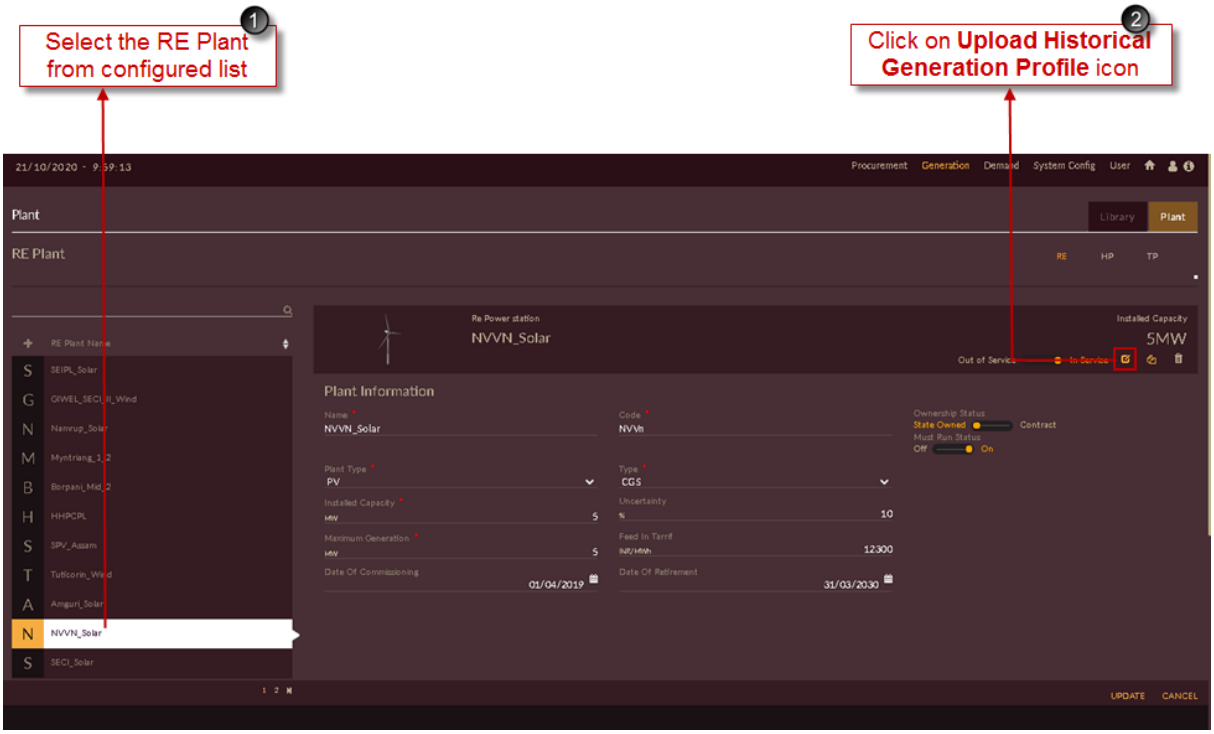


Figure 141. Steps to Add Historical RE Historical Generation Profile

Once you click on **Upload Historical Generation Profile** icon for selected RE plant page will appear as shown in Figure 142.

3. Click on **Download Template** icon.

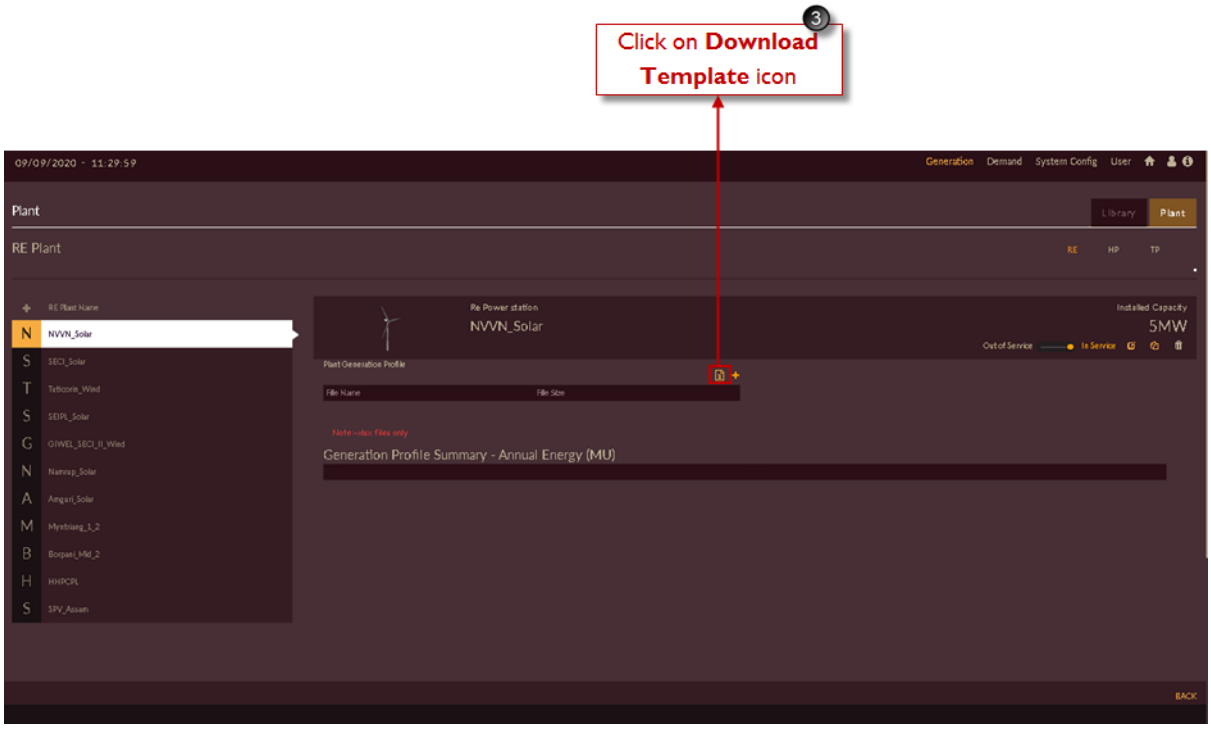


Figure 142. Download RE generation profile template

4. Software will ask to choose **From** & **To** date. Choose dates from calender drop-down, and click on **Download** DOWNLOAD icon to download the template.

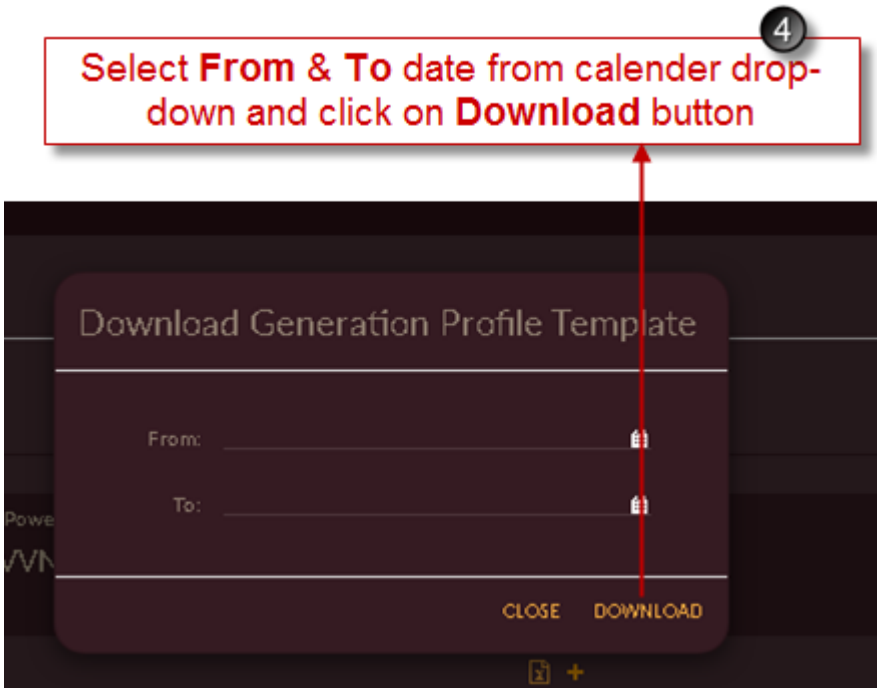


Figure 143. Select RE Generation Profile Date

Template will be downloaded in **.xlsx** format with selected plant name (here NVVN Solar) for chosen dates as shown in Figure 144. Upload the historical generation profile available for respective plant and save the file in **.xlsx** format only.

	A	B	C	D
1	Years	1		
2				
3	Date	Time Block (Hourly)	NVVN_Solar (MWh)	
4	01-04-2019	1		
5	01-04-2019	2		
6	01-04-2019	3		
7	01-04-2019	4		
8	01-04-2019	5		
9	01-04-2019	6		
10	01-04-2019	7		
11	01-04-2019	8		
12	01-04-2019	9		
13	01-04-2019	10		
14	01-04-2019	11		
15	01-04-2019	12		
16	01-04-2019	13		
17	01-04-2019	14		
18	01-04-2019	15		
19	01-04-2019	16		
20	01-04-2019	17		

Figure 144. Downloaded RE Generation Profile Template

After file is saved, you have to upload it in software.

5. Click on **Select Files To Upload** + icon, select the saved template.
6. Once you select the template, **File Name** will be displayed along with **File Size**.
7. Click on **Import** IMPORT button to upload the profile into the software.

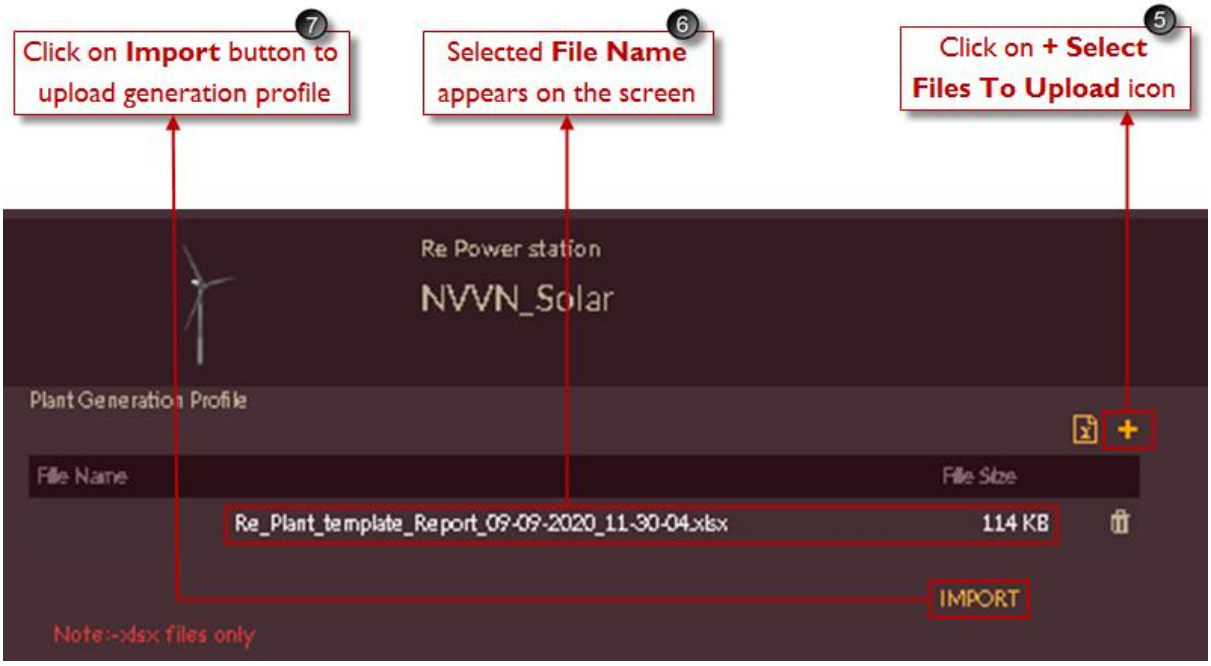


Figure 145. Steps to Import RE Generation Profile

8. Once file is imported successfully, the **Generation Profile Summary – Annual Energy (MU)** will display on the page.
9. Click on **Export** EXPORT button to download and view the uploaded or existing historical genertaion profile for selected plant.

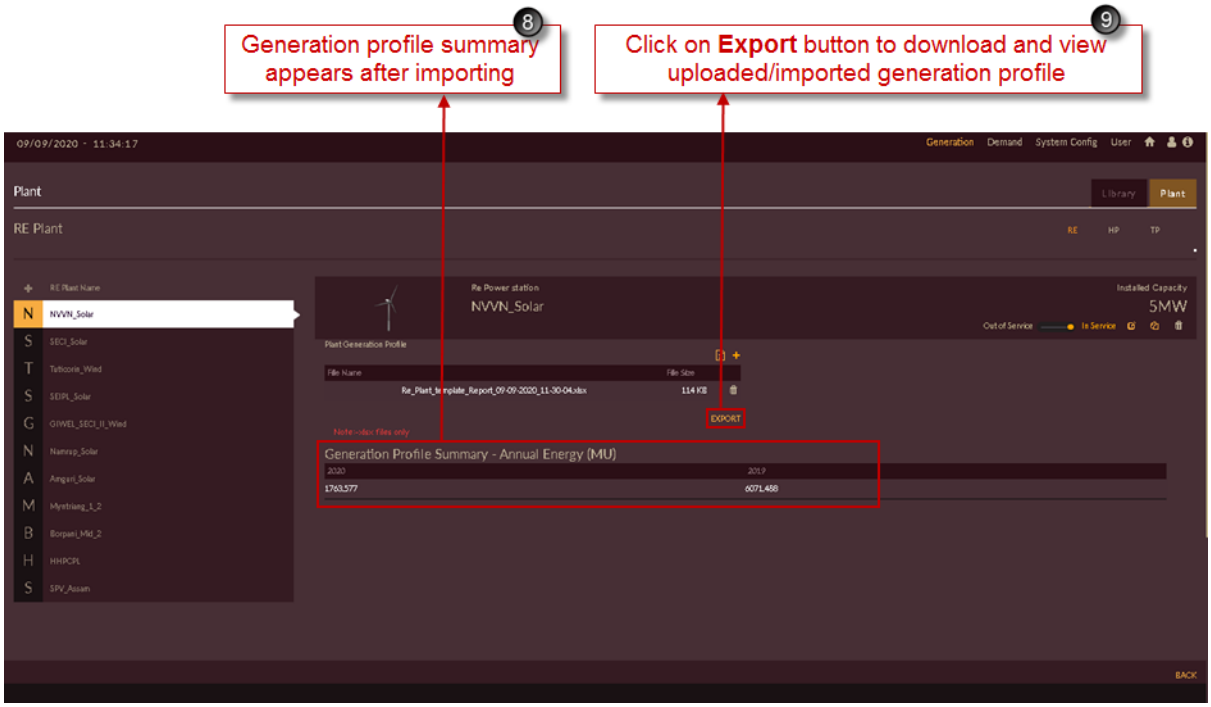


Figure 146. Imported RE Generation Profile

Repeat above steps to import historical generation profile for other RE plants.

2.2.2.5 HYDRO PLANT

HP – Hydro plants are the plants which generate electricity from water energy.

This section helps you to add available Hydro Plants in State required for carrying out Integrated Resource Mapping – IRM studies.

STEPS TO ADD HYDRO PLANTS:

1. Click on **Generation** tab. The **Generation** tab appears.
2. Click on **Plant** tab. The **Plant** tab appears as shown in Figure 147.
3. Click on **Hydro Plant** HP tab.
4. Click on **Add Hydro Plant** icon for configuring new Hydro Plant into the software.

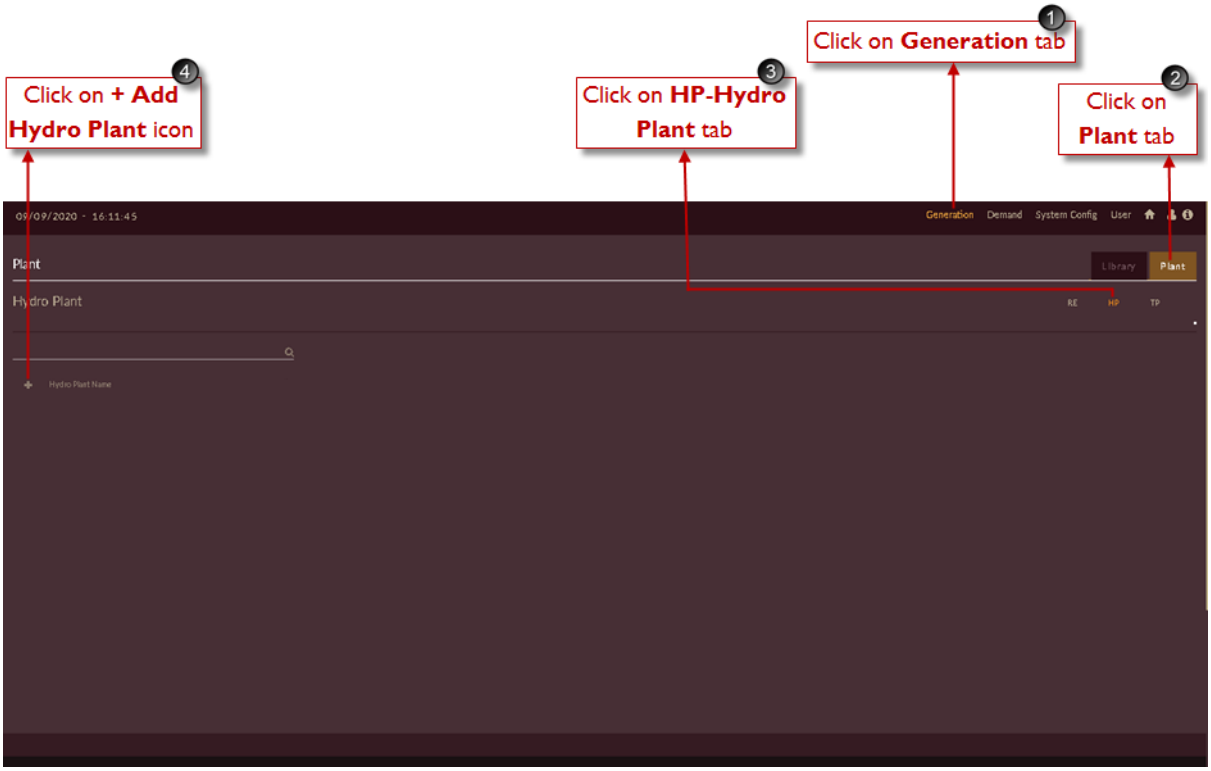
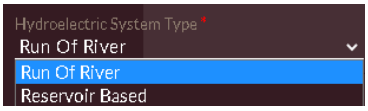


Figure 147. Steps to Add Hydro Plant

Once you click on **Add Hydro Plant**, a blank record appears for adding plant information as shown in Figure 148.

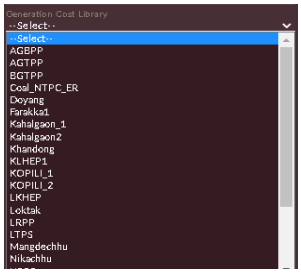
5. Fill the correct **Plant Information** available for respective State/Region. Plant information like;
   - Enter plant name in **Name** field.
   - Enter suitable plant code in **Code** field.
   - Select **Hydroelectric System Type** from the drop-down i.e. Run Of River or Reservoir Based.



   - Select **Type** for which category the Hydro plant belongs to from the drop-down i.e. State, IPP or CGS.

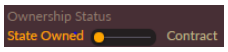
   - Select **Crew Constraint** from drop-down if available**.**
6. Fill the correct **Unit Information** available for respective added plant. Unit information to be entered like;
   - Unit name in **Unit Name** field.
   - Unit code in **Unit Code** field.

- **Initial Generation** of the unit in **MW.**
- **Minimum Generation** and **Maximum Generation** of the unit in **MW.**
- **Auxiliary Consumption** and **Annual Unavailability (Forced Outage Rate)** in percentage **(%)**.
- Select suitable **Generation Cost Library** configured in "COST CHARACTERISTICS" section from the drop-down for respective unit.



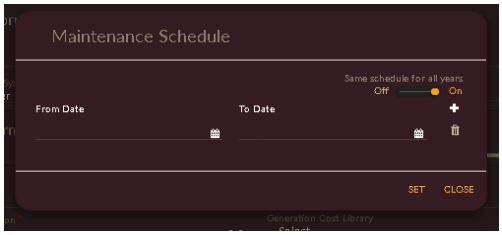
- **Reserve Allocation** in % and **Reserve Cost** in **INR/MWh** details.
- **Ramp Up Rate** and **Ramp Down Rate** in **MW/Min**.
- **Minimum Up time** and **Minimum Down Time** in **Hours (Hrs).**
- **Start Up Cost** in **INR**, **Startup Time** in **Hours (Hrs)** and **Start Ups/Week** details.
- Choose **Date Of Commissioning** and **Date Of Retirement** of the unit.
- Unit can be made as must run unit or not if required by setting **Off/On** 

toggle icon.
- Unit can be made in-service or out-of-service if required by setting **Out Of Service/In Service** 

toggle icon.
- Unit's Ownership status can be chosen as **State Owned/Contract** using 

Ownership Status toggle.

  [Note: When Ownership is set as contract the fields like generation cost library, must run status, Start Up Cost, Startup Time and Start Ups/Week will be disabled as they do not participate for contracted hydro units.]
- If there is any maintenance for the unit, dates of maintenance can be scheduled in **Maintenance Schedule** option.



- By clicking on **Add Unit**  icon we can add multiple units in for one hydro plant.

[Note: * marked field are mandatory to fill.]

7. Hydro plant can be made in-service or out-of-service if required by setting **Out Of Service/In Service** 

toggle icon.

8. Click on **Copy From**  icon to copy plant information from previously added Hydro plant if data is same.

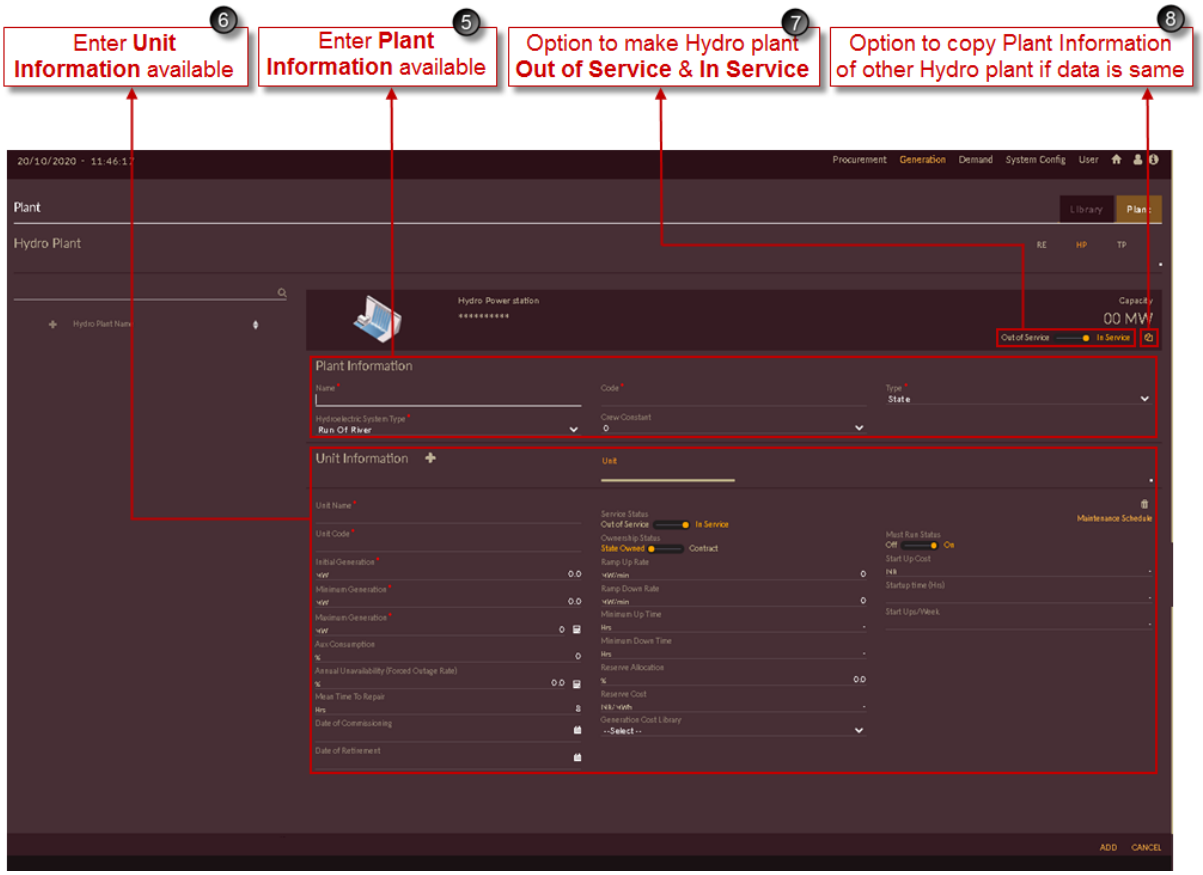


Figure 148. Blank Record for Adding Hydro Plant

9. Figure 149 shows the sample Hydro plant data entered for **KLHEP HYDRO** plant of Assam state.

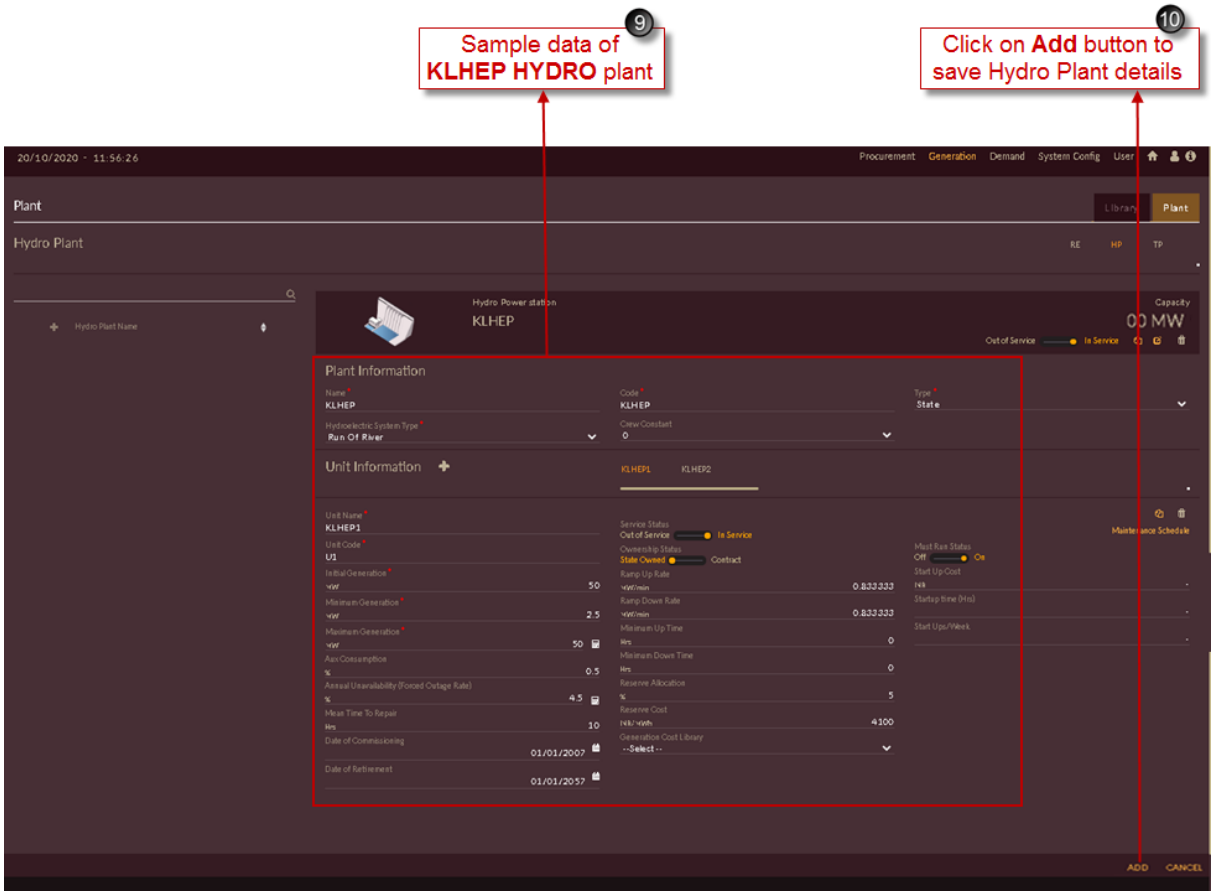
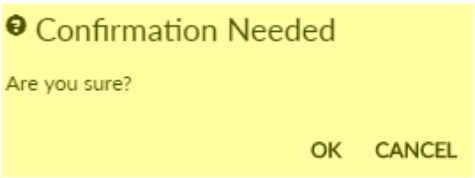


Figure 149. Sample Hydro Plant Data

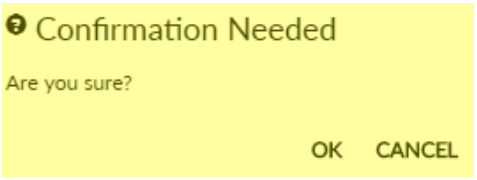
10. After entering the plant information, click on **Add** button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

11. Configured Hydro plant list will appear on left of the page as shown in Figure 150.
12. You can select the configured plant, and can make changes if required. Click on **Update** UPDATE button to save the changes made.
13. Click on **Delete** icon to remove the entire plant or particular unit record. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Deleted successfully" message appears.

Click on **CANCEL** to discard the task.

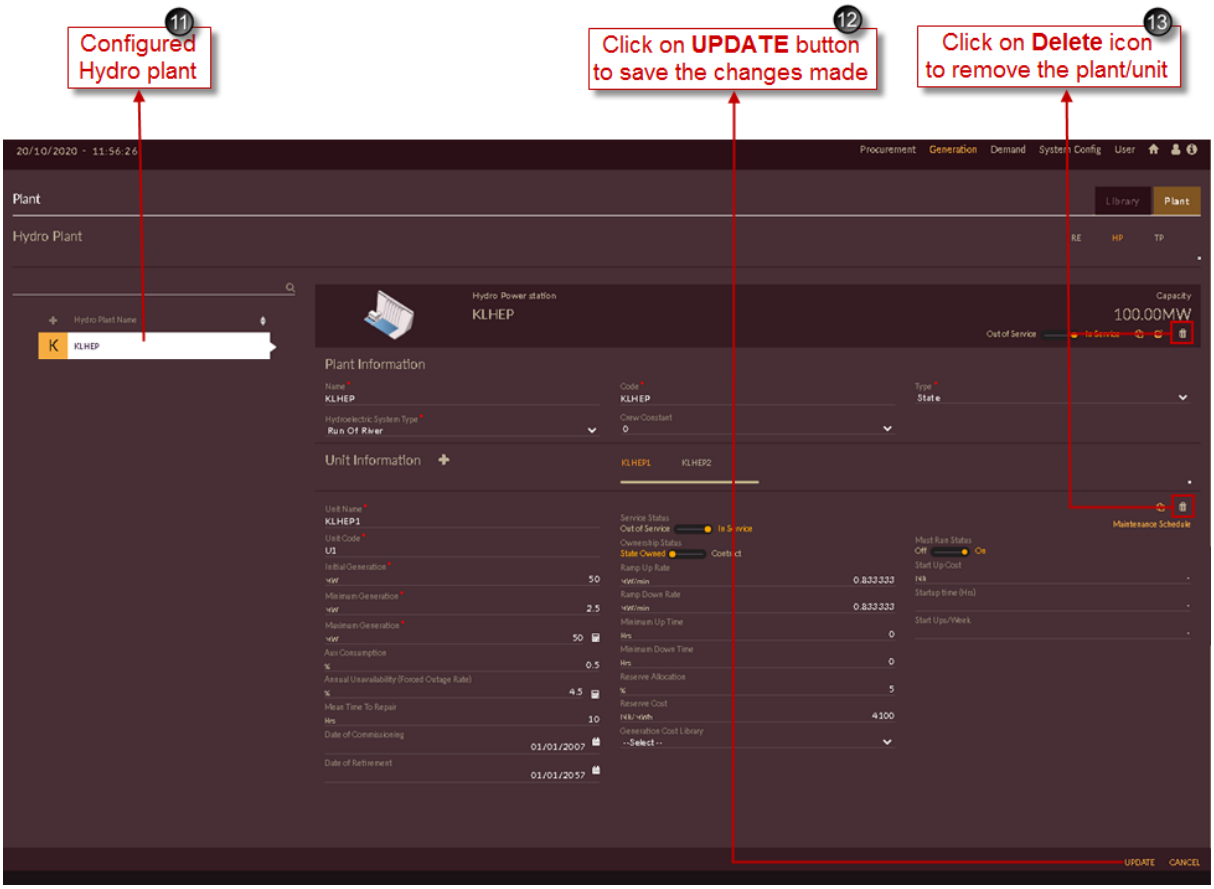


Figure 150. Updated Hydro Plant

Repeat above steps to add and update new Hydro plants into the software.

14. Once all the Hydro plants are added and configured the final Hydro plant - HP page will appear as shown in Figure 151. List of all the Hydro plants will appear on left of the applicication page.

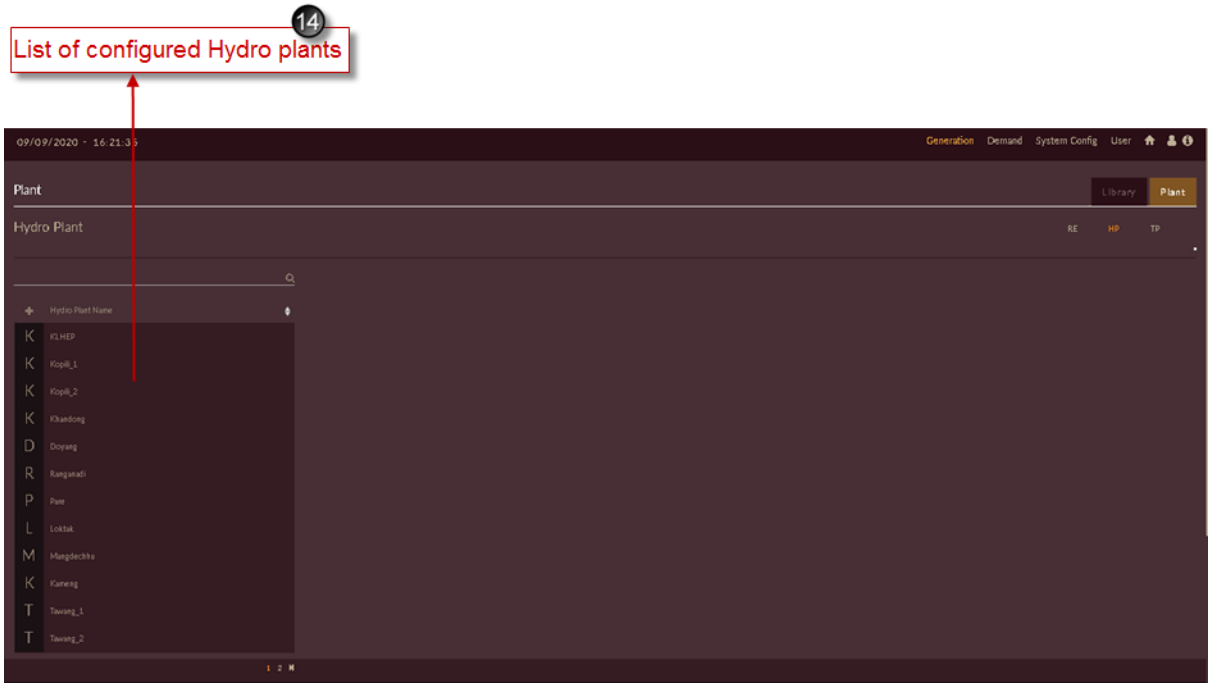


Figure 151. List of Configured Hydro Plants

STEPS TO IMPORT HISTORICAL GENEATION PROFILE FOR HYDRO PLANTS:

1. Select the plant from the configured list for which you need to upload generation profile. Here KLHEP hydro plant is selected.
2. Click on **Upload Historical Generation Profile** icon.

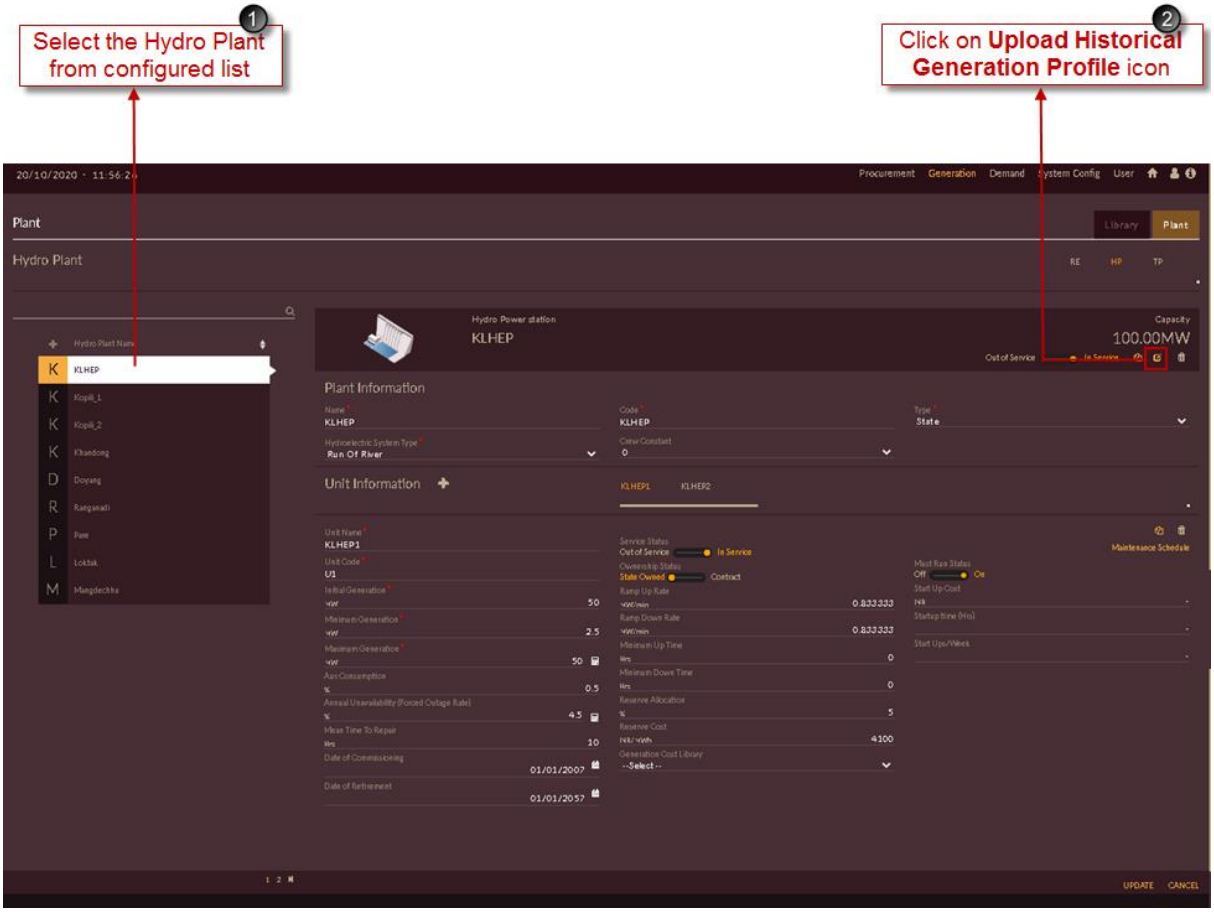


Figure 152. Steps to Add Historical Hydro Generation Profile

Once you click on **Upload Historical Generation Profile** icon for selected Hydro plant page will appear as shown in Figure 153.

3. Click on **Download Template** icon.

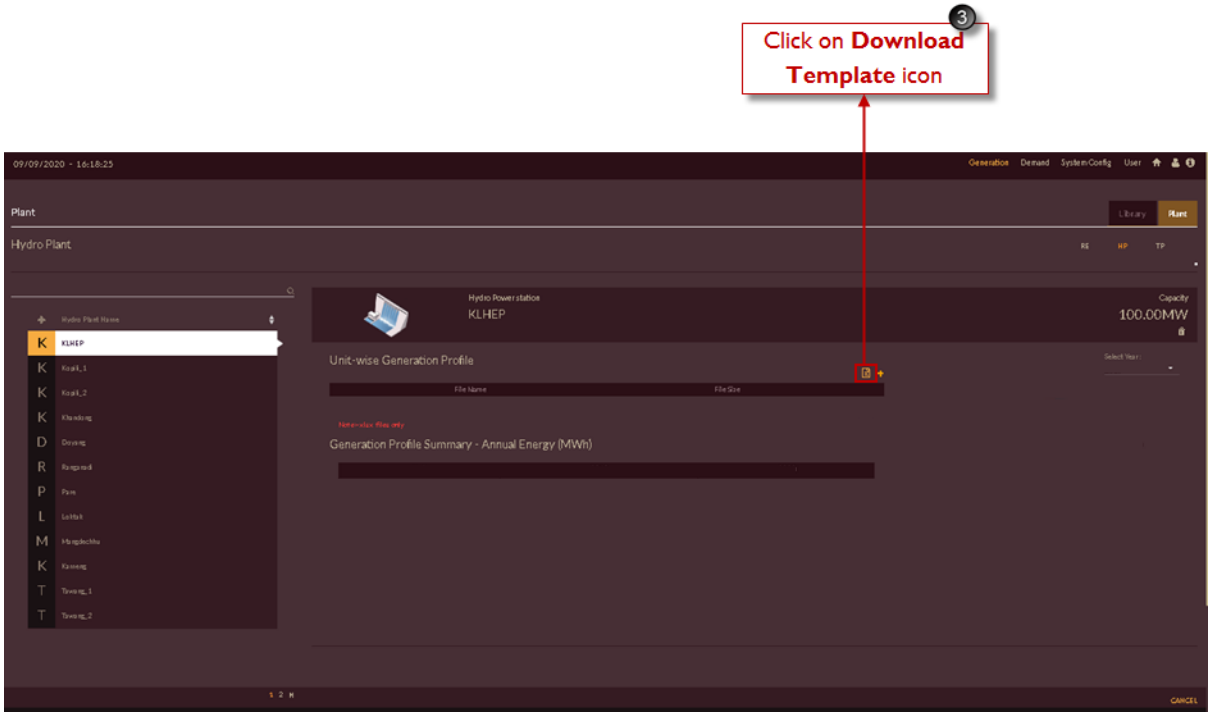


Figure 153. Download Hydro Generation Profile Template

4. Select the **From** & **To** date. Choose dates from calender drop-down, and click on **Download** DOWNLOAD icon to download the template.

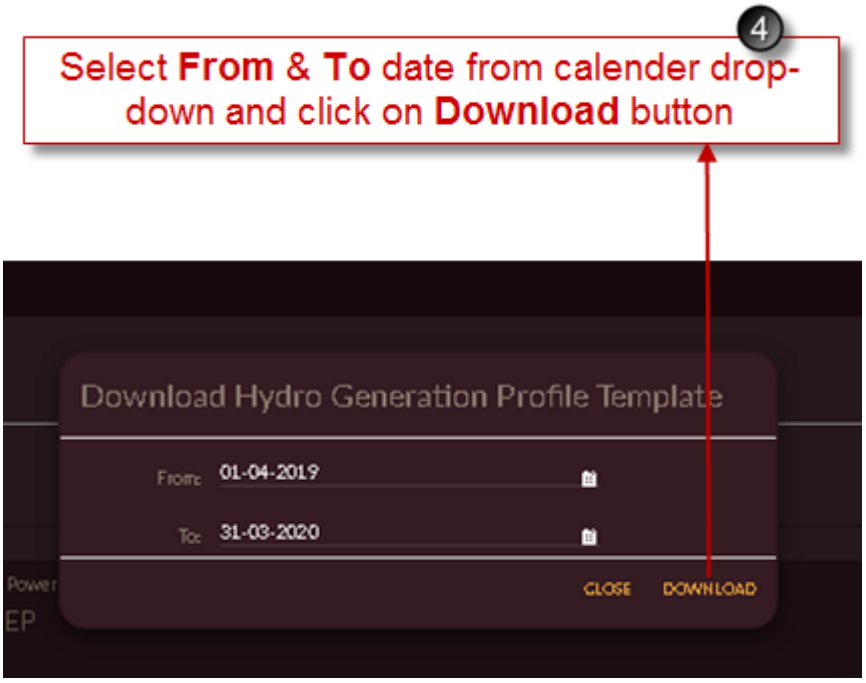


Figure 154. Select Hydro Generation Profile Date

The Template gets downloaded in **.xlsx** format with selected plant name (here KLHEP Hydro) for chosen dates as shown in Figure 155.

Upload the historical generation profile available for respective plant and save the file in **.xlsx** format only.

	A	B	C	D	E
1	**Years**	1	**Type**	Historical	
2					
3	**From**	**To**	**Week**	**KLHEP1_Energy(MWh)**	**KLHEP2_Energy(MWh)**
4	01-04-2019	07-04-2019	14		
5	08-04-2019	14-04-2019	15		
6	15-04-2019	21-04-2019	16		
7	22-04-2019	28-04-2019	17		
8	29-04-2019	05-05-2019	18		
9	06-05-2019	12-05-2019	19		
10	13-05-2019	19-05-2019	20		
11	20-05-2019	26-05-2019	21		
12	27-05-2019	02-06-2019	22		
13	03-06-2019	09-06-2019	23		
14	10-06-2019	16-06-2019	24		
15	17-06-2019	23-06-2019	25		
16	24-06-2019	30-06-2019	26		
17	01-07-2019	07-07-2019	27		
18	08-07-2019	14-07-2019	28		
19	15-07-2019	21-07-2019	29		
20	22-07-2019	28-07-2019	30		

Figure 155. Downloaded Hydro Generation Profile Template

Fill the template with correct data, save it and upload it in the software.

H15

	A	B	C	D
1	Weekly Energy Availabilit	KLHEP		
2				
3	**Week Start Date (DD/M**	**Week End Date (DD/MM)**	**KLHEP1_Energy(MWh)**	**KLHEP2_Energy(MWh)**
4	01/04	07/04	1806.56	2221.92
5	08/04	14/04	1806.56	2221.92
6	15/04	21/04	1806.56	2221.92
7	22/04	28/04	1806.56	2221.92
8	29/04	05/05	3158.71	3140.66
9	06/05	12/05	3699.57	3508.16
10	13/05	19/05	3699.57	3508.16
11	20/05	26/05	3699.57	3508.16
12	27/05	02/06	4140.22	4283.55
13	03/06	09/06	5241.84	6222.01
14	10/06	16/06	5241.84	6222.01
15	17/06	23/06	5241.84	6222.01
16	24/06	30/06	5241.84	6222.01
17	01/07	07/07	6036.92	5034.35
18	08/07	14/07	6036.92	5034.35
19	15/07	21/07	6036.92	5034.35
20	22/07	28/07	6036.92	5034.35
21	29/07	04/08	6451.0	6088.26
22	05/08	11/08	6761.56	6878.69
23	12/08	18/08	6761.56	6878.69
24	19/08	25/08	6761.56	6878.69
25	26/08	01/09	6902.28	7003.05

Hydro_Generation_Portfolio_'APG

Figure 156. Filled in Hydro Plant Template

5. Click on **Select Files To Upload** + icon, select the saved template.
6. Once you select the template, **File Name** will be displayed along with **File Size**.
7. Click on **Import** IMPORT button to upload the profile into the software.

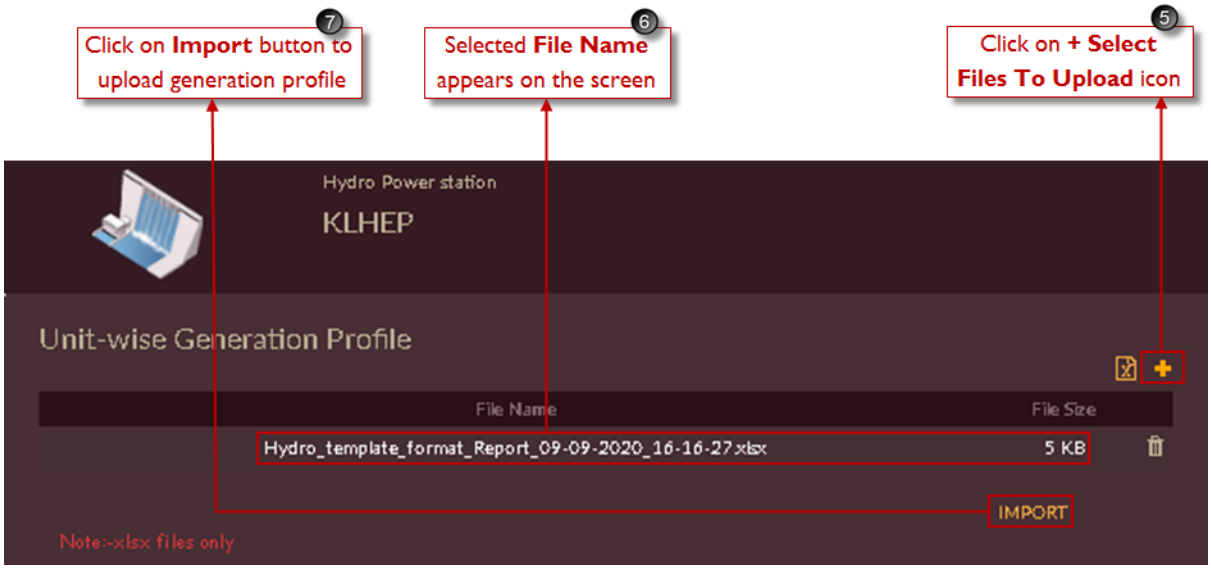


Figure 157. Steps to Import Hydro Generation Profile

8. Once file is imported successfully, the **Generation Profile Summary – Annual Energy (MU)** will display on the page.
9. Click on **Export** EXPORT button to download and view the uploaded or existing historical genertaion profile for selected plant.

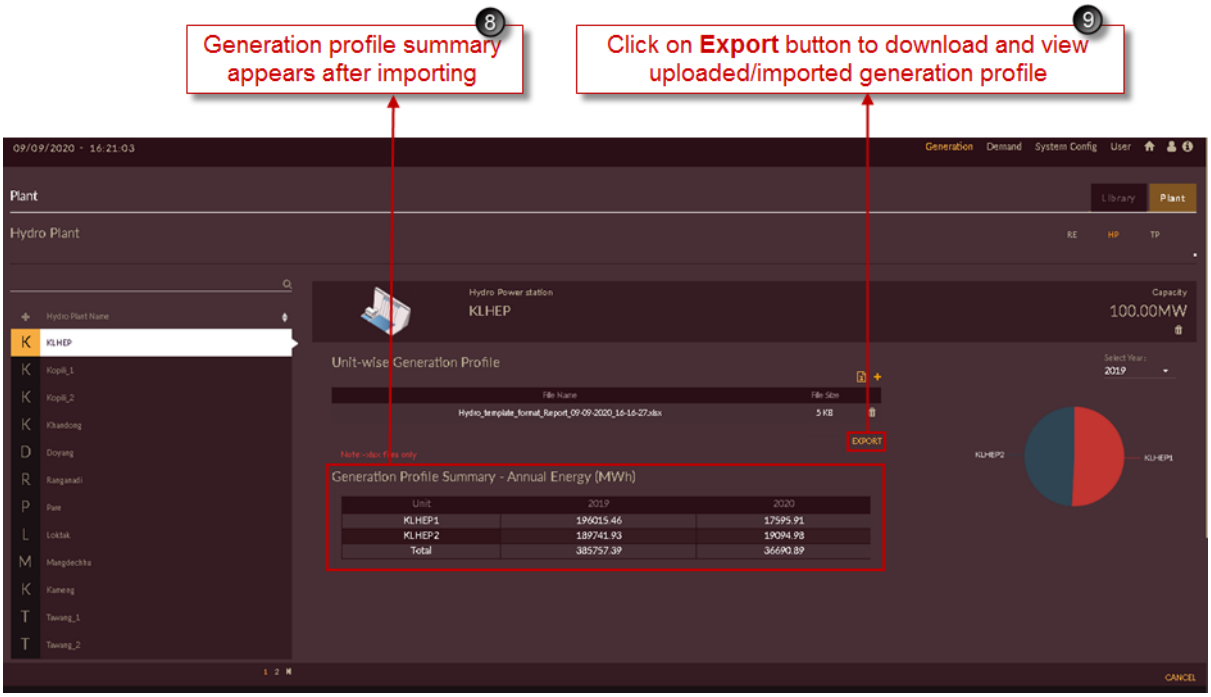


Figure 158. Imported Hydro Generation Profile

Repeat above steps to import historical generation profile for other Hydro plants.

2.2.2.6 THERMAL PLANT

TP – Thermal plants are the plants which generate electricity from Coal, Diesel, Nuclear, Gas, LPG etc.

This section helps you to add available Thermal Plants in State required for carrying out Integrated Resource Mapping – IRM studies.

STEPS TO ADD THERMAL PLANTS:

1. Click on **Generation** tab. The **Generation** tab appears.
2. Click on **Plant** tab. The **Plant** tab appears as shown in Figure 159.
3. Click on **Thermal Plant** TP tab.
4. Click on **Add Thermal Plant** icon for configuring new Thermal Plant into the software.

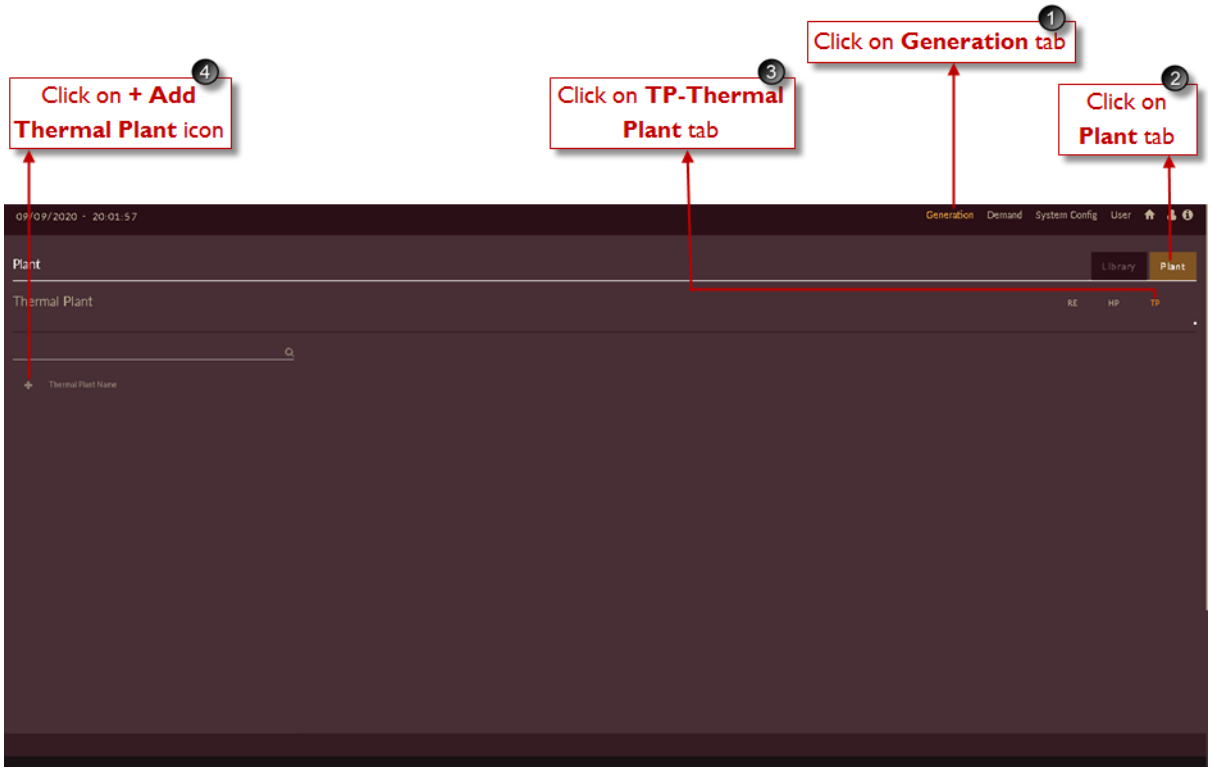
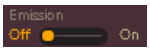


Figure 159. Steps to Add Thermal Plant

Once you click on **Add Thermal Plant**, a blank record appears for adding plant information as shown in Figure 160.

5. Fill the correct **Plant Information** available for respective State/Region. Plant information like;
   - Enter plant name in **Name** field.
   - Enter suitable plant code in **Code** field.
   - Select **Fuel Type** from the drop-down i.e. Coal, Diesel, Nuclear, Gas or LPG.

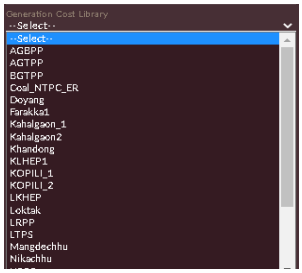
   - Select **Type** for which category the Thermal plant belongs to from the drop-down i.e. State, IPP or CGS.

   - You can set **Emission** toggle 

Off/On based on availability.
   - Select **Crew Constraint** from drop-down if available**.**
6. Fill the correct **Unit Information** available for respective added plant. Unit information to be entered like;
   - Unit name in **Unit Name** field.
   - Unit code in Unit Code field.

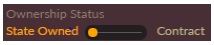
- Select **Fuel Type** from drop-down.

- **Initial Generation** of the unit in **MW.**
- **Minimum Generation** and **Maximum Generation** of the unit in **MW.**
- **Auxiliary Consumption** and **Annual Unavailability (Forced Outage Rate)** in percentage **(%)**.
- Select suitable **Fuel Contract Library** configured in **"**FUEL CONTRACT**"** section from the drop-down for respective unit if available.
- Select suitable **Emission Library** configured in **"**EMISSION CHARACTERISTICS**"** section from the drop-down for respective unit if available.
- Select suitable **Generation Cost Library** configured in "COST CHARACTERISTICS" section from the drop-down for respective unit.



- **Reserve Allocation** in % and **Reserve Cost** in **INR/MWh** details.
- **Ramp Up Rate** and **Ramp Down Rate** in **MW/Min**.
- **Minimum Up time** and **Minimum Down Time** in **Hours (Hrs).**
- **Hot Start Up Cost, Warm Start Up Cost, Cold Start Up Cost** in **INR**.
- **Start Ups/Week** details.
- **Fuel Consumption** details of unit in **Tons/MW.**
- **Time to Warm Start** and **Time to Cold Start** in **Hours (Hrs).**
- Choose **Date Of Commissioning** and **Date Of Retirement** of the unit.
- Unit can be made as must run unit or not if required by setting **Off/On** 

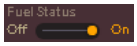
toggle icon.
- Unit can be made in-service or out-of-service if required by setting **Out Of Service/In Service** 

toggle icon.
- Unit's Ownership status can be chosen as **State Owned/Contract** using 

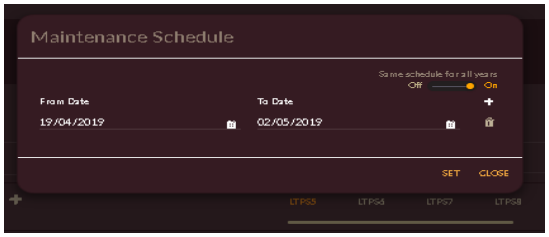
Ownership Status toggle.

  [Note: When Ownership is set as contract the fields like generation cost library, emission library, must run status, fuel status, fuel contract library, fuel consumption, time to warm

start, time to cold start, hot startup cost, warm startup cost, cold startup cost and startups/week will be disabled as they do not participate for contracted thermal units.]

- Set **Fuel Status** toggle to **Off/On** 

based on data availability.
- If there is any maintenance for the unit, dates of maintenance can be scheduled in **Maintenance Schedule** option.



- By clicking on **Add Unit**  icon we can add multiple units in for one thermal plant.

Note: Fields marked with * are mandatory to fill.

7. Thermal plant can be made in-service or out-of-service if required by setting **Out Of Service/In Service** 

toggle icon.
8. Click on **Copy From**  icon to copy plant information from previously added Thermal plant if data is same.

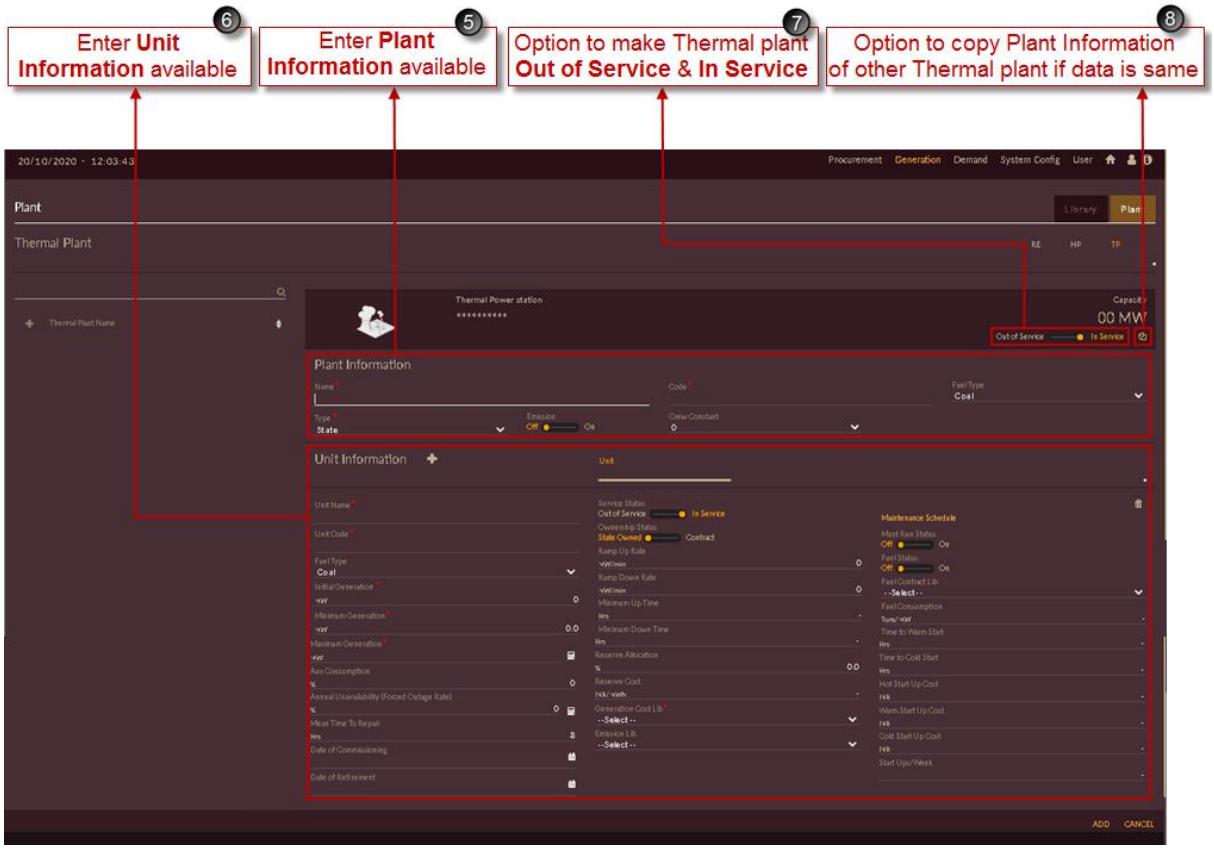


Figure 160. Blank Record for Adding Thermal Plant

9. Figure 161 shows the sample Thermal plant data entered for **LAKWA_TPS THERMAL** plant of Assam state.

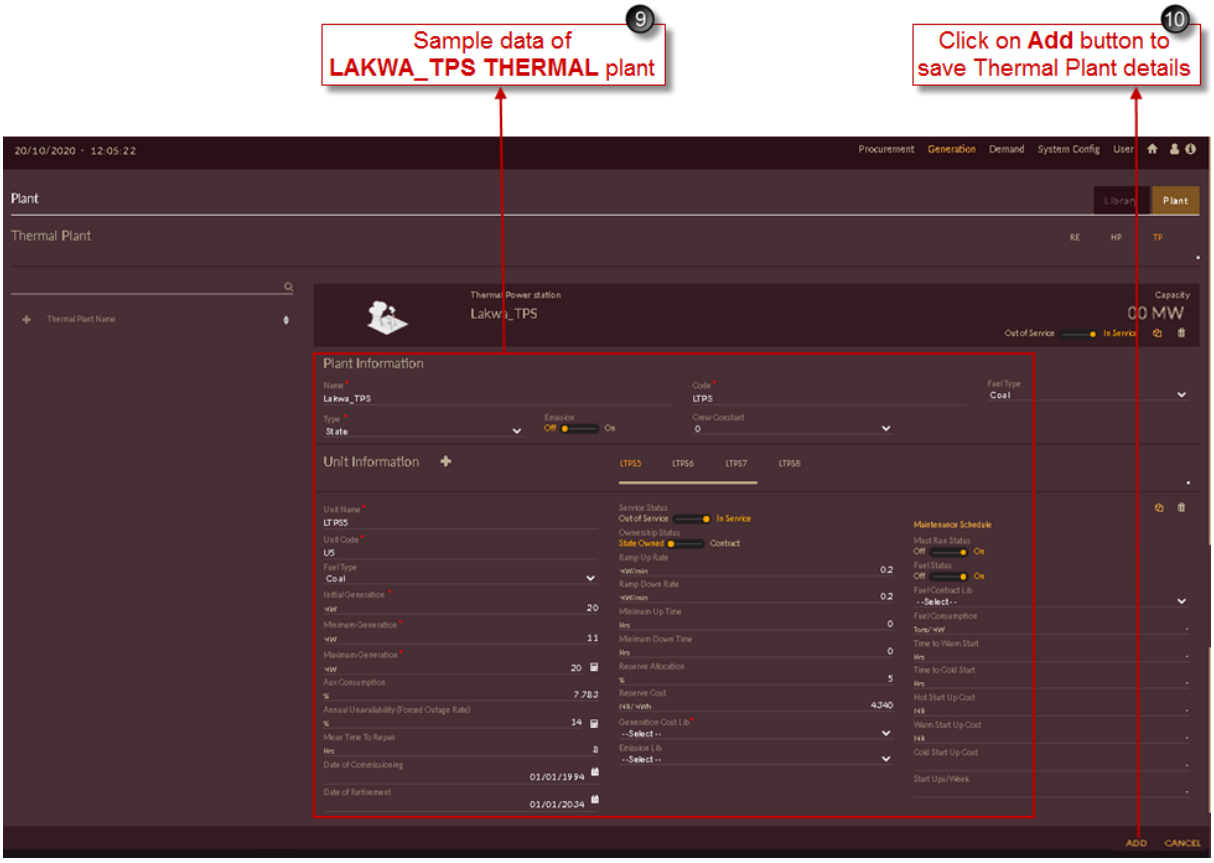
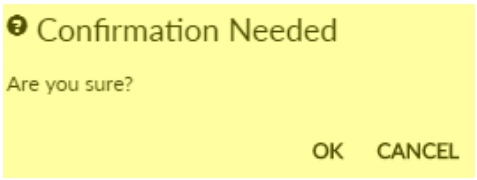


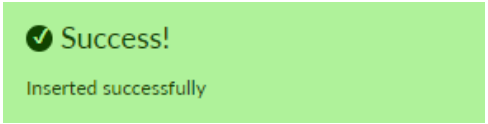
Figure 161. Sample Thermal Plant Data

10. After entering the plant information, click on **Add** button. The "Are you sure?" confirmation pop-up appears.



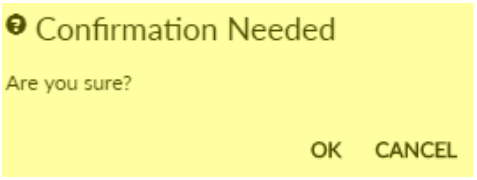
Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.



11. Configured Thermal plant list will appear on left of the page as shown in Figure 162.
12. You can select the configured plant, and can make changes if required.

    Click on Update UPDATE button to save the changes made.
13. Click on Delete icon to remove the entire plant or particular unit record. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Deleted successfully" message appears.

Click on **CANCEL** to discard the task.

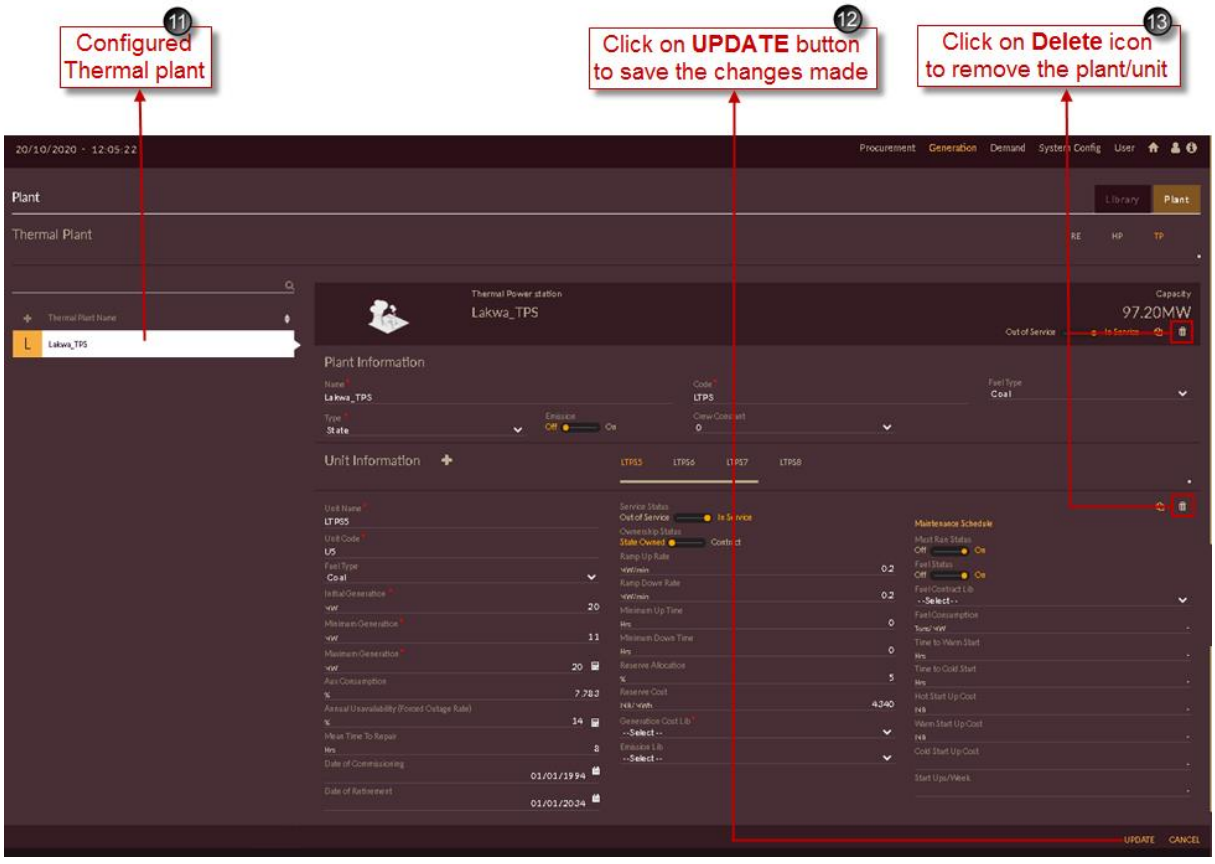


Figure 162. Updated Thermal Plant

Repeat above steps to add and update new Thermal plants into the software.

14. Once all the Thermal plants are added and configured the final Thermal plant - TP page will appear as shown in Figure 163. List of all the Thermal plants will appear on left of the applicication page.

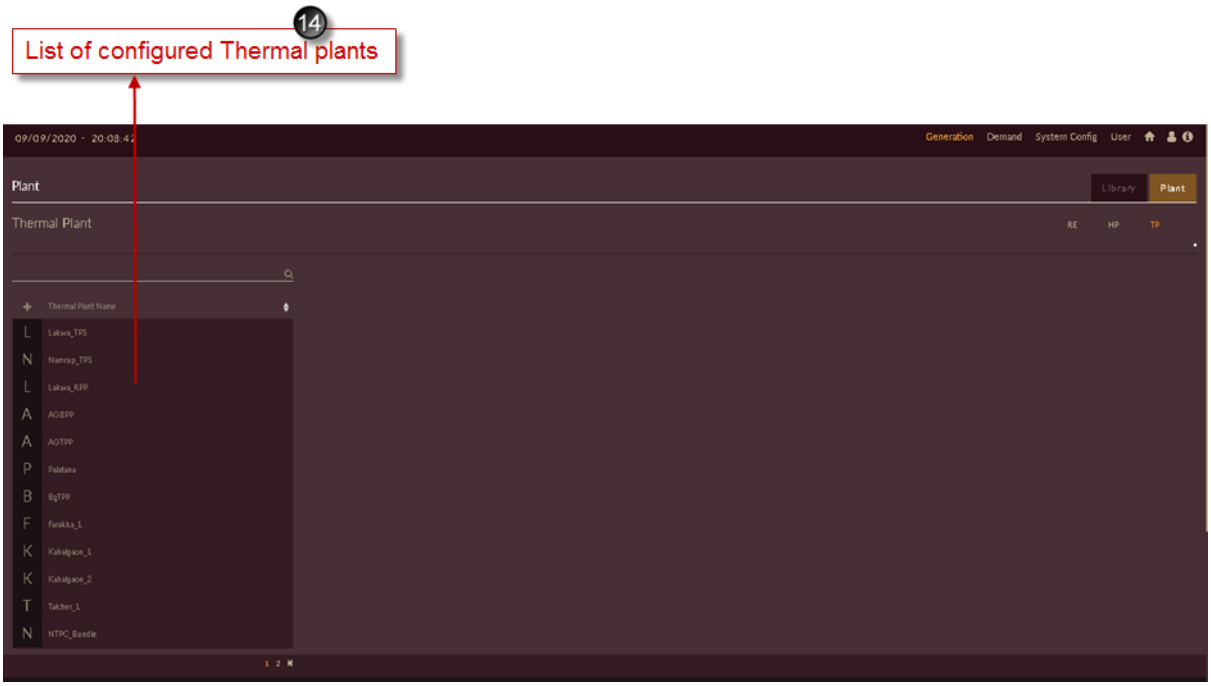


Figure 163. List of Configured Thermal Plants

2.2.2.7 HYDRO GENERATION PORTFOLIO

Once all available hydro power plants are configured into the software for IRM studies, we need reference generation profile for the plant energy dispatch.

You may get the generation profile for hydro plants from SLDC data of respective state.

You can consider previous year's generation/dispatch pattern as reference generation profile.

Weekly hydro generation profile is required for IRM – Studies in DISCOM – REPOSE software.

Once you gather generation profiles for all hydro plants, we need to configure them into the software.

This section helps us to configure/upload hydro generation profile.

STEPS TO CREATE HYDRO GENERATION PORTFOLIO:

1. Click on **Generation** tab. The **Generation** tab appears as shown in Figure 164
2. By default, **Library** tab will be selected.
3. Click on **Hydro Generation Portfolio** HP tab.
4. Click on **Add Hydro Portfolio** icon to add new hydro generation portfolio.

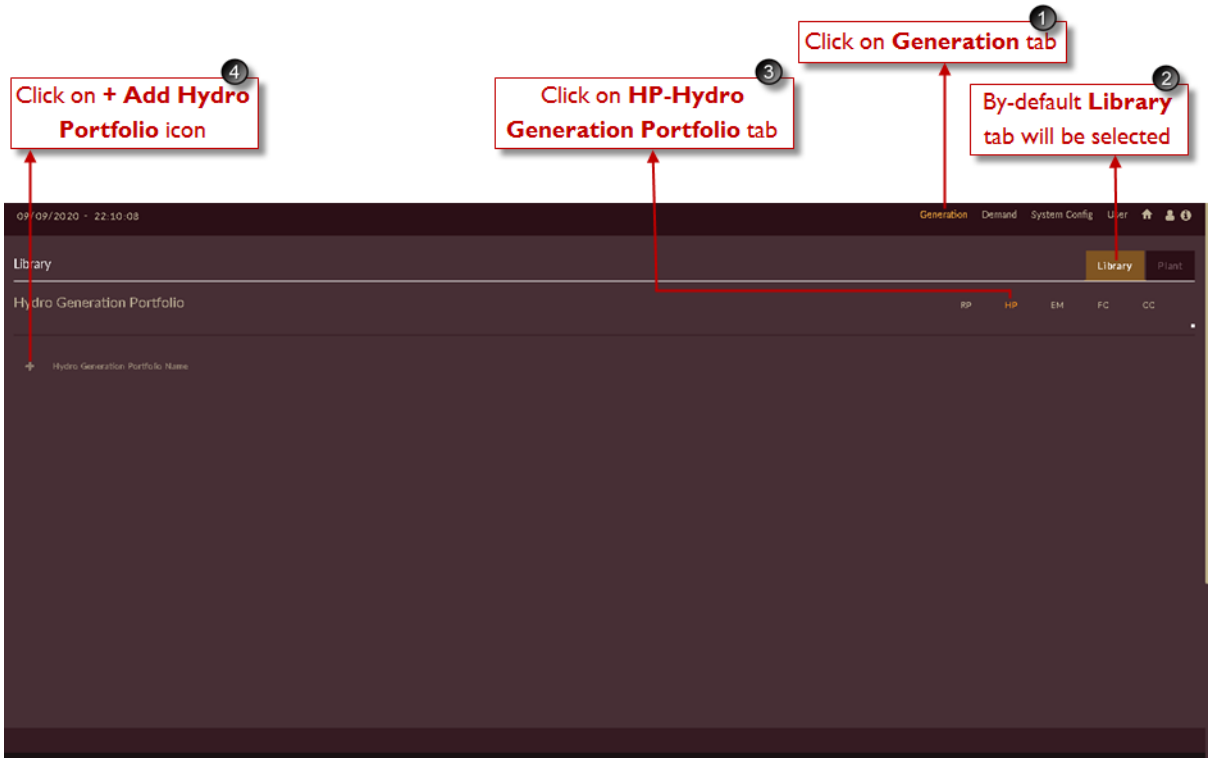


Figure 164. Adding Hydro Generation Portfolio

Once you click on **Add Hydro Portfolio** icon, you will see the blank record appeared on page as shown in Figure 165.

5. Enter appropriate hydro generation portfolio name in **Name** field and reference year of which profile you are uploading in **Year** field.

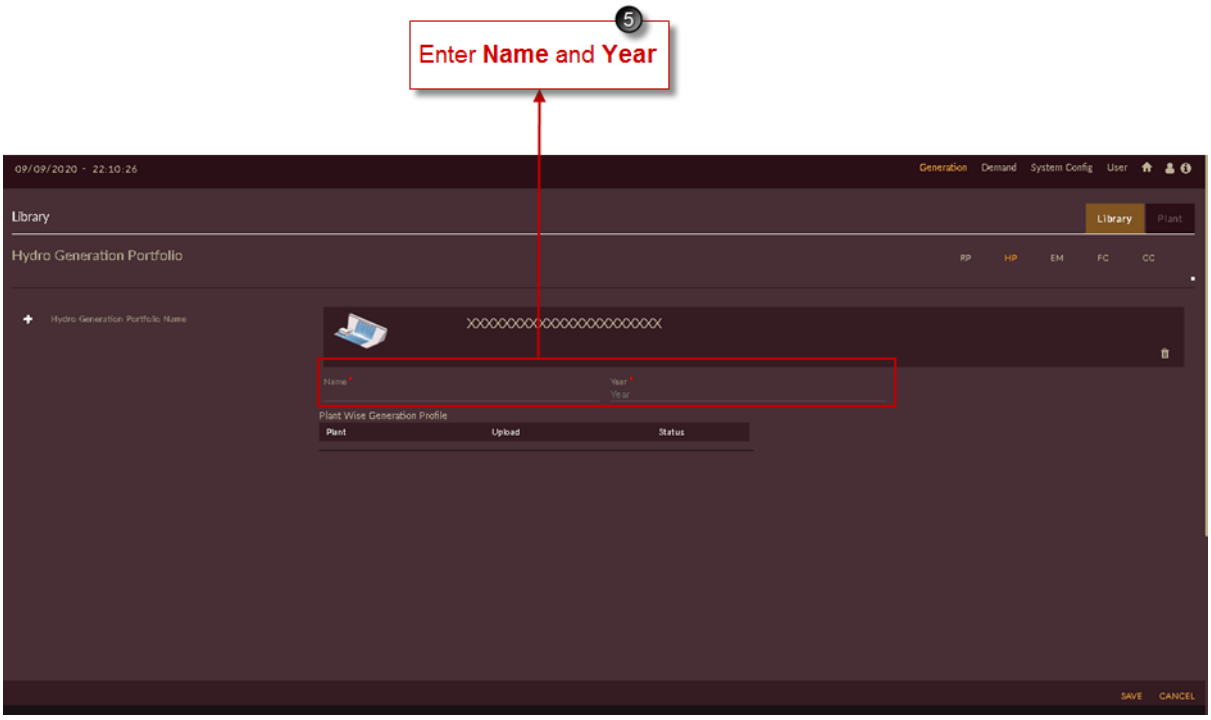


Figure 165. Blank Record to Create Hydro Generation Portfolio

Figure 166 shows sample name and year entered to create the hydro generation portfolio.

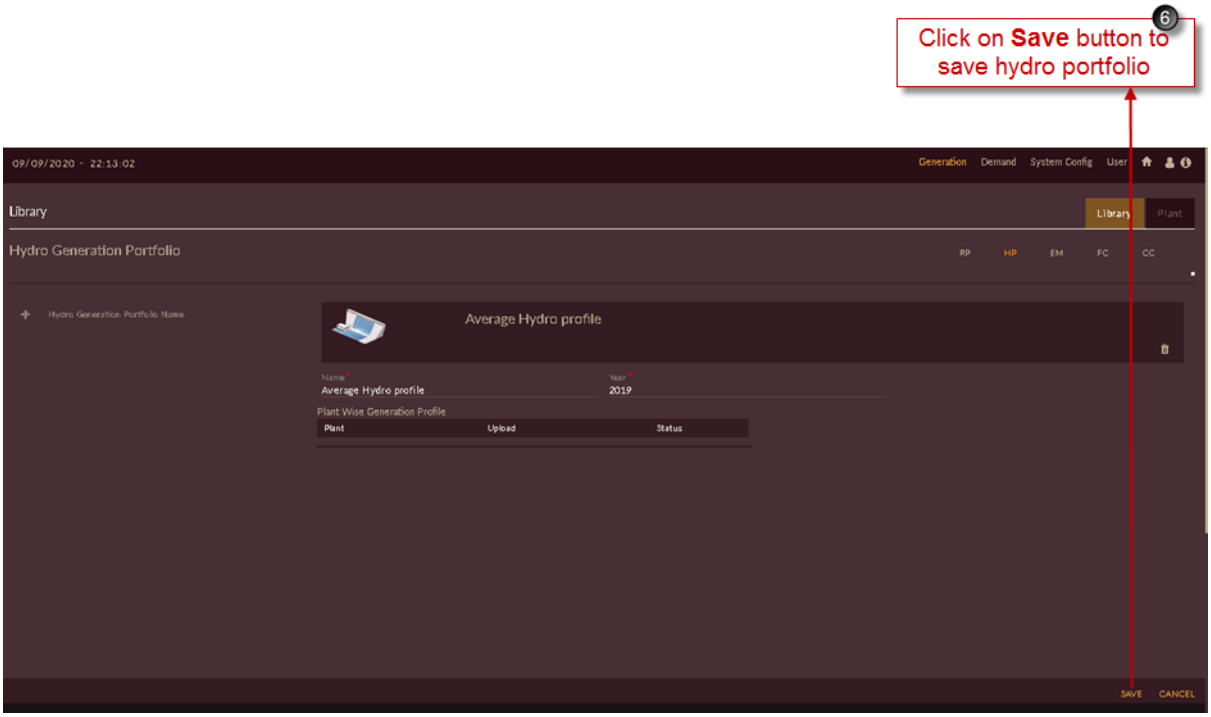
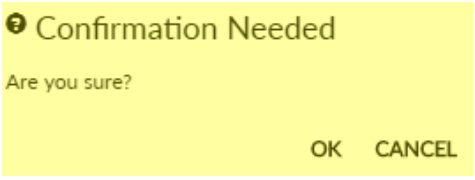


Figure 166. Saving Hydro Generation Portfolio

6. Click on the **SAVE** SAVE button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

STEPS TO UPLOAD HYDRO GENERATION PROFILE:

Successfully added/configured hydro generation portfolio reflects on left of the page as shown in Figure 167.

7. Select configured hydro portfolio.
8. Hydro plants added in HYDRO PLANT section appears as list showing **Pending** Pending indication as hydro generation profile is not uploaded.
9. To upload hydro generation profile, click on **Upload Plant Wise Generation Profile** icon for which plant you need to upload. Here **KLHEP** plant is shown.

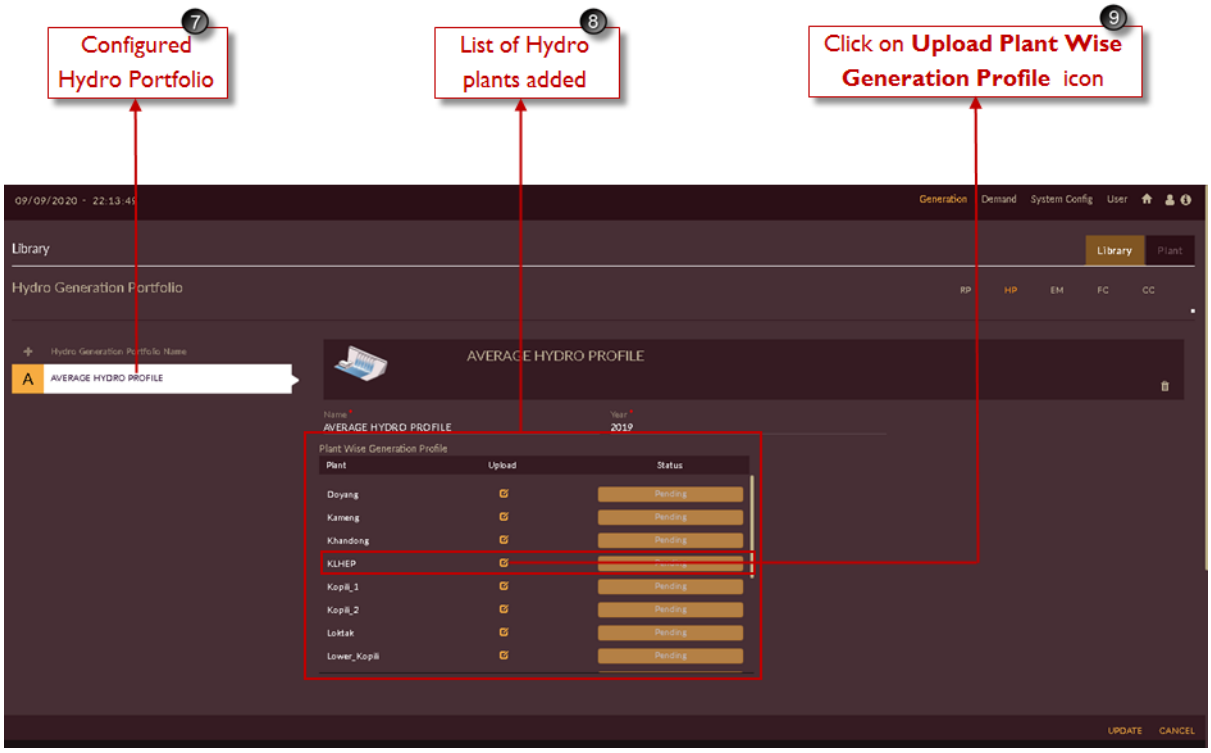


Figure 167. Configured Hydro Generation Portfolio

Once you click on **Upload Plant Wise Generation Profile** icon for selected Hydro plant page will appear as shown in Figure 168.

10. Click on **Download Template** icon.
11. Template gets downloaded in **.xlsx** format amnd appears in taskbar of your browser.

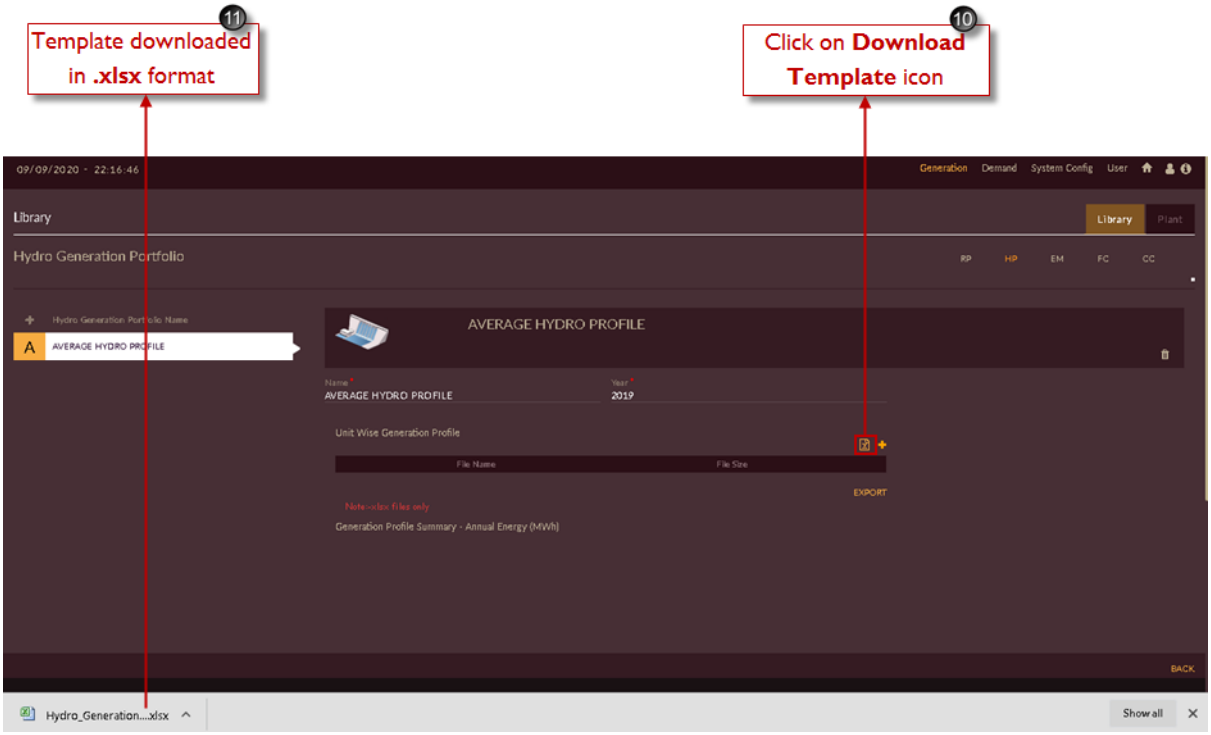
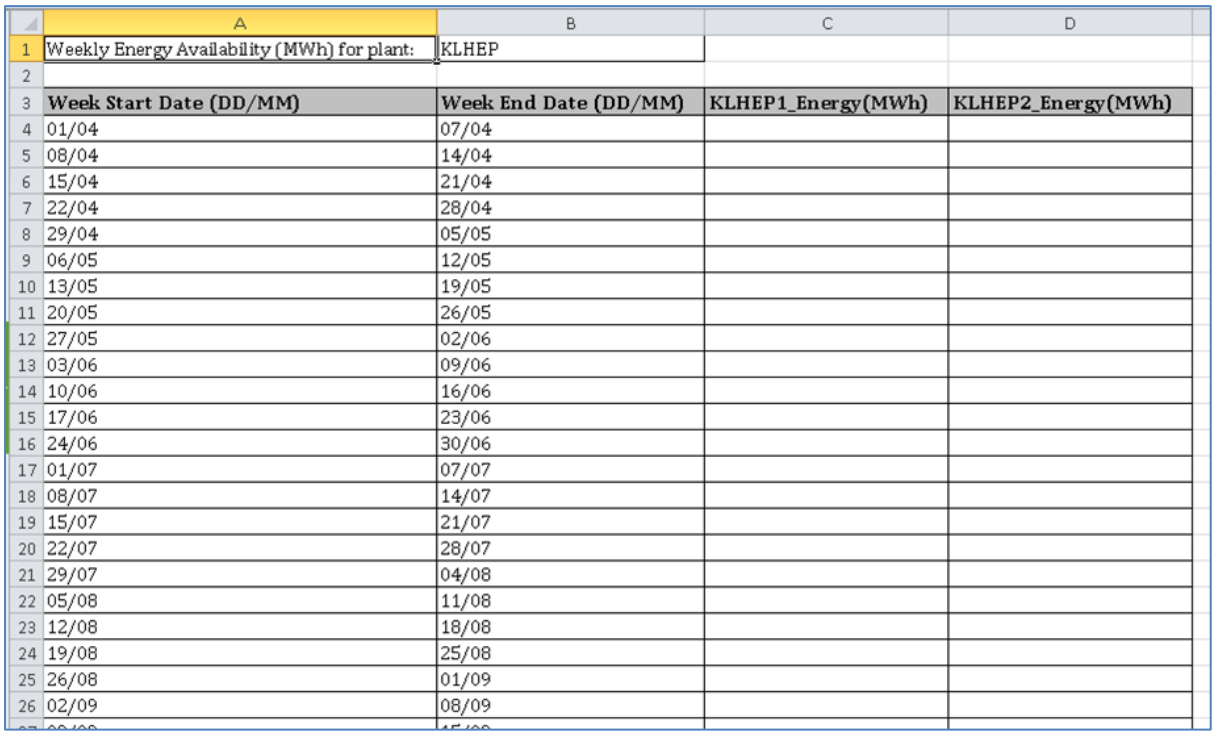


Figure 168. Downloading Hydro Generation Profile Template

Template will be downloaded for weekly in **.xlsx** format with selected plant name unit wise (here KLHEP Hydro) as shown in Figure 169.

Upload the generation profile available for respective plant and save the file in **.xlsx** format only.



	A	B	C	D
1	Weekly Energy Availability (MWh) for plant:	KLHEP		
2				
3	**Week Start Date (DD/MM)**	**Week End Date (DD/MM)**	**KLHEP1_Energy(MWh)**	**KLHEP2_Energy(MWh)**
4	01/04	07/04		
5	08/04	14/04		
6	15/04	21/04		
7	22/04	28/04		
8	29/04	05/05		
9	06/05	12/05		
10	13/05	19/05		
11	20/05	26/05		
12	27/05	02/06		
13	03/06	09/06		
14	10/06	16/06		
15	17/06	23/06		
16	24/06	30/06		
17	01/07	07/07		
18	08/07	14/07		
19	15/07	21/07		
20	22/07	28/07		
21	29/07	04/08		
22	05/08	11/08		
23	12/08	18/08		
24	19/08	25/08		
25	26/08	01/09		
26	02/09	08/09		

Figure 169. Downloaded Hydro Generation Profile Template

After file is saved,with actual data you have to upload it in software.

12. Click on **Select Files To Upload** icon, select the saved template.
13. Once you select the template, **File Name** will be displayed along with **File Size**.
14. Click on **Import** IMPORT button to upload the completed profile into the software.

Note: The same filled in template can be exported for future reference as shown inFigure 172. Exported Hydro Generation Profile.

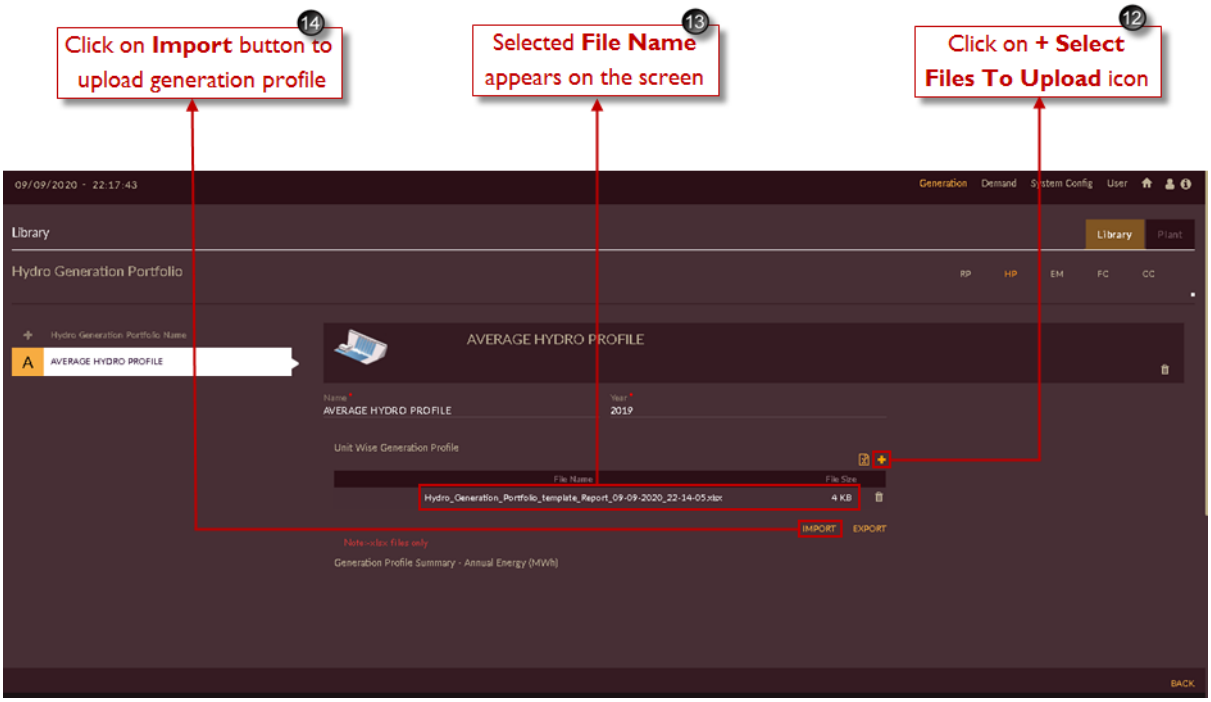


Figure 170. Steps to Import Hydro Generation Profile

15. Once the hydro generation file is imported successfully, the unit wise **Generation Profile Summary – Annual Energy (MU)** will display on the page.
16. Click on **Export** EXPORT button to download and view the uploaded or existing genertaion profile for selected plant.

Figure 171. Imported Hydro Generation Profile

Once you click on **Export** EXPORT button the imported hydro generation profile will get downloaded in .xlsx format and will appear as shown in Figure 172.

A1 | Weekly Energy Availability (MWh) for plant:

	A	B	C	D
1	Weekly Energy Availability (MWh) for plant:	KLHEP		
2				
3	**Week Start Date (DD/MM)**	**Week End Date (DD/MM)**	**KLHEP1_Energy(MWh)**	**KLHEP2_Energy(MWh)**
4	01/04	07/04	1806.56	2221.92
5	08/04	14/04	1806.56	2221.92
6	15/04	21/04	1806.56	2221.92
7	22/04	28/04	1806.56	2221.92
8	29/04	05/05	3158.71	3140.66
9	06/05	12/05	3699.57	3508.16
10	13/05	19/05	3699.57	3508.16
11	20/05	26/05	3699.57	3508.16
12	27/05	02/06	4140.22	4283.55
13	03/06	09/06	5241.84	6222.01
14	10/06	16/06	5241.84	6222.01
15	17/06	23/06	5241.84	6222.01
16	24/06	30/06	5241.84	6222.01
17	01/07	07/07	6036.92	5034.35
18	08/07	14/07	6036.92	5034.35
19	15/07	21/07	6036.92	5034.35
20	22/07	28/07	6036.92	5034.35
21	29/07	04/08	6451.0	6088.26
22	05/08	11/08	6761.56	6878.69
23	12/08	18/08	6761.56	6878.69
24	19/08	25/08	6761.56	6878.69

Figure 172. Exported Hydro Generation Profile

17. Once profile is imported succesfully, **Pending** Pending indication will get changed to **Uploaded** Uploaded indication as shown in Figure 173.

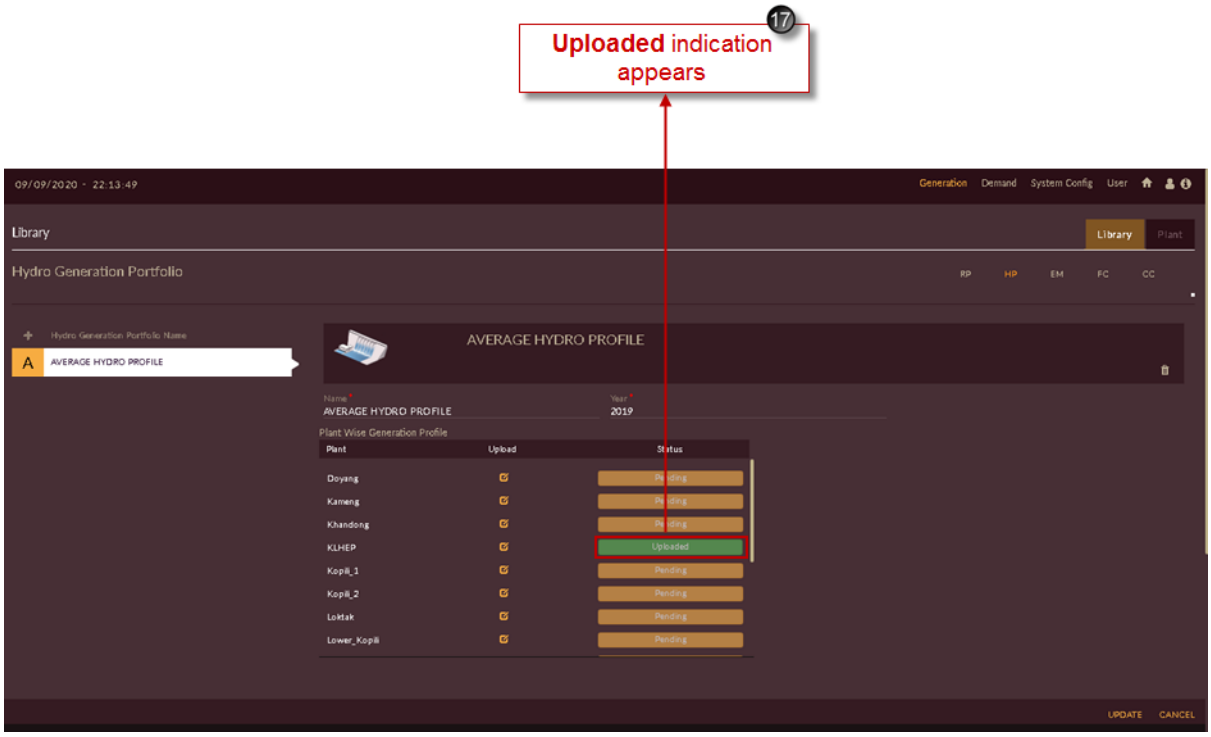


Figure 173. Uploaded Profile Indication

Repeat above steps to add hydro generation profile for remaining hydro plants.

Once hydro generation profiles are imported to all Hydro plants, page will appear as shown in Figure 174.

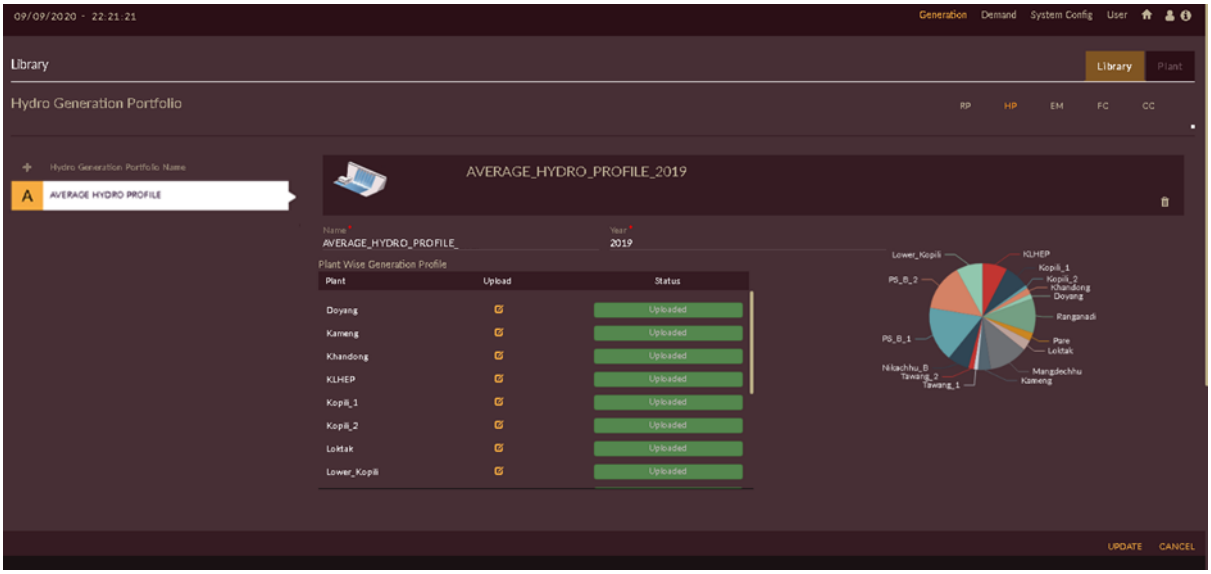


Figure 174. Successfully Created Hydro Generation Portfolio

2.2.2.8 RE GENERATION PORTFOLIO

Once all available RE power plants are configured into the software for IRM studies, we need reference generation profile for the plant energy dispatch.

You may get the generation profile for RE plants from SLDC data of respective state.

You can consider previous year's generation/dispatch pattern as reference generation profile.

Hourly RE generation profile is required for IRM – Studies in DISCOM – REPOSE software.

Once you gather generation profiles for all RE plants, we need to configure them into the software.

This section helps us to configure/upload RE generation profile.

STEPS TO CREATE RE GENERATION PORTFOLIO:

1. Click on **Generation** tab. The **Generation** tab appears as shown in Figure 175.
2. By default, **Library** tab will be selected.
3. Click on **RE Generation Portfolio** RP tab.
4. Click on **Add RE Gen** icon to add new RE generation portfolio.

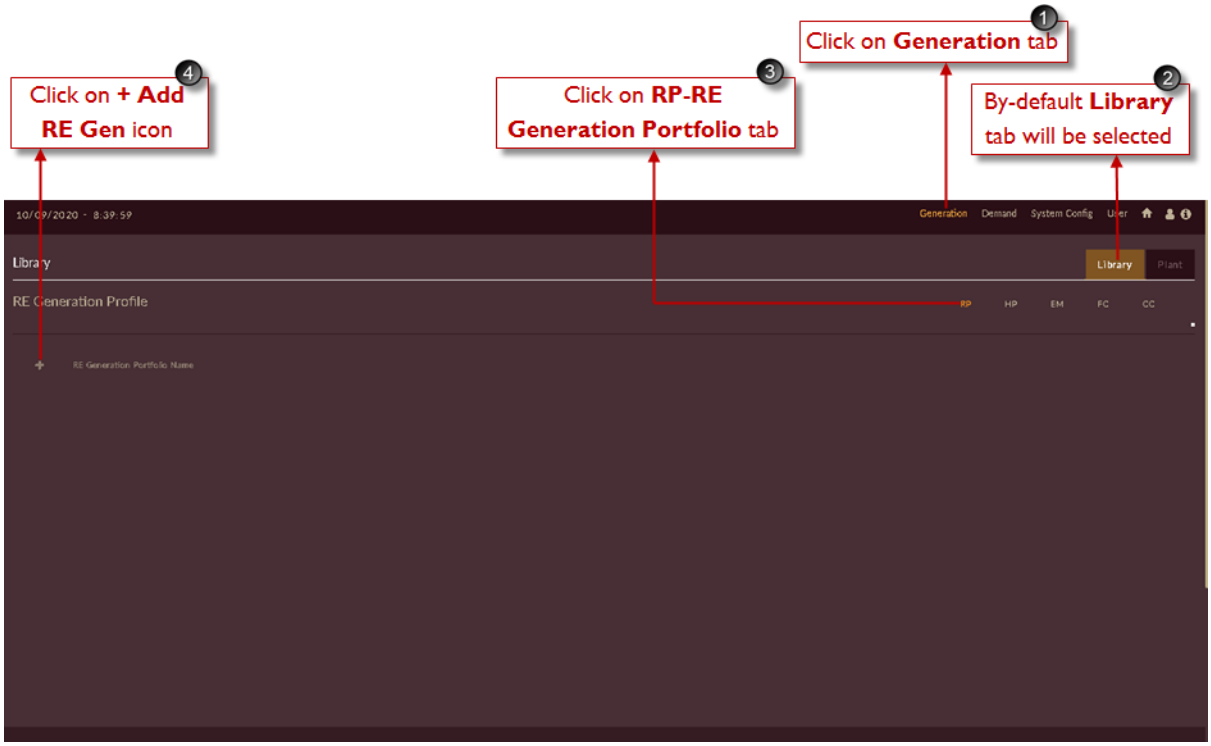


Figure 175. Steps to add RE Generation Portfolio

Once you click on **Add RE Gen** icon, you will see the blank record appeared on page as shown in Figure 176.

5. Enter appropriate RE generation portfolio name in **Name** field and reference year of which profile you are uploading in **Year** field.

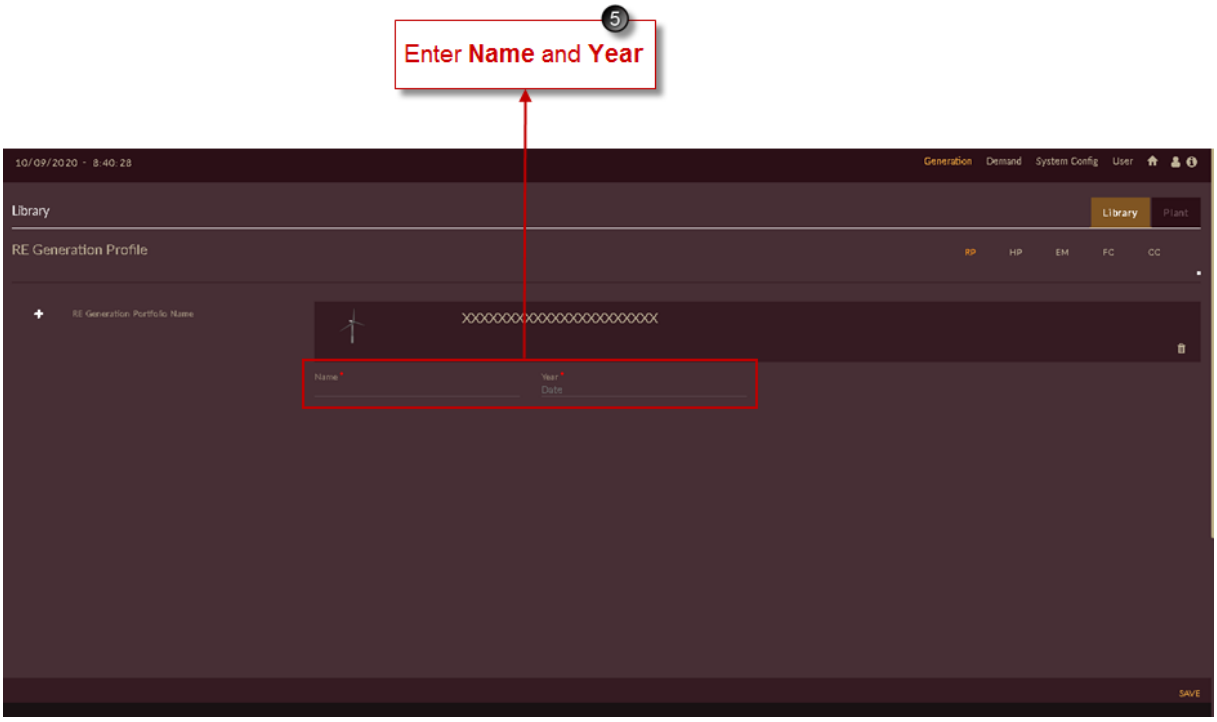


Figure 176. Blank Record to Create RE Generation Portfolio

Figure 177 shows sample name and year entered to create the RE generation portfolio.

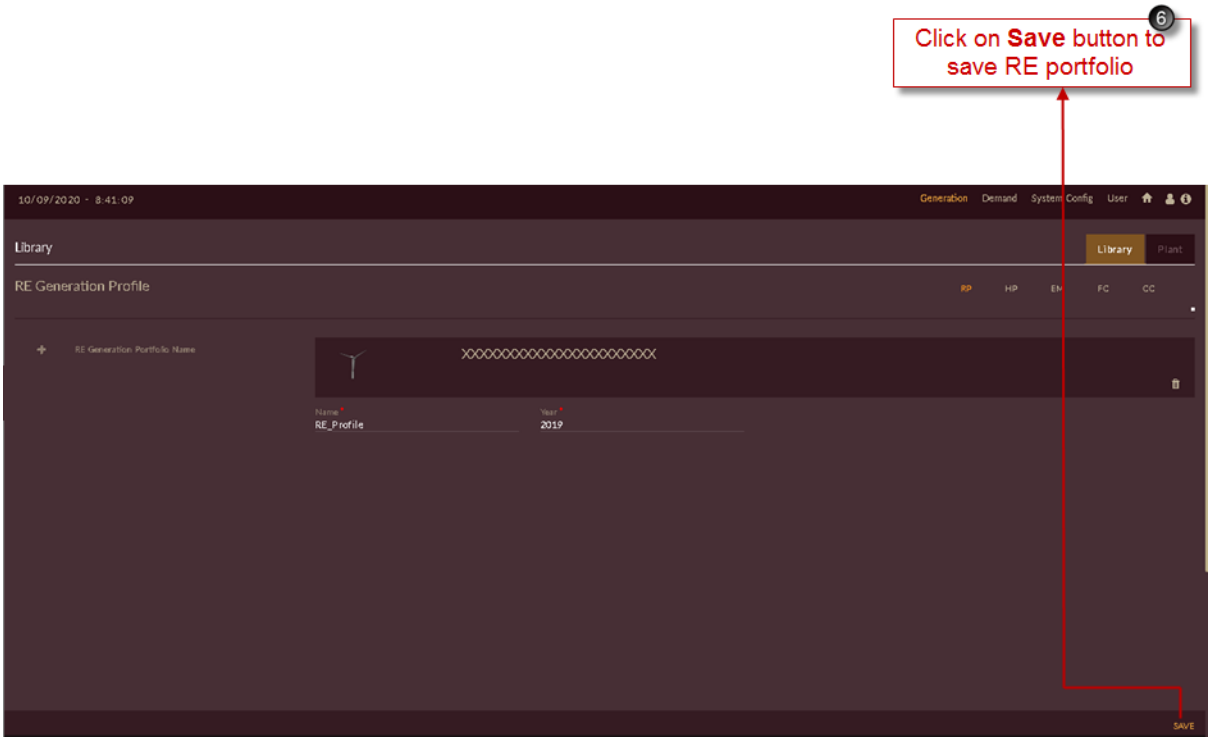
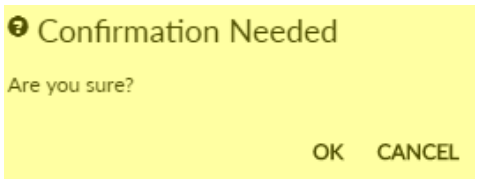


Figure 177. Saving RE Generation Portfolio

6. Click on the **SAVE** SAVE button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

STEPS TO UPLOAD RE GENERATION PROFILE:

Successfully added/configured RE generation portfolio reflects on left of the page as shown in Figure 178.

7. Select configured RE portfolio.
8. RE plants added in RE PLANT section appears as list showing **Pending** Pending indication as RE generation profile is not uploaded.
9. To upload RE generation profile, click on **Upload Plant Wise Generation Profile** icon for which plant you need to upload. Here **NVVN_SOLAR** plant is shown.

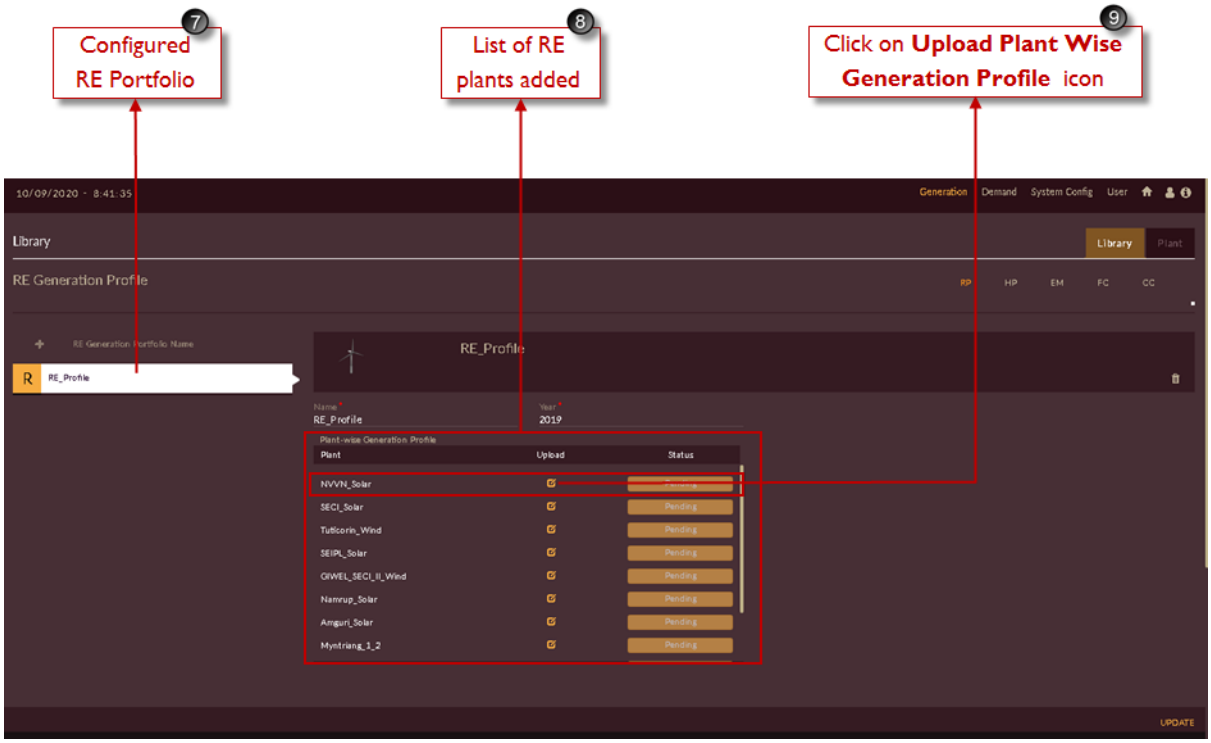


Figure 178. Configured RE Generation Portfolio

Once you click on **Upload Plant Wise Generation Profile** icon for selected RE plant page will appear as shown in Figure 179.

10. Click on **Download Template** icon.
11. Template gets downloaded in **.xlsx** format and appears in taskbar of your browser.

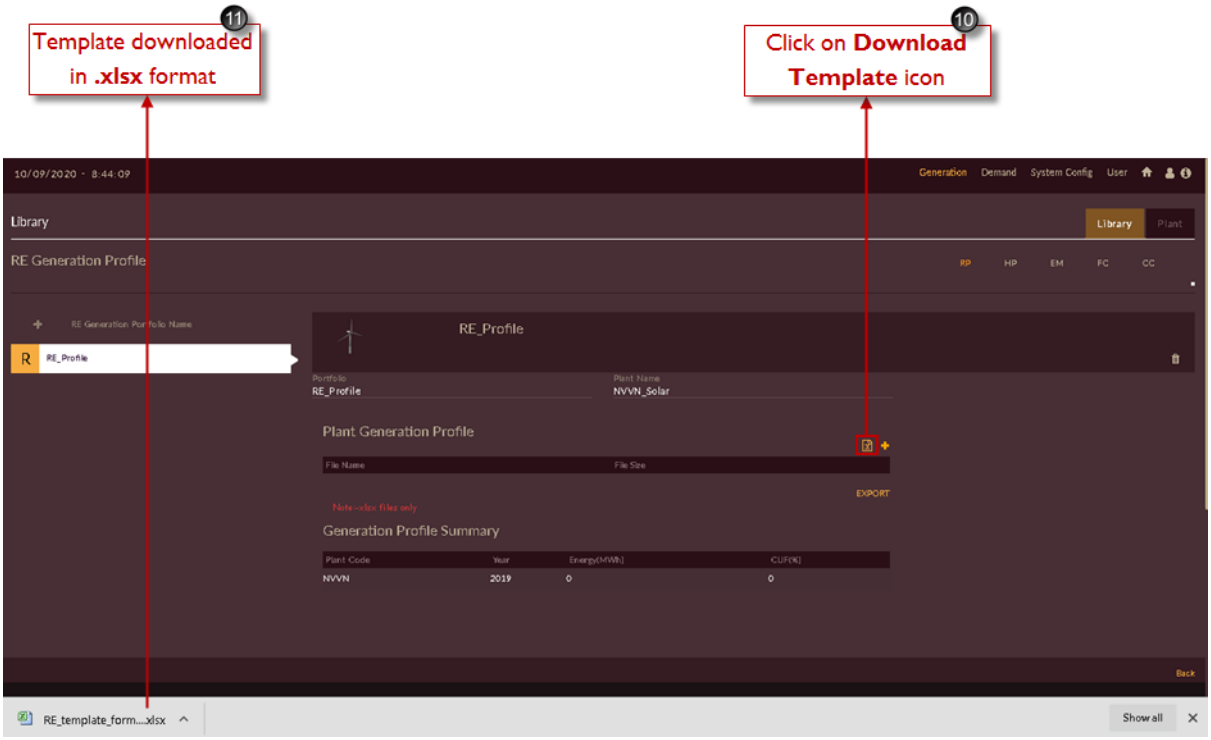


Figure 179. Downloading RE Generation Profile Template

Template will be downloaded for hourly (in time block) in **.xlsx** format with selected plant name unit wise (here NVVN Solar) as shown in Figure 180.

Upload the generation profile available for respective plant and save the file in **.xlsx** format only.

	A	B	C
1	Date	TimeBlock	NVVN_Solar (MWh)
2	01-04-2019	1	
3	01-04-2019	2	
4	01-04-2019	3	
5	01-04-2019	4	
6	01-04-2019	5	
7	01-04-2019	6	
8	01-04-2019	7	
9	01-04-2019	8	
10	01-04-2019	9	
11	01-04-2019	10	
12	01-04-2019	11	
13	01-04-2019	12	
14	01-04-2019	13	
15	01-04-2019	14	
16	01-04-2019	15	
17	01-04-2019	16	
18	01-04-2019	17	
19	01-04-2019	18	
20	01-04-2019	19	

Figure 180. Downloaded RE Generation Profile Template

After file is saved with actual data, you have to upload it in software.

12. Click on **Select Files To Upload** icon, select the saved template.
13. Once you select the template, **File Name** will be displayed along with **File Size**.
14. Click on **Import** IMPORT button to upload the profile into the software.

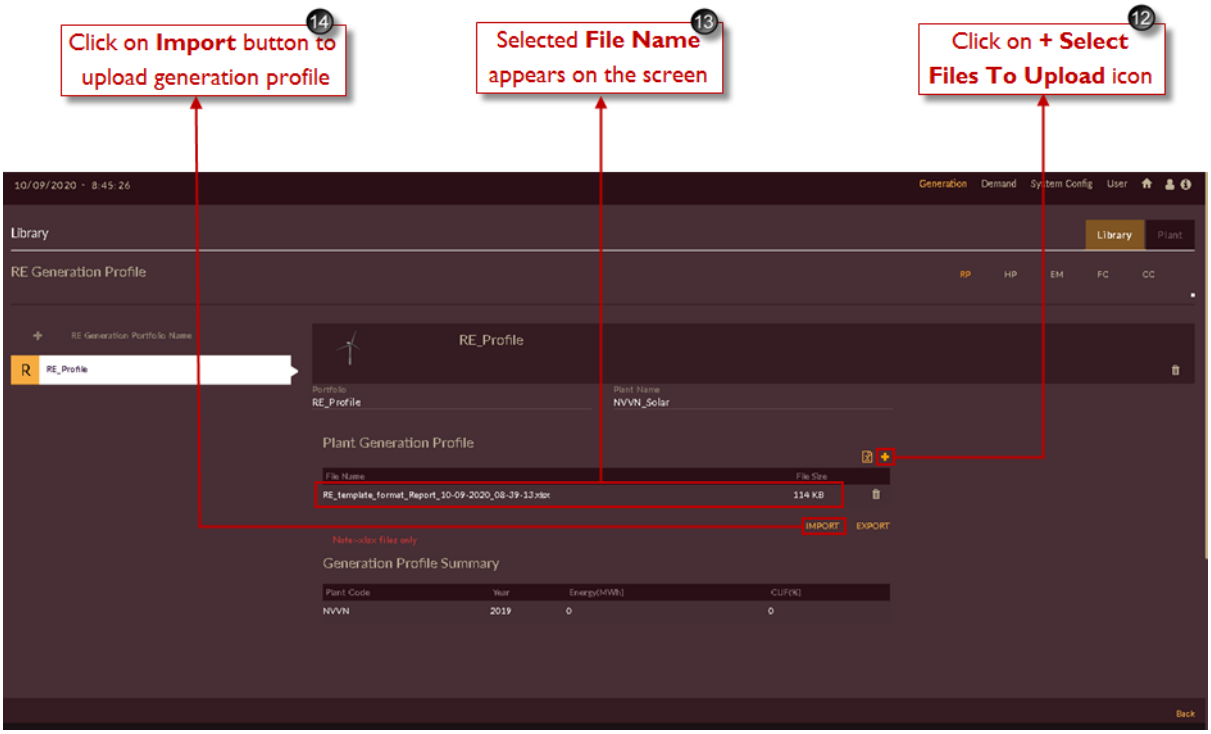


Figure 181. Steps to import RE Generation Profile

15. Once file is imported successfully, **Generation Profile Summary – Annual Energy (MU)** will display on the page.
16. Click on **Export** EXPORT button to download and view the uploaded or existing genertaion profile for selected plant.

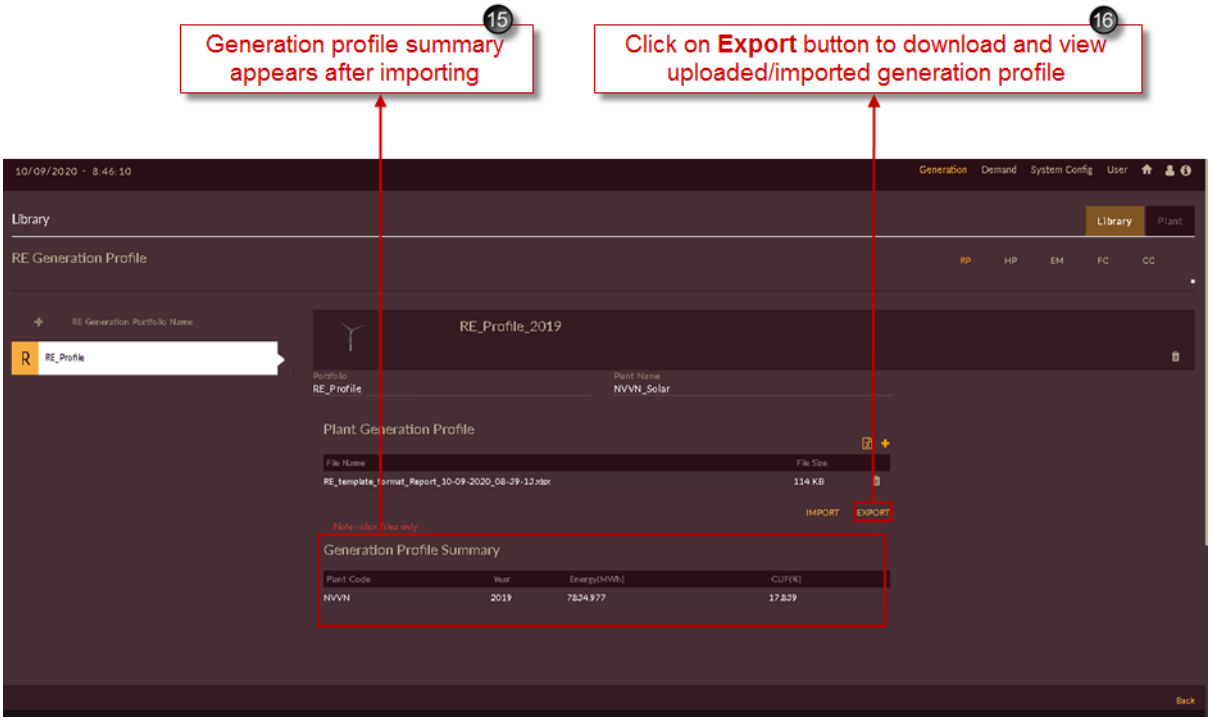


Figure 182. Imported RE Generation Profile

Once you click on **Export** EXPORT button the imported RE generation profile will get downloaded in .xlsx format and will appear as shown in Figure 183.

C1 NVVN_Solar (MWh)

	A	B	C
1	**Date**	**TimeBlock**	**NVVN_Solar (MWh)**
2	01-04-2019	1	0.0
3	01-04-2019	2	0.0
4	01-04-2019	3	0.0
5	01-04-2019	4	0.0
6	01-04-2019	5	0.0
7	01-04-2019	6	0.0
8	01-04-2019	7	0.055
9	01-04-2019	8	0.453
10	01-04-2019	9	1.35
11	01-04-2019	10	2.357
12	01-04-2019	11	3.3
13	01-04-2019	12	4.062
14	01-04-2019	13	4.33
15	01-04-2019	14	4.328
16	01-04-2019	15	4.105
17	01-04-2019	16	3.553
18	01-04-2019	17	2.52
19	01-04-2019	18	1.177
20	01-04-2019	19	0.297
21	01-04-2019	20	0.02
22	01-04-2019	21	0.0
23	01-04-2019	22	0.0
24	01-04-2019	23	0.0
25	01-04-2019	24	0.0

Figure 183. Exported RE Generation Profile

17. Once profile is imported succesfully, **Pending** Pending indication will get changed to **Uploaded** Uploaded indication as shown in Figure 184.

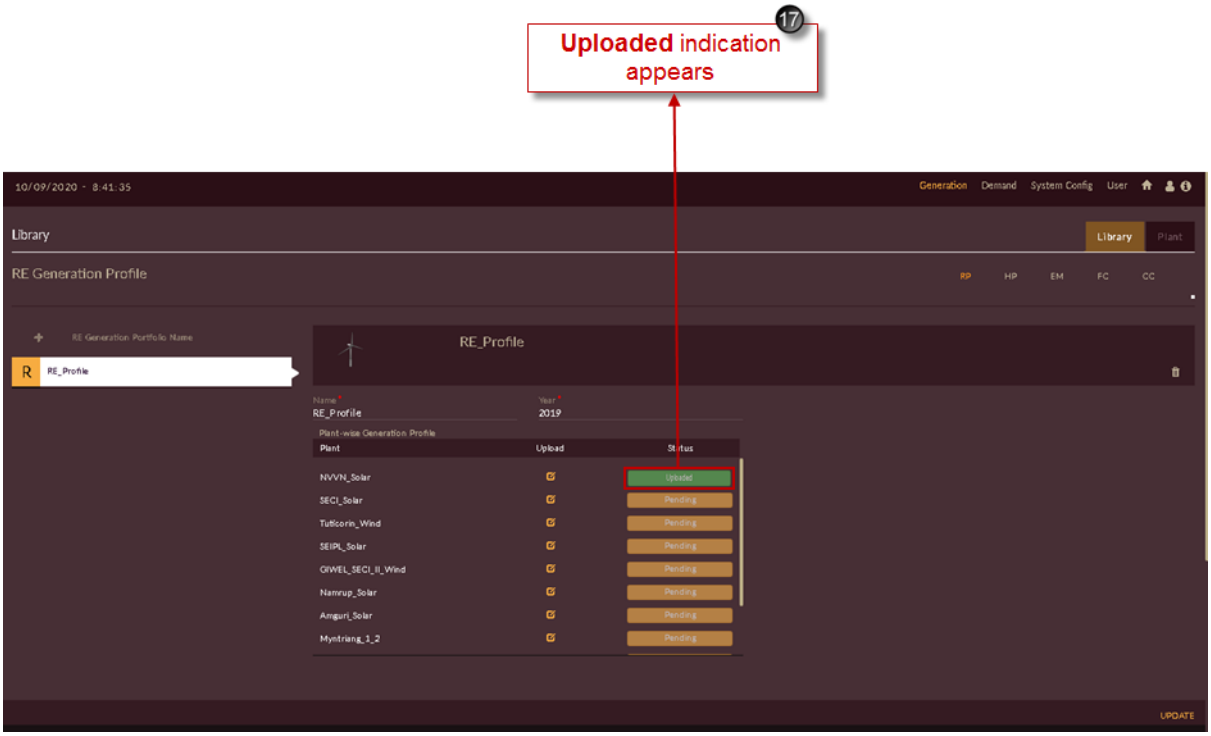


Figure 184. Uploaded Profile Indication

Repeat above steps to add RE generation profile for remaining RE plants.

Once RE generation profiles are imported to all RE plants, page will appear as shown in Figure 185.

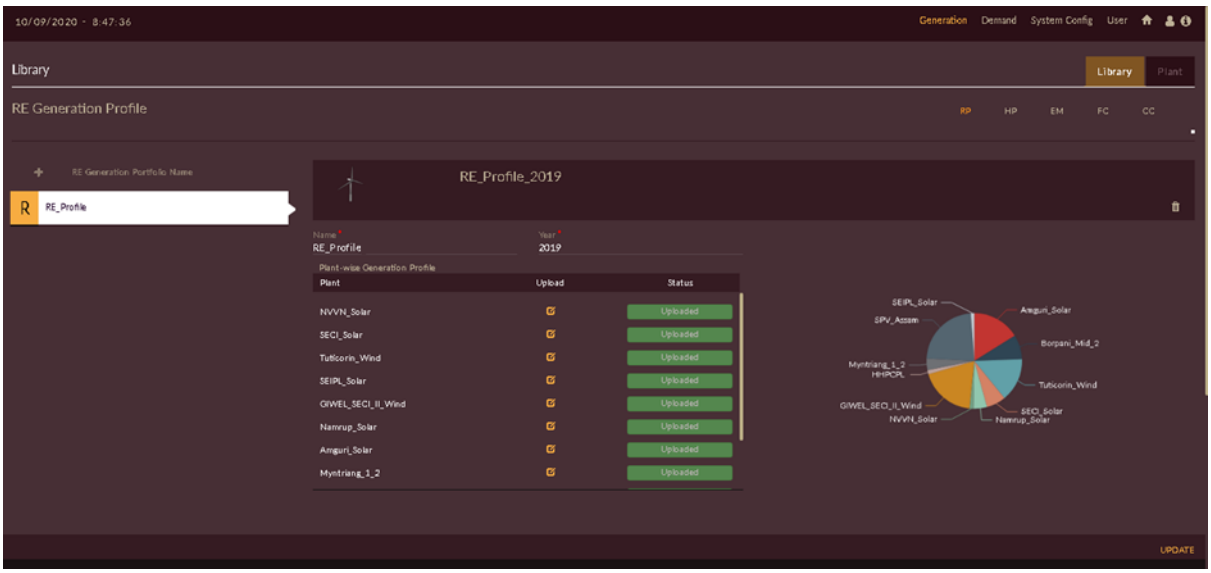


Figure 185. Successfully Created RE Generation Portfolio

2.2.3 Building Scenarios for Integrated Resource Mapping Studies

Once you feed all the inputs to the software now it's time to perform the **Integrated Resource Mapping Studies.**

For performing studies of integrated resource mapping in DISCOM – REPOSE software you have to create study scenarios.

For performing IRM - Integrated Resource Mapping or Generation planning studies you have to give demand data as input.

Since we have created **Business As usual (BAU)** scenario for Demand forecast studies we have demand data as output from that BAU scenario we can use as input for IRM studies.

2.2.3.1 CREATE IRM SCENARIO

This section gives you the steps to access and create IRM scenario.

Follow these steps to add a scenario.

1. Login to the software. The **Dashboard/ Home** page appears.

   Alternatively, click on **Home** icon to access the execution page. The page will appear as shown in Figure 186.

(The scenarios which we created i.e. **Business As usual (BAU)** and **Scenario with Drivers** in **BUILDING SCENARIOS FOR DEMAND FORECAST STUDIES** section appears in the scenario list).

2. Click on **settings** option provided on IRM block 

to add the scenario creation page.

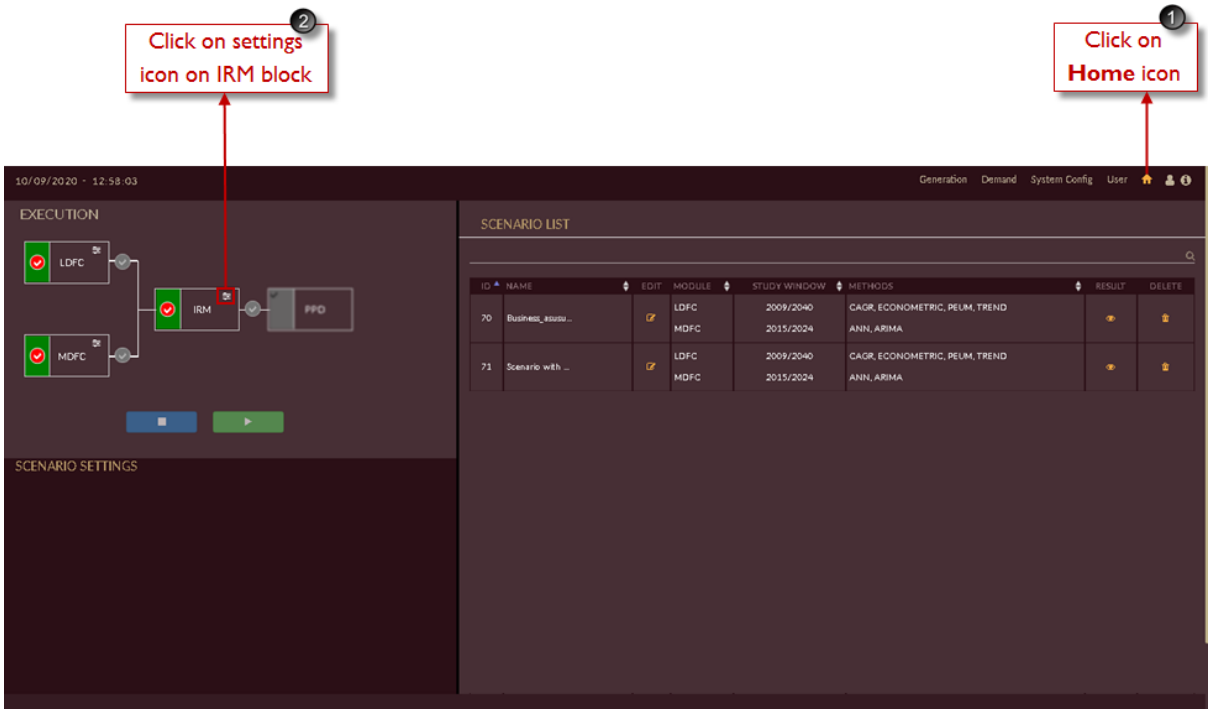


Figure 186. DISCOM – REPOSE Home Page

Once you click settings icon blank record will appear on the page as shown in Figure 187.

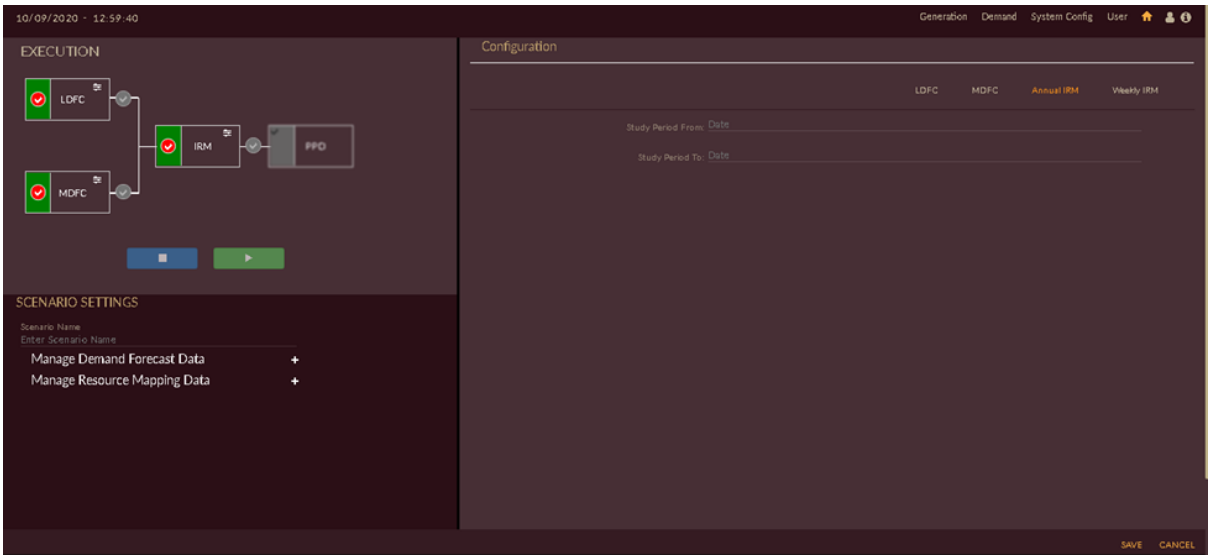


Figure 187. Blank Record to Create Scenario for IRM Studies

3. By default **Annual IRM** Annual IRM option will be selected.
4. Give appropriate scenario name in **Scenario Name** field, here we have named as '**IRM_Basecase**'.
5. Add study period for Annual IRM studies by choosing **Study Period From** and **Study Period TO** from the calender drop-down.

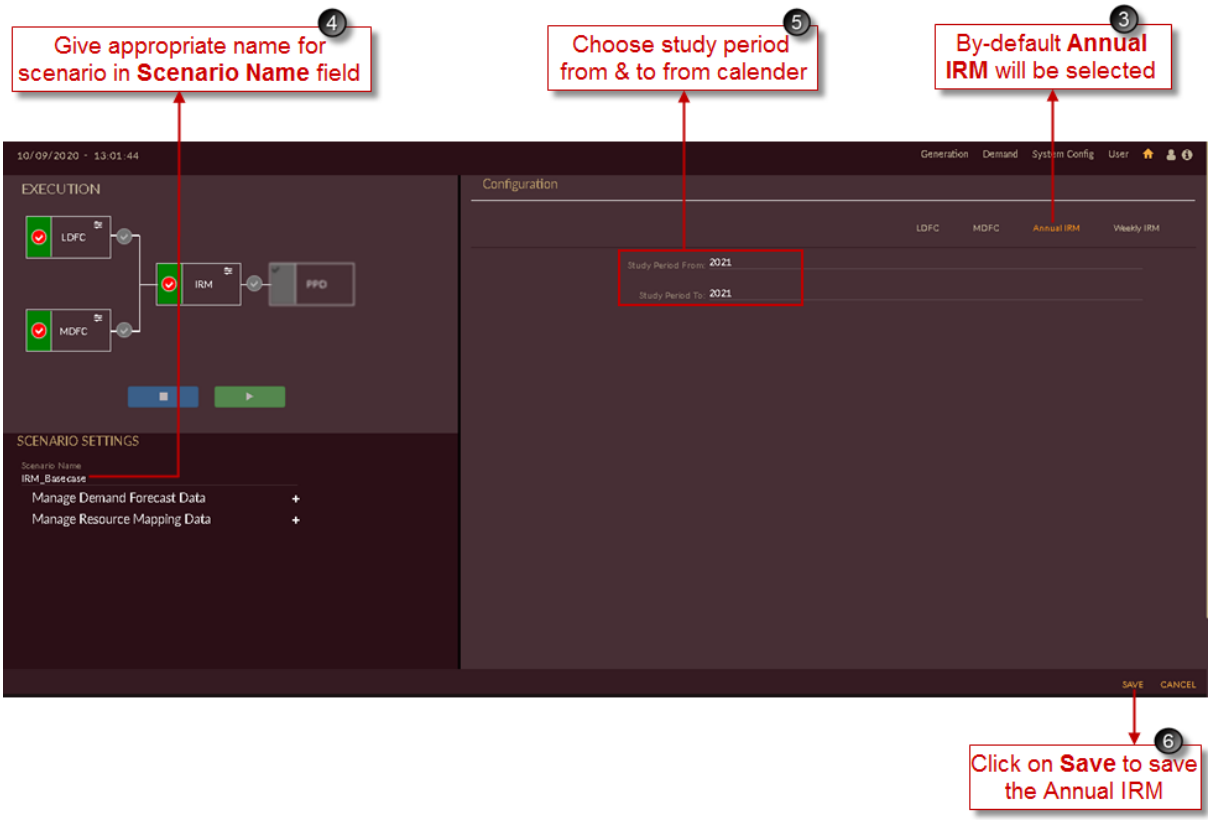
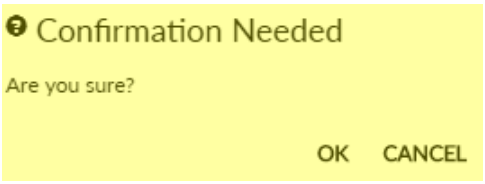


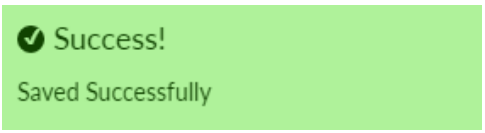
Figure 188. Creating Annual IRM Study Period

6. Click on the **SAVE** SAVE button to save the Annual IRM scenario settings.

   The **"Are you sure?"** confirmation message appears.



   Click on the **OK** icon to save the scenario.



   The "Saved Successfully" message appears.

7. Click on **Weekly IRM** Weekly IRM tab to add hourly study details.
   You will see the page as shown in Figure 189.
8. Select required week from the drop-down for which you need to carry out studies. You can select one or multiple weeks. If you set **Consider Peak Demand** toggle to Yes No Yes option software will choose the week which has peak demand in whole study year.

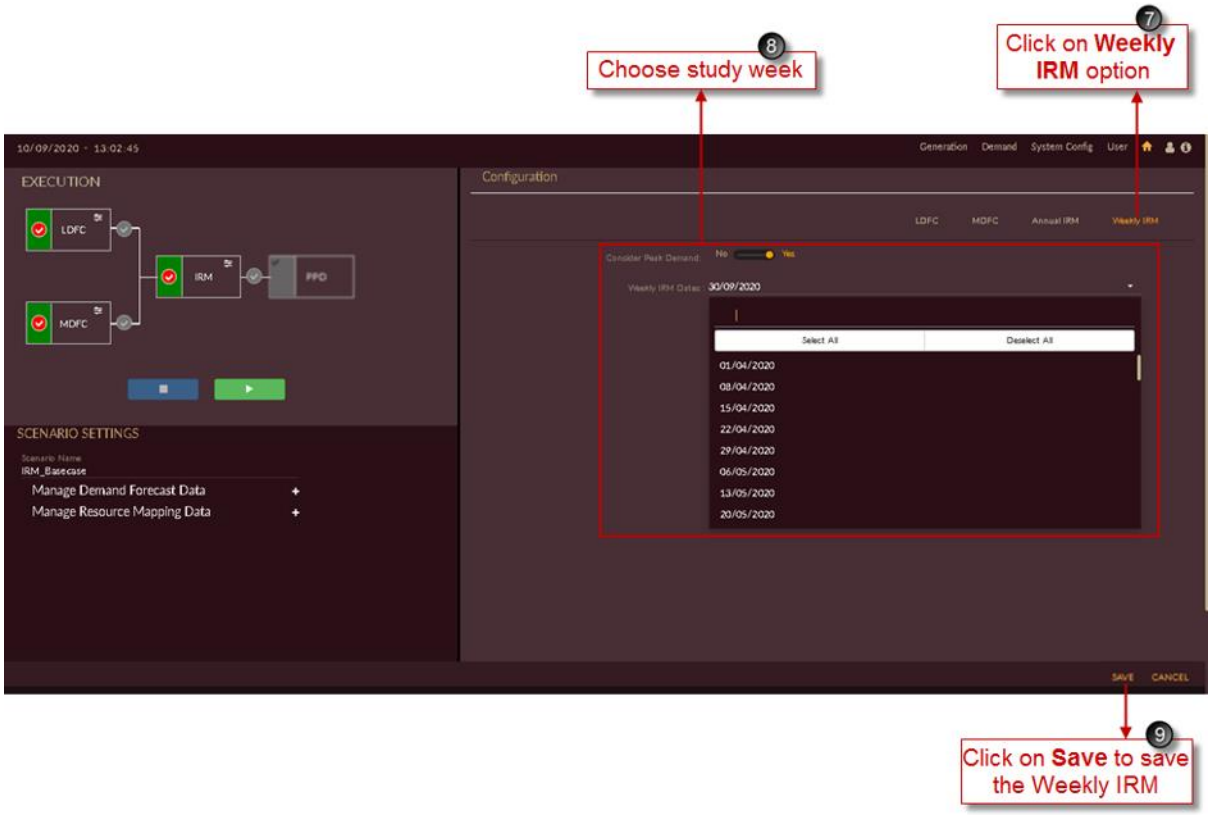
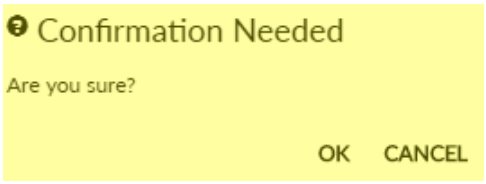


Figure 189. Creating Weekly IRM Study Period

9. Click on the **SAVE** SAVE button to save the Weekly IRM scenario settings.

The **"Are you sure?"** confirmation message appears.



Click on the **OK** icon to save the scenario.

The "Saved Successfully" message appears.

10. The scenario appears in the scenario list as shown in Figure 190.

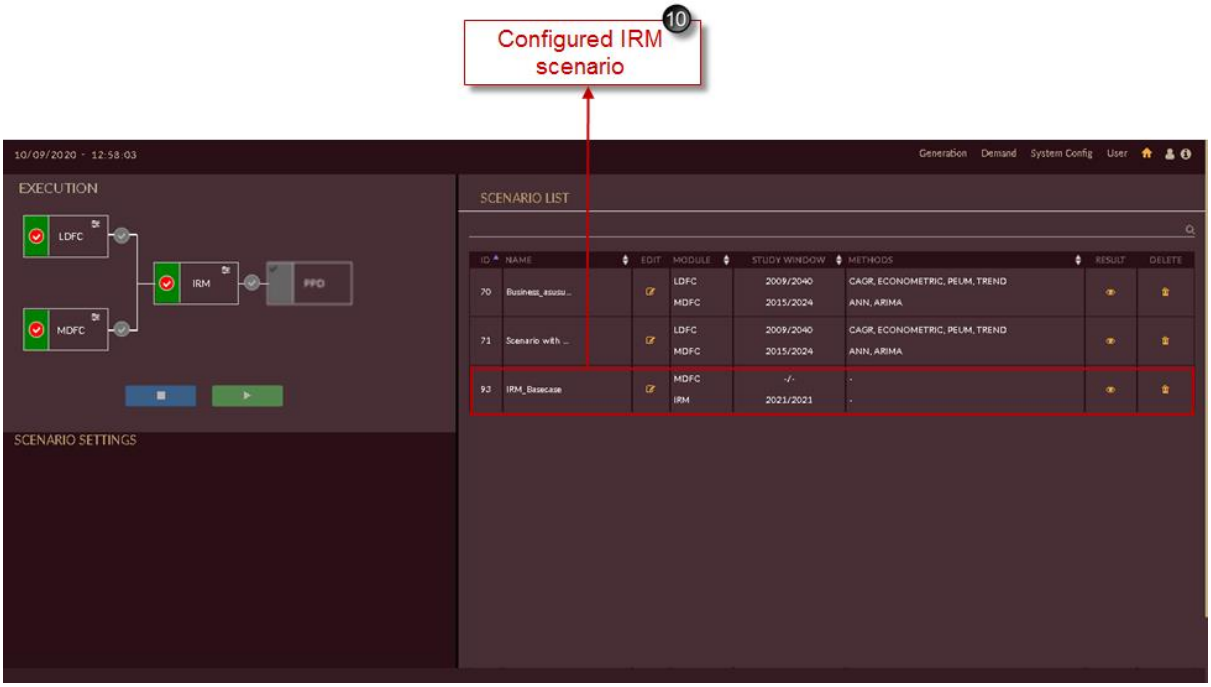


Figure 190. IRM Scenario in Scenario List Page

The scenario page and the scenario will be having following features;

-  icon to sort the records.
- **View Result**  icon to view the results.
- **Edit Scenario**  icon to edit the scenario.
- **Delete**  icon to remove the scenario from the list.

2.2.3.2 EDIT IRM SCENARIO

Once scenario is created and it appears on the page it will not be having any data, you have to configure all the data which you have given as input.

This section gives explains how to edit the scenario.

We have to edit or configure four different data for the scenario, they are;

- Demand Data
- Hydro Plant Data
- Thermal Plant Data
- RE Plant Data

Follow these steps to edit a scenario.

STEPS TO EDIT/CONFIGURE DEMAND DATA INTO IRM_BASECASE:

1. In the scenario list shown in Figure 191 click on the **Edit scenario** icon for IRM_Basecase scenario.

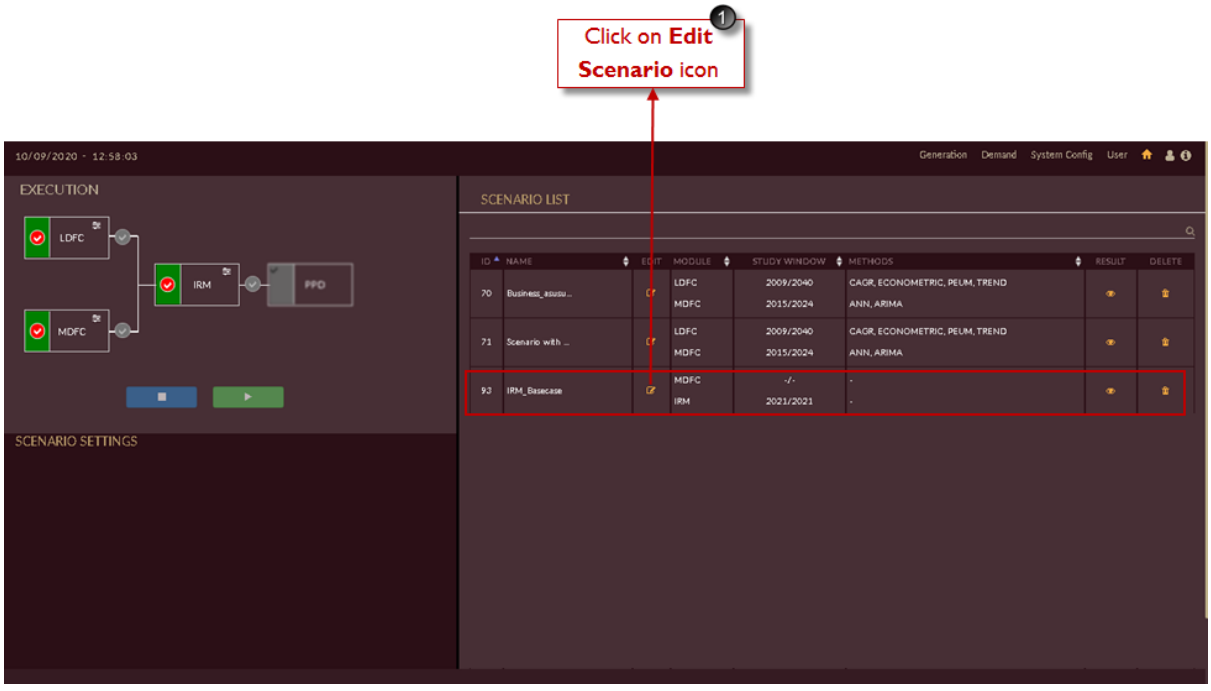


Figure 191. Editing IRM Scenario

Once Scenario is created you need add the required data for studies from raw data section by selecting required data's from **Manage Resource Mapping Data** drop-down list.

Once you click **Edit scenario** icon page will appear as shown in Figure 192.

2. Click on **Manage Resource Mapping Data** icon in IRM Base case scenario.
3. Select **Demand Data** from drop-down list as shown in Figure 192.

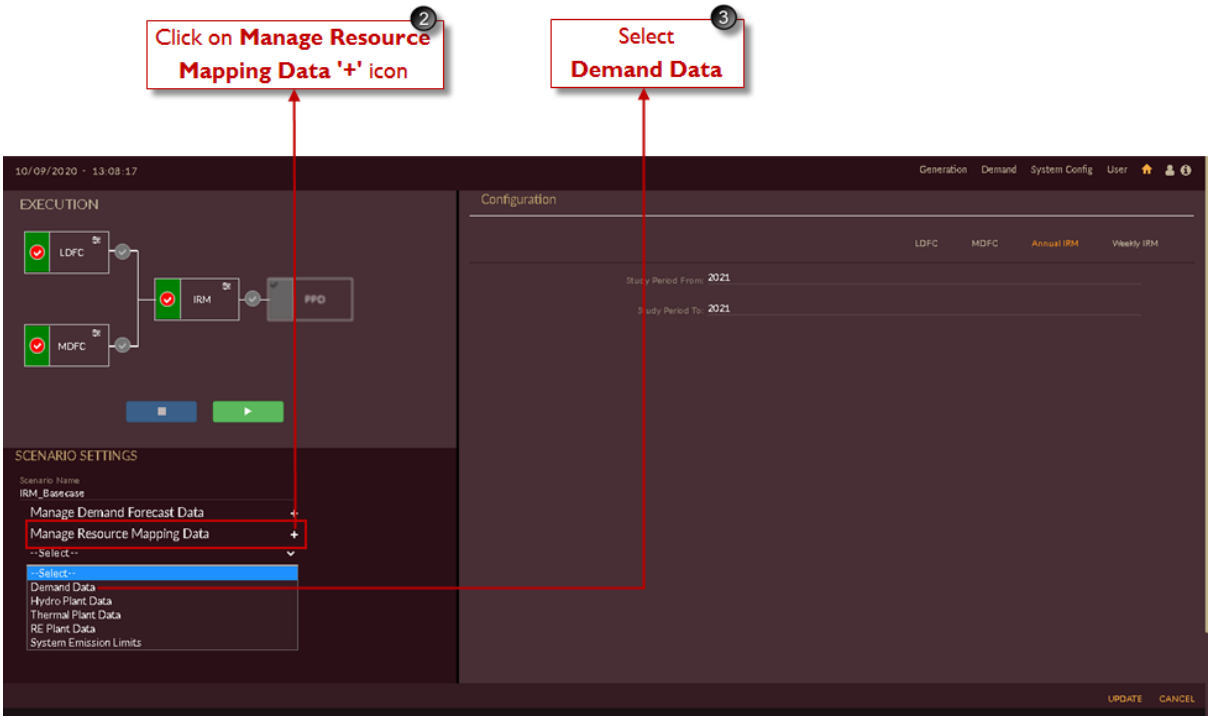


Figure 192. Manage Demand Data

Once you click on **Demand Data** link. The scenario specific **Demand Configuration** data page appears as shown in Figure 193.

In demand configuration you have to enter the following data;

- Demand data source.
  - Option 1: Consider demand forecasted in current scenario.
  - Option 2: Consider demand forecasted in pre-executed scenario.
  - Option 3: Import demand data.
- Uncertainty in %.
- Demand data scaling.
- Unmet requirements like penalty on unmet demand.
- System reserve requirements like penalty on unmet reserve.

4. If you have configured both DFC and IRM in same scenario, choose first option under **Demand Data Source.**

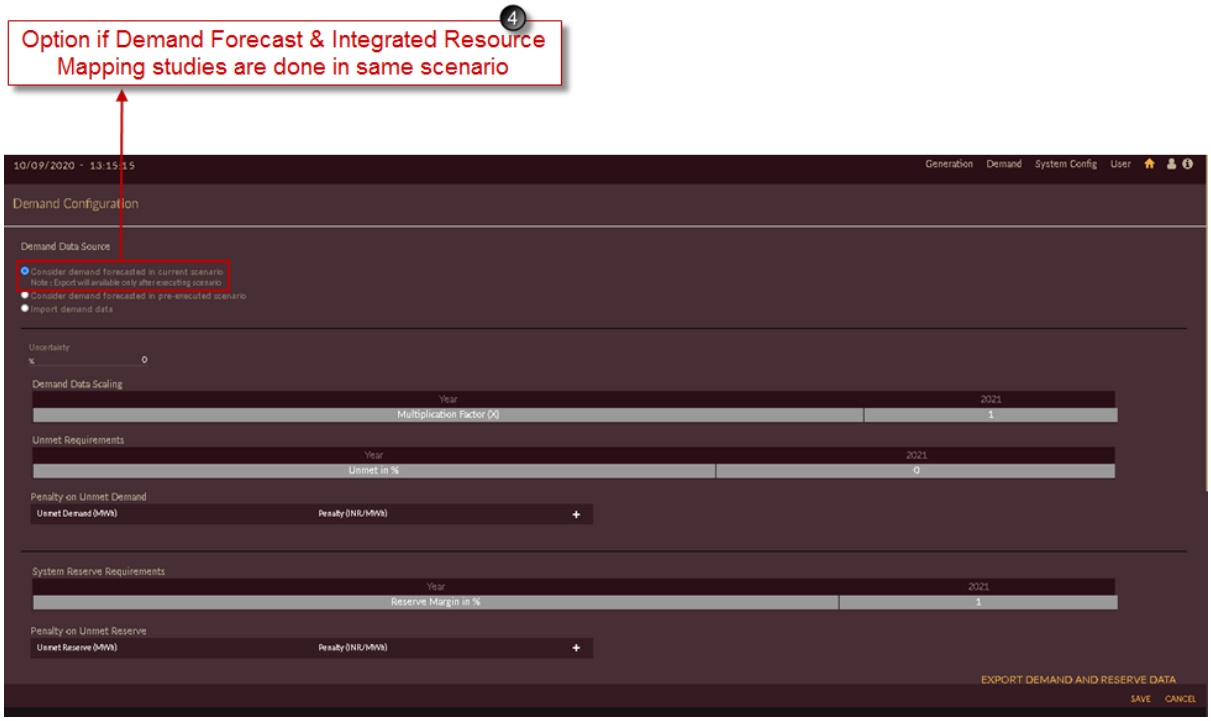
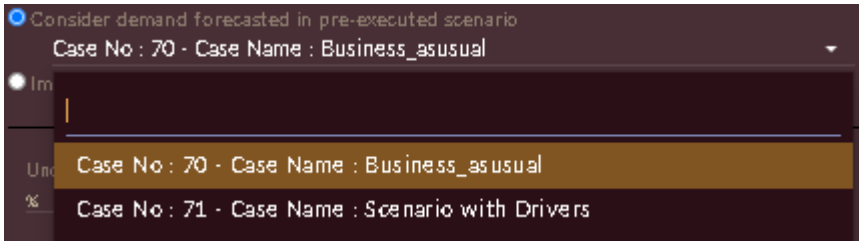


Figure 193. Blank Record for Demand Data

5. Since we have created separate scenarios for DFC and IRM we will choose second option under **Demand Data Source.**

   Drop-down appears for previously executed cases, you can choose from which case you need to consider the demand data.



   [Note: To get scenario list in drop-down you have to download **Load Profiles** for the selected year in DFC scenarios i.e. **Business As usual (BAU)** and **Scenario with Drivers.**

   See note given in **STEPS TO DOWNLOAD BAU-DFC** RESULTS: section under **DOWNLOAD/EXPORT/VIEW BAU SCENARIO RESULTS** section.]

6. Fill other demand details like Uncertainty, Unmet requirements, system reserve requirements, etc.

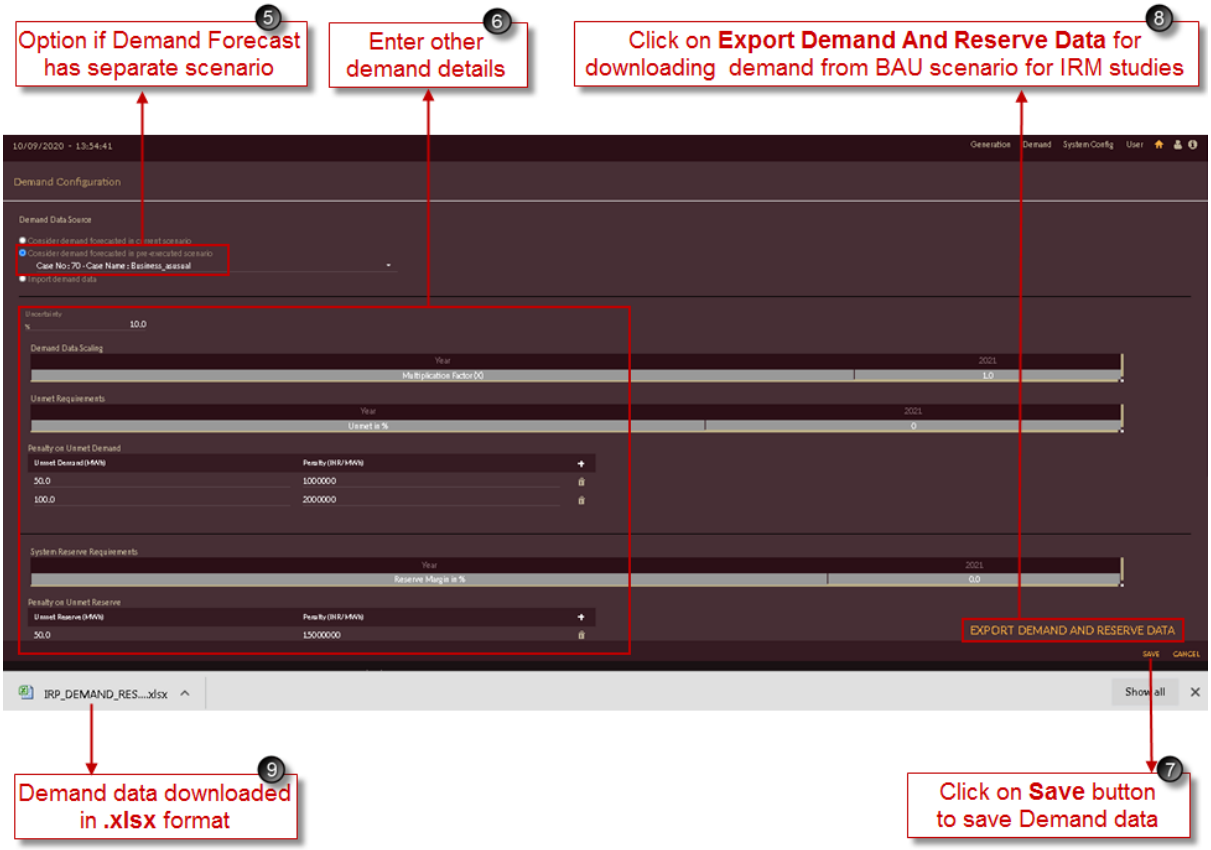
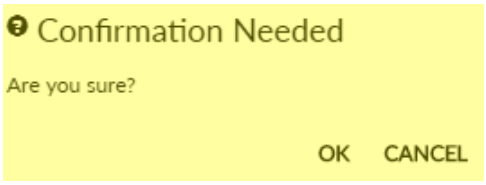


Figure 194. Configured Demand Data

7. Click on the **SAVE** SAVE icon to save the Demand data settings.

   The **"Are you sure?"** confirmation message appears.



   Click on the **OK** icon to save the scenario.

   The "Saved Successfully" message appears.

8. You can view your demand data just by clicking **Export Demand And Reserve Data** EXPORT DEMAND AND RESERVE DATA icon.

9. Demand data will be downloaded in **.xlsx** format and will appear in task bar of your browser.

   Figure 195 shows demand data exported from Business As Usual (BAU) scenario.

	A	B	C	D	E	F	G
1	Scenario	Case : 93 - Name : IRM_Basecase	From Year	2020	To Year	2021	
2							
3	Date	Time Block (Hours)	Demand (MW)	Scaling Factor	Scaled Demand (MW)	Reserve (%)	Reserve Requirement (MW)
4	01-04-2020	1	920.804	1	920.804	0	0
5	01-04-2020	2	903.78	1	903.78	0	0
6	01-04-2020	3	896.834	1	896.834	0	0
7	01-04-2020	4	925.597	1	925.597	0	0
8	01-04-2020	5	923.934	1	923.934	0	0
9	01-04-2020	6	907.746	1	907.746	0	0
10	01-04-2020	7	871.361	1	871.361	0	0
11	01-04-2020	8	906.238	1	906.238	0	0
12	01-04-2020	9	872.095	1	872.095	0	0
13	01-04-2020	10	878.355	1	878.355	0	0
14	01-04-2020	11	889.75	1	889.75	0	0
15	01-04-2020	12	879.088	1	879.088	0	0
16	01-04-2020	13	890.483	1	890.483	0	0
17	01-04-2020	14	912.578	1	912.578	0	0
18	01-04-2020	15	908.48	1	908.48	0	0
19	01-04-2020	16	879.822	1	879.822	0	0
20	01-04-2020	17	870.04	1	870.04	0	0
21	01-04-2020	18	1416.659	1	1416.659	0	0
22	01-04-2020	19	1460.117	1	1460.117	0	0
23	01-04-2020	20	1446.342	1	1446.342	0	0
24	01-04-2020	21	1285.849	1	1285.849	0	0
25	01-04-2020	22	1129.561	1	1129.561	0	0
26	01-04-2020	23	872.045	1	872.045	0	0

Figure 195. Exported Demand and Reserve Data

10. In case you don't have any DFC scenario and you only have raw demand data you can import it mannually by choosing third option i.e. **Import demand data** under Demand Data Source.

11. Click on **Download Template** icon.

12. Template gets downloaded in **.xlsx** format amnd appears in taskbar of your browser.

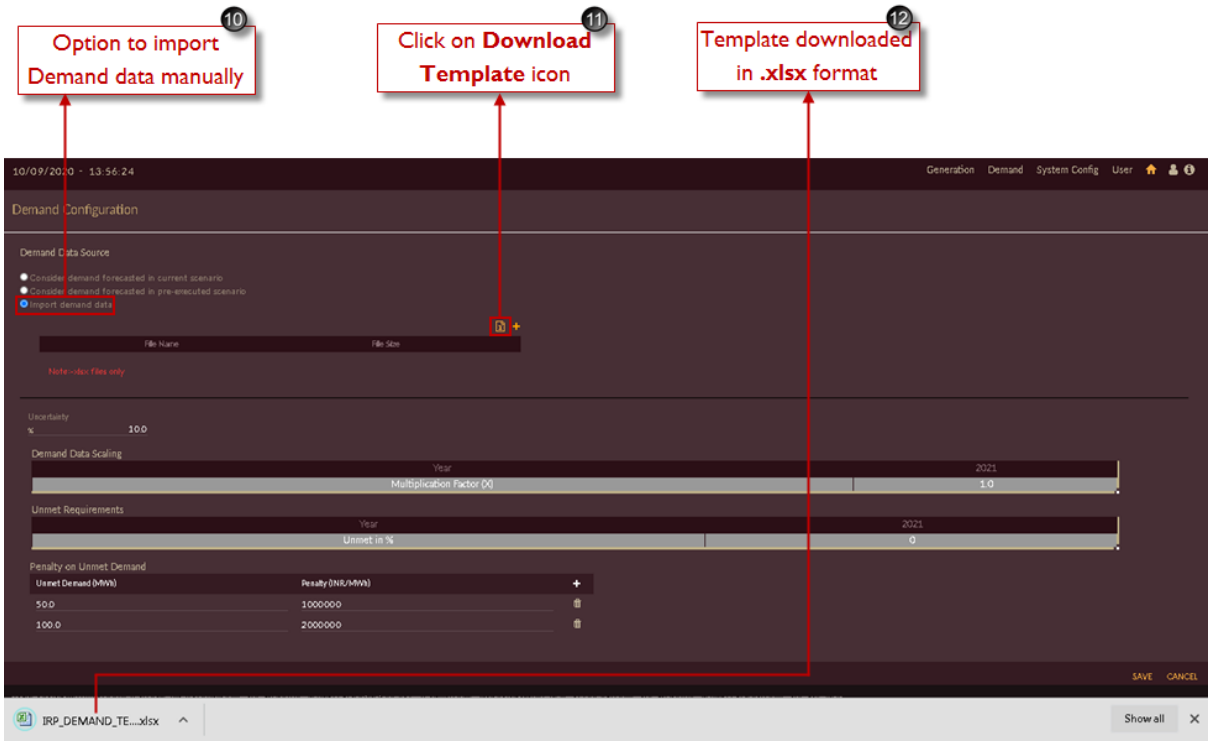


Figure 196. Downloading Demand Data Template

Template for importing demand data will be downloaded for hourly (in time block) in **.xlsx** format for selected study period with scenario name as shown in Figure 197.

Upload the demand data available for scenario and save the file in **.xlsx** format only.

	A	B	C	D	E	F
1	**Scenario**	Case : 93 - Name : IRM_Basecase	**From Year**	2020	**To Year**	2021
2						
3	**Date**	**Time Block (Hours)**	**Demand (MW)**			
4	01-04-2020	1				
5	01-04-2020	2				
6	01-04-2020	3				
7	01-04-2020	4				
8	01-04-2020	5				
9	01-04-2020	6				
10	01-04-2020	7				
11	01-04-2020	8				
12	01-04-2020	9				
13	01-04-2020	10				
14	01-04-2020	11				
15	01-04-2020	12				
16	01-04-2020	13				
17	01-04-2020	14				
18	01-04-2020	15				
19	01-04-2020	16				

Figure 197. Downloaded Demand Data Template

After file is saved with actual data, you have to import it into the software.

13. Click on **Select Files To Upload** icon, select the saved template.
14. Once you select the template, **File Name** will be displayed along with **File Size**.
15. Click on **Import** IMPORT button to upload the demand data into the software.

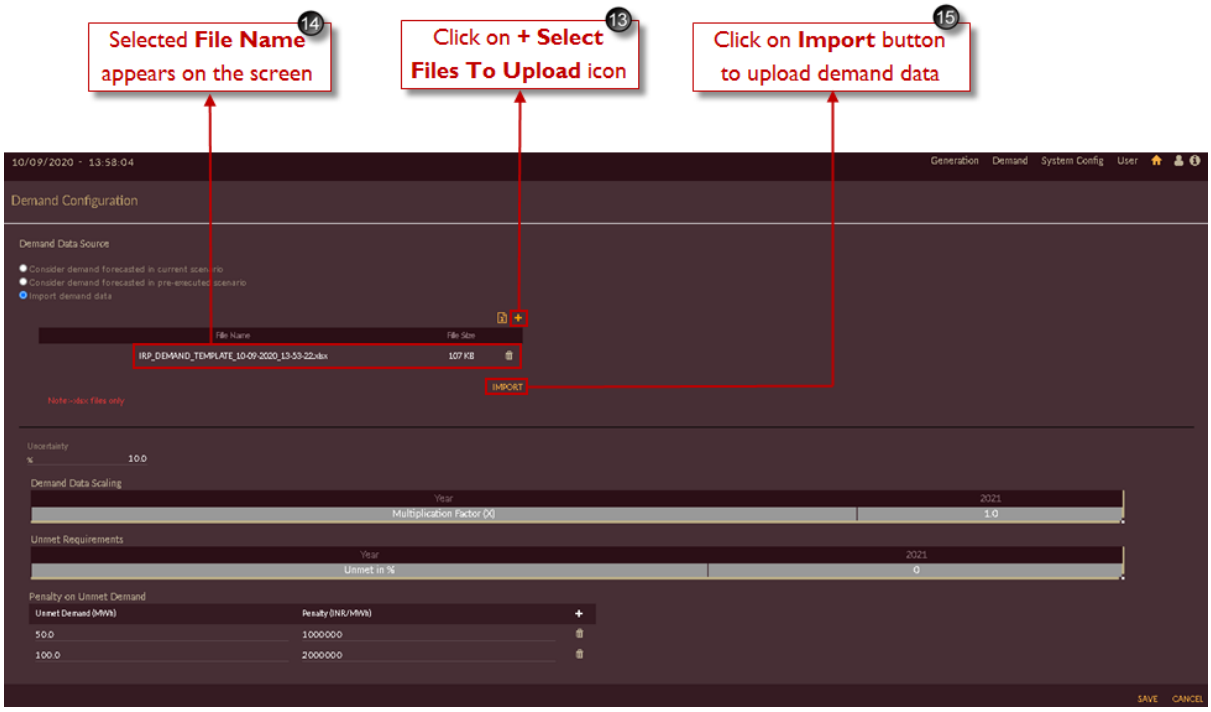
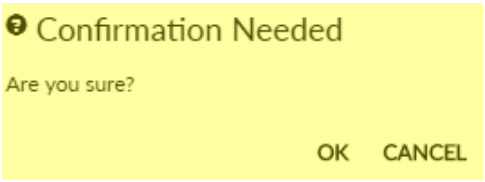


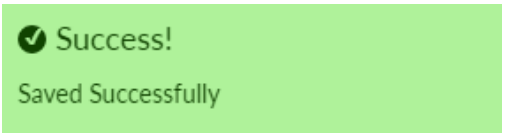
Figure 198. Imported Demand Data

Click on the SAVE  button to save the Demand data settings.

The **"Are you sure?"** confirmation message appears.



Click on the **OK** icon to save the scenario.



The "Saved Successfully" message appears.

STEPS TO EDIT/CONFIGURE HYDRO PLANT DATA INTO IRM_BASECASE:

1. Click on **Manage Demand Forecast Data** icon in IRM Base case scenario.
2. Select **Hydro Plant Data** from the drop-down list as shown in Figure 198.

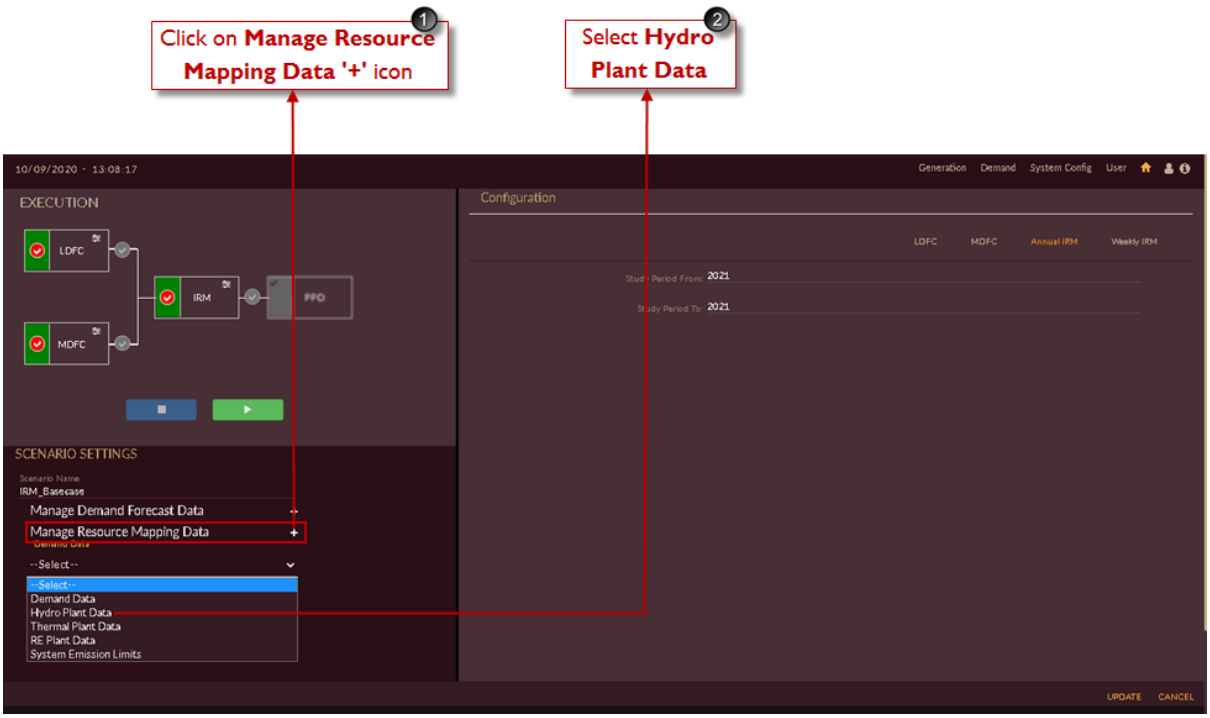


Figure 199. Manage Hydro Plant Data

Once you click **Hydro Plant Data**, you are navigated to the **Hydro Plant Configuration** page of **IRM Basecase** senario as shown in Figure 200.

3. Click on **Upload Generation Portfolio** icon to configure hydro generation profiles.

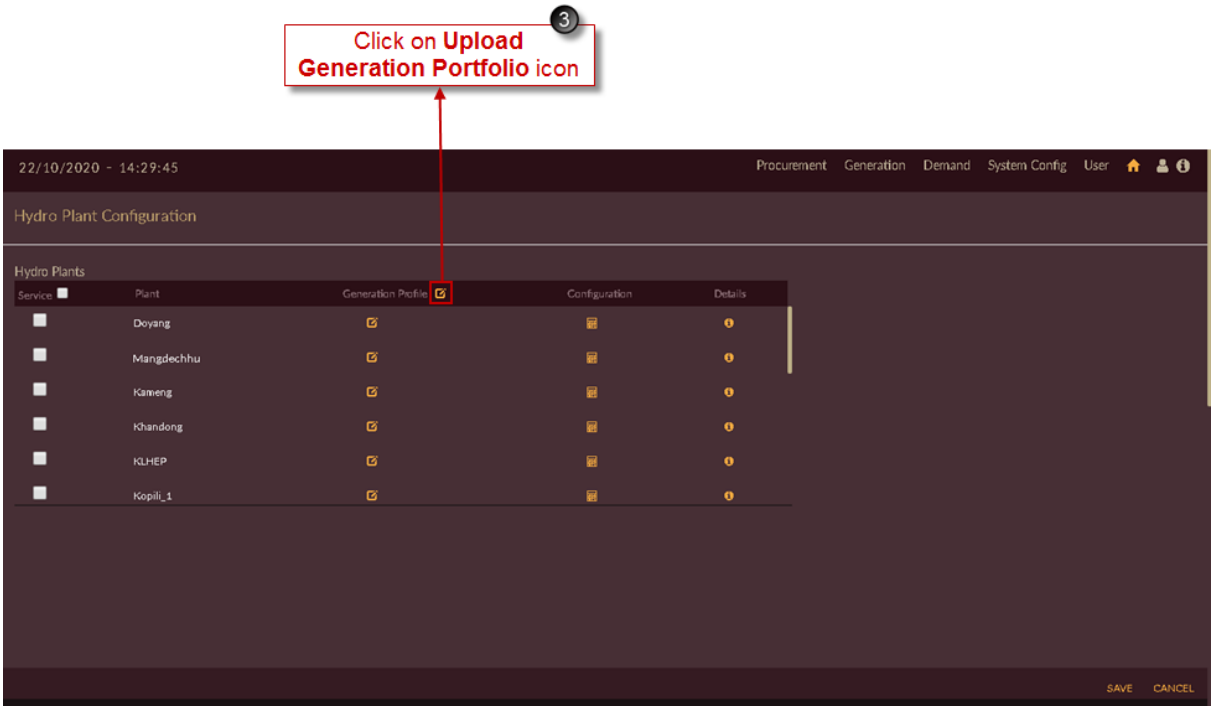


Figure 200. Uploading Hydro Generation Portfolio to Hydro Plants

Once you click on **Upload Generation Portfolio** software will appear as shown in Figure 201.

4. You have to select **Hydro Generation Portfolio** from drop-down list. The hydro generation portfolio configured in HYDRO GENERATION PORTFOLIO section will appear in drop-down list.

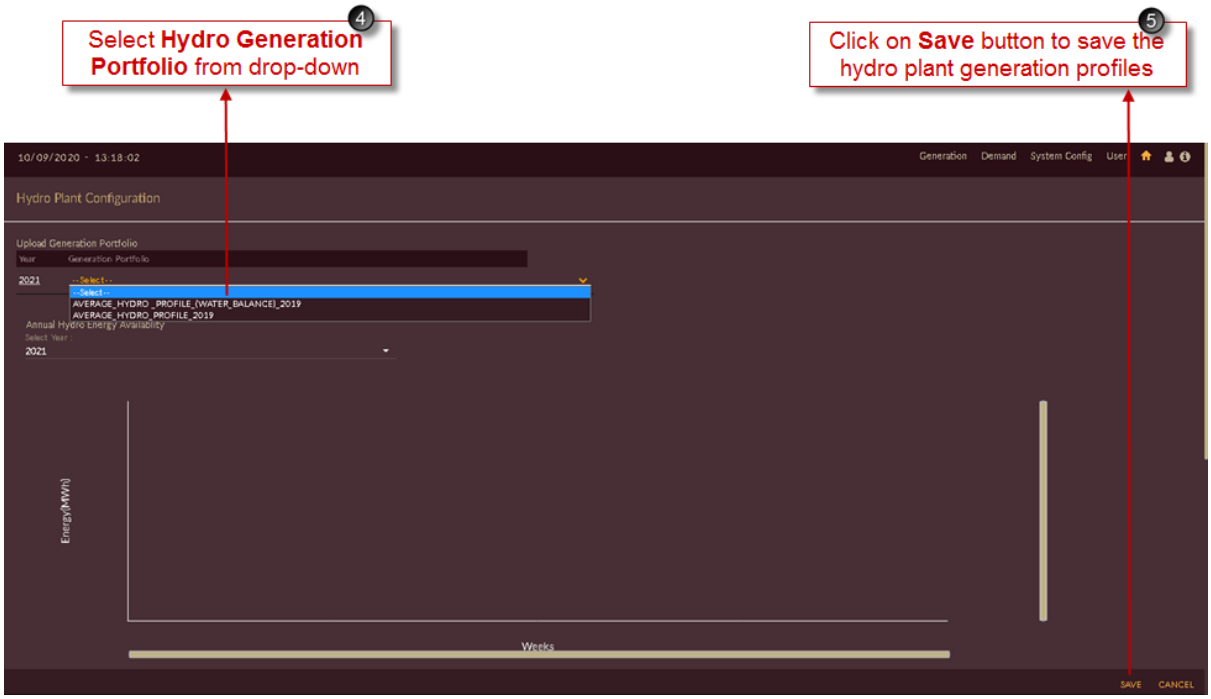
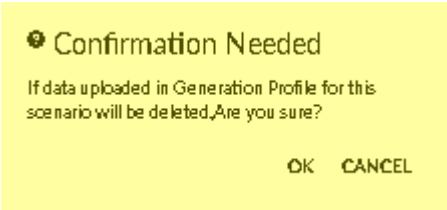


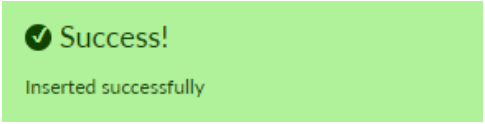
Figure 201. Selecting Hydro Generation Portfolio

5. Click on the **SAVE** SAVE button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.



Once hydro generation portfolio is successfully inserted into the IRM Base case graph will get updated as shown in Figure 202.

Figure 202. Successfully Configured Hydro Generation Portfolio

Once hydro generation portfolio is successfully inserted into the IRM Base case, we have to check whether generation profile is updated into each hydro plant. For doing so;

6. Click on **Edit** icon of respective plant for which you want to see or edit the data. Here **KLHEP Hydro** plant is selected in Figure 203.

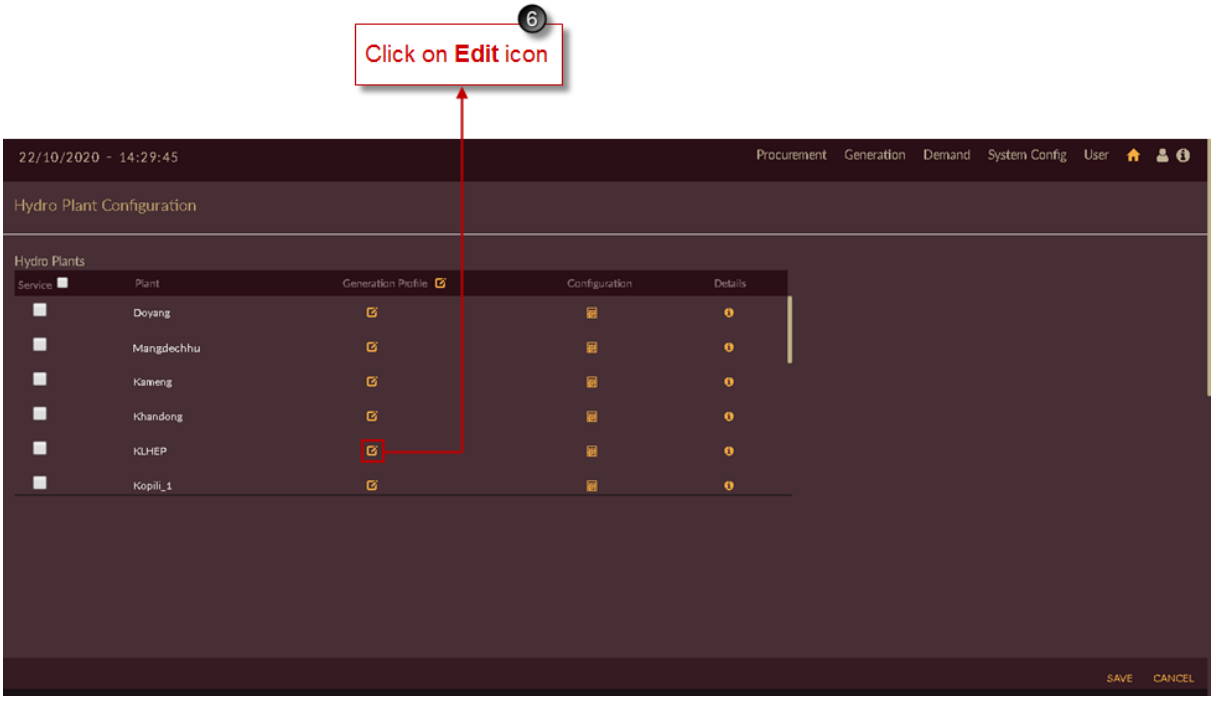


Figure 203. Edit/View Configured Hydro Generation Portfolio for Plant

Once you click on **Edit** icon of respective plant, page will appear as shown in Figure 204.

7. Table is displayed containing hydro generation profile imported for respective unit. Here KLHEP1 unit is shown.
8. Weekly graphs of respective units will be displayed below table according to generation profile. You can also edit the generation profile data by just double clicking the row and click on **Refresh** icon to update the graph.

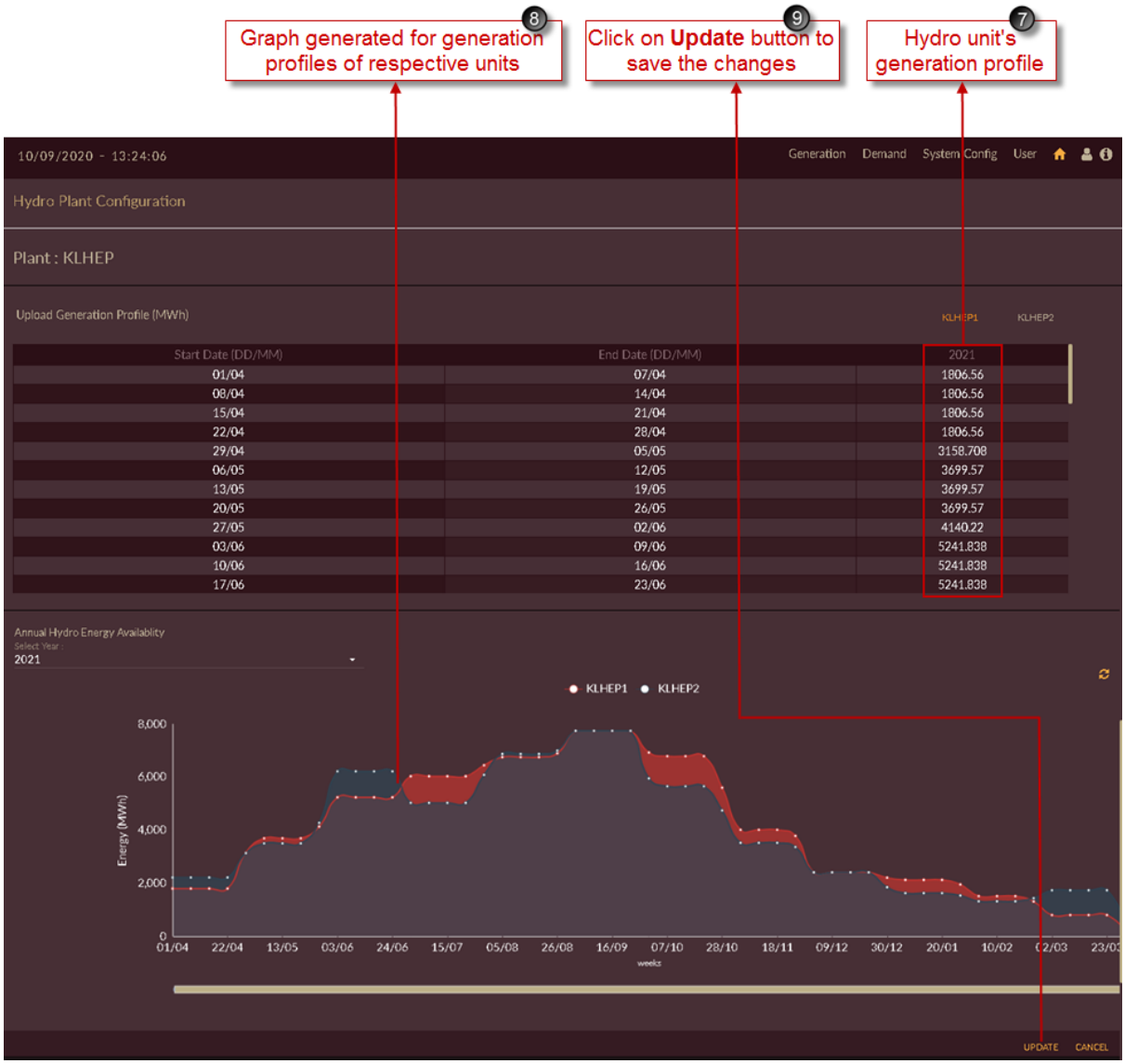
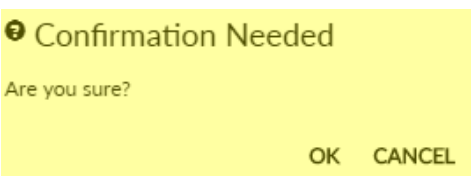


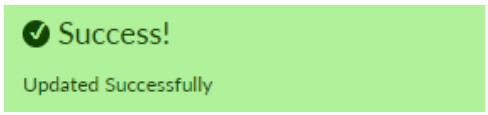
Figure 204. Updated Hydro Generation Profile of Hydro Plant

9. Click on **UPDATE** UPDATE button to save the changes.

The "Are you sure?" confirmation message appears.



Click on **OK** to accept the changes made. The "Updated successfully" message appears.



Once hydro generation portfolio is updated successfully we have to configure each hydro plant into the IRM Base case scenario.

10. Click on **Configuration** icon of respective hydro plant to configure it into IRM Basecase scenario. Here KLHEP Hydro plant is selected in Figure 205.

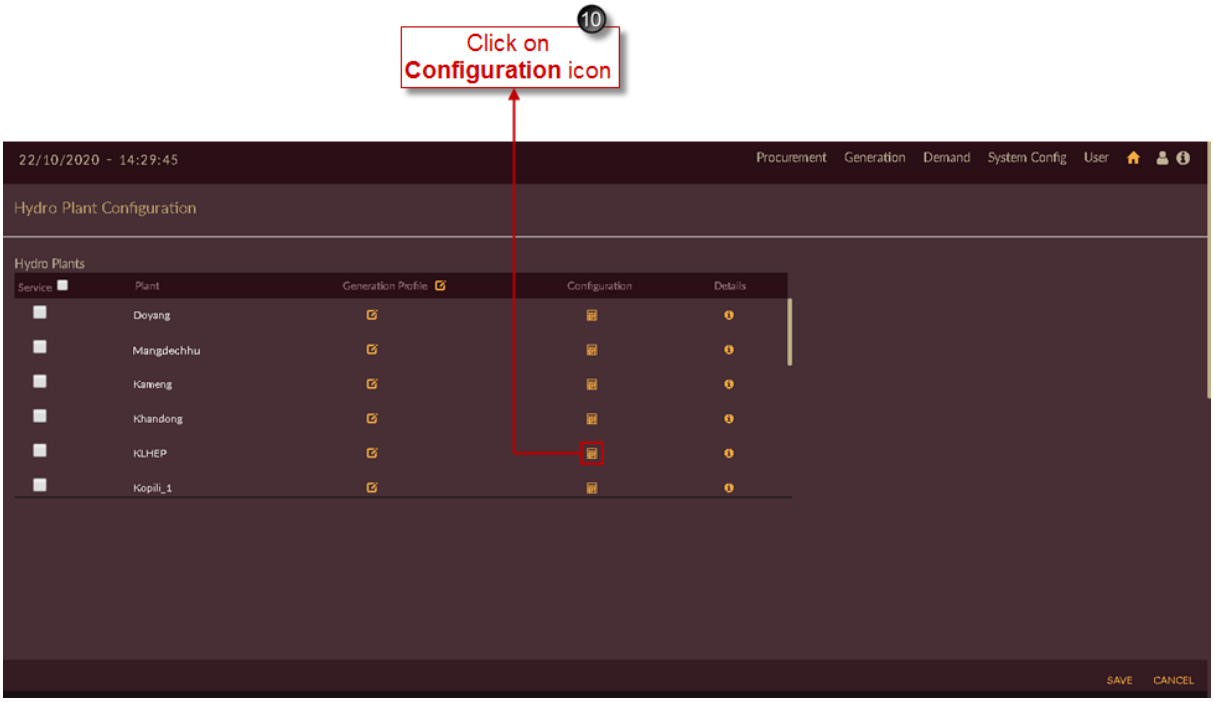


Figure 205. Configuring Hydro Plants for IRM scenario

Once you click on **Configuration** icon of respective plant, unit information of selected plant page will appear as shown in Figure 206.

11. You can edit the unit information here if required, the fields like;
    - Minimum and Maximum generation of unit in MW.
    - Ramp up and Ramp down rate in MW/min.
    - Annual Unavailability (Forced outage rate) in percentage (%).
    - You can change generation cost library.
    - Percentage (%) reserve allocation.
12. You can make hydro units Out of service or In- service for scenario specific by setting **Out Of Service/In Service** 

toggle icon and can set **Maintenance Schedule** for selected unit if required.

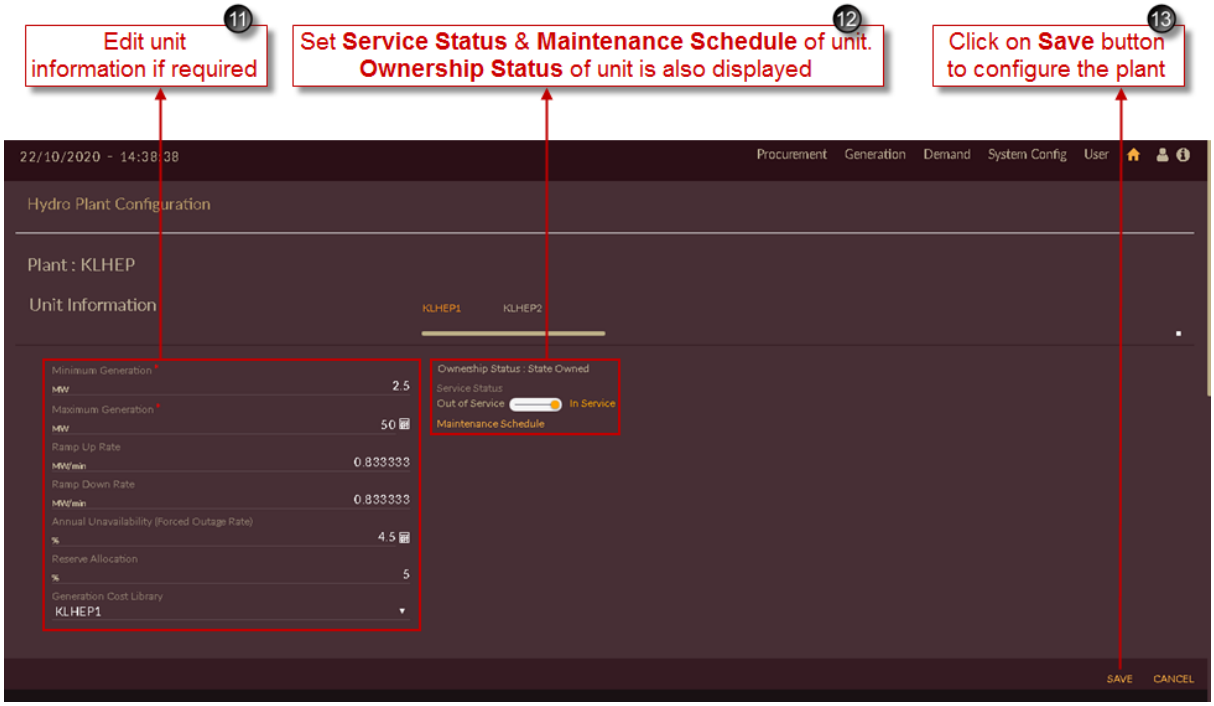
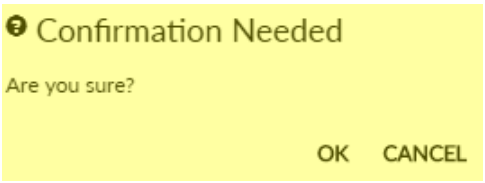


Figure 206. Saving Configured Hydro Plant

13. Click on the **SAVE** 

button to save and configure Hydro plant data settings.

    The **"Are you sure?"** confirmation message appears.



    Click on the **OK** icon to save the scenario. The "Saved Successfully" message appears.

14. Figure 207 shows configured hydro plant into the IRM Base case scenario. Blue tick indication appears for the plant which is configured or partcipating into the scenario for IRM studies.

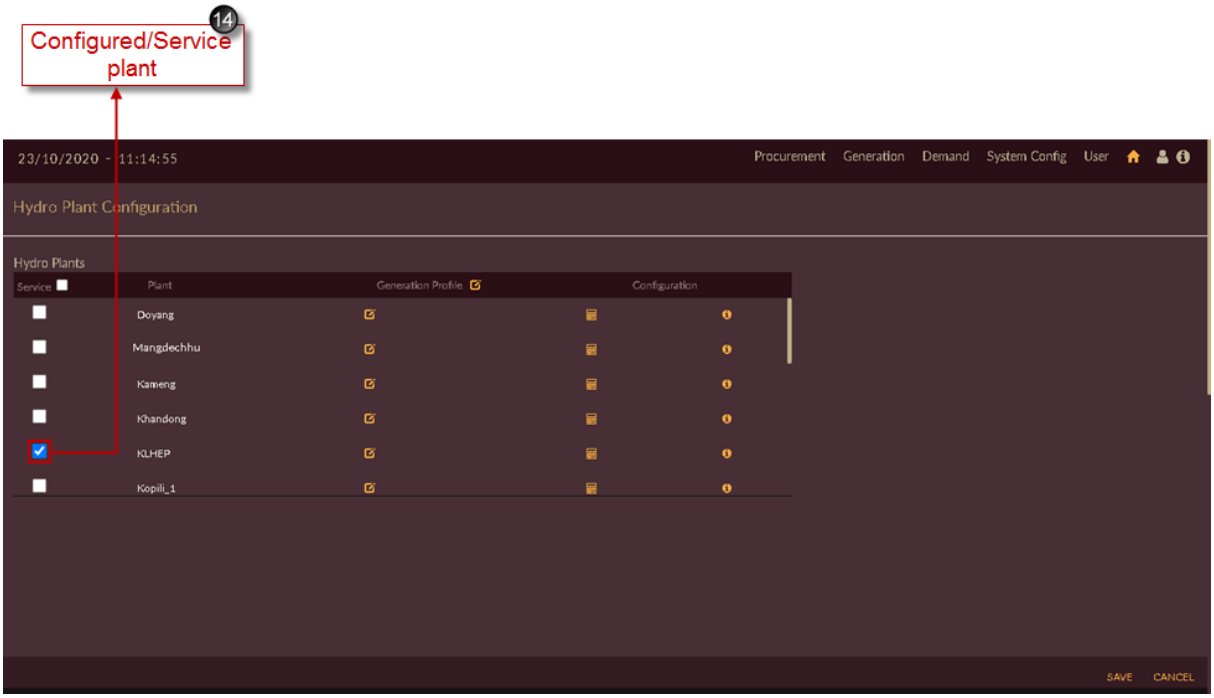
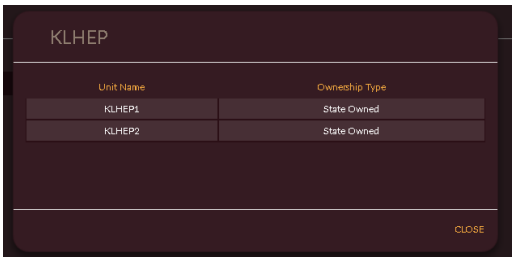


Figure 207. Successfully Configured Hydro Plant

Repeat above steps for configuring other hydro plants into the IRM Base case scenario for IRM studies.

You can see the ownership status of each unit by clicking on **Details** icon.



Once all the Hydro plants are configured into the IRM Base case scenario the final Hydro Plant Configuration page will appear as shown in Figure 208.

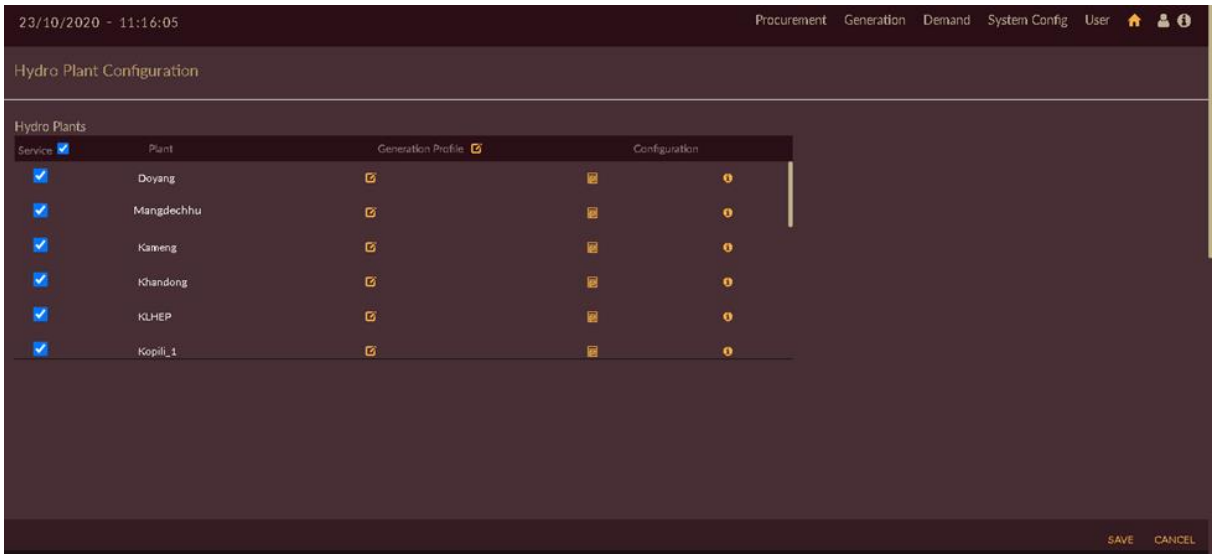


Figure 208. List of Successfully Configured Hydro Plants

STEPS TO EDIT/CONFIGURE THERMAL PLANT DATA INTO IRM_BASECASE:

1. Click on **Manage Demand Forecast Data** icon in IRM Base case scenario.
2. Select **Thermal Plant Data** from the drop-down list as shown in Figure 209.

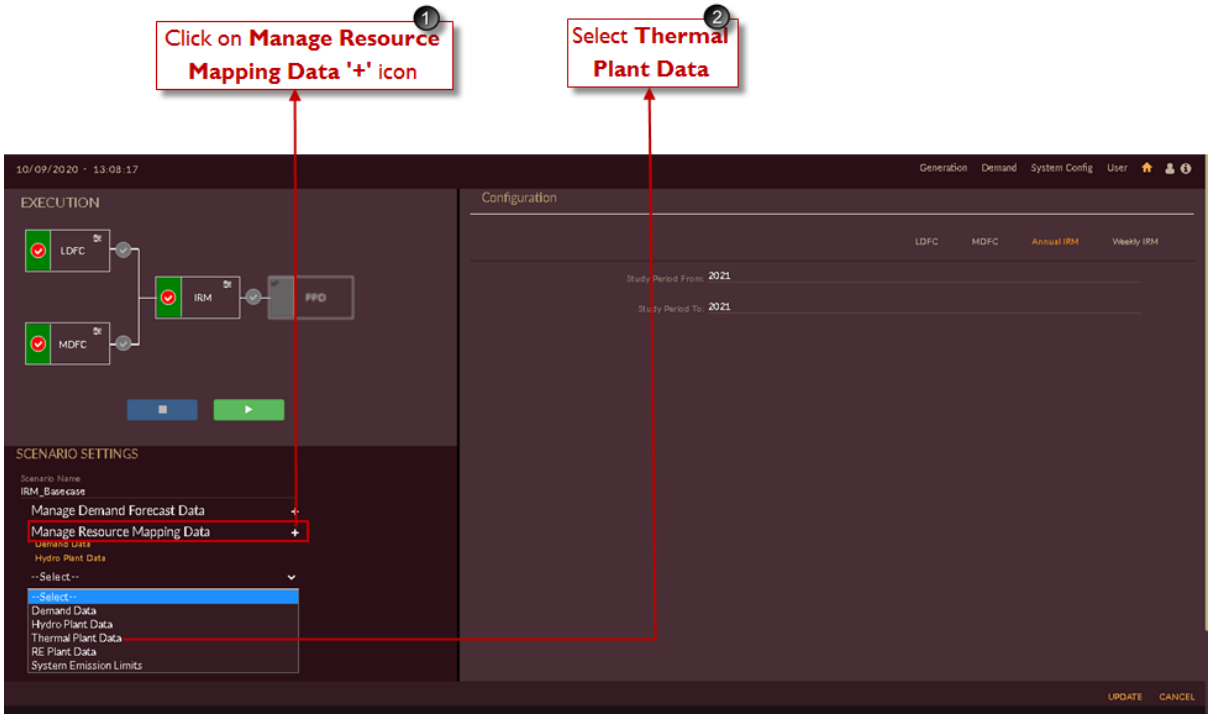


Figure 209. Manage Thermal Plant Data

Once you click **Thermal Plant Data**, software will take user to **Thermal Plant Configuration** page of **IRM Basecase** senario as shown in Figure 210.

3. Click on **Config** icon of respective thermal plant to configure it into IRM Basecase scenario. Here **LAKWA_TPS Thermal** plant is selected in Figure 210.

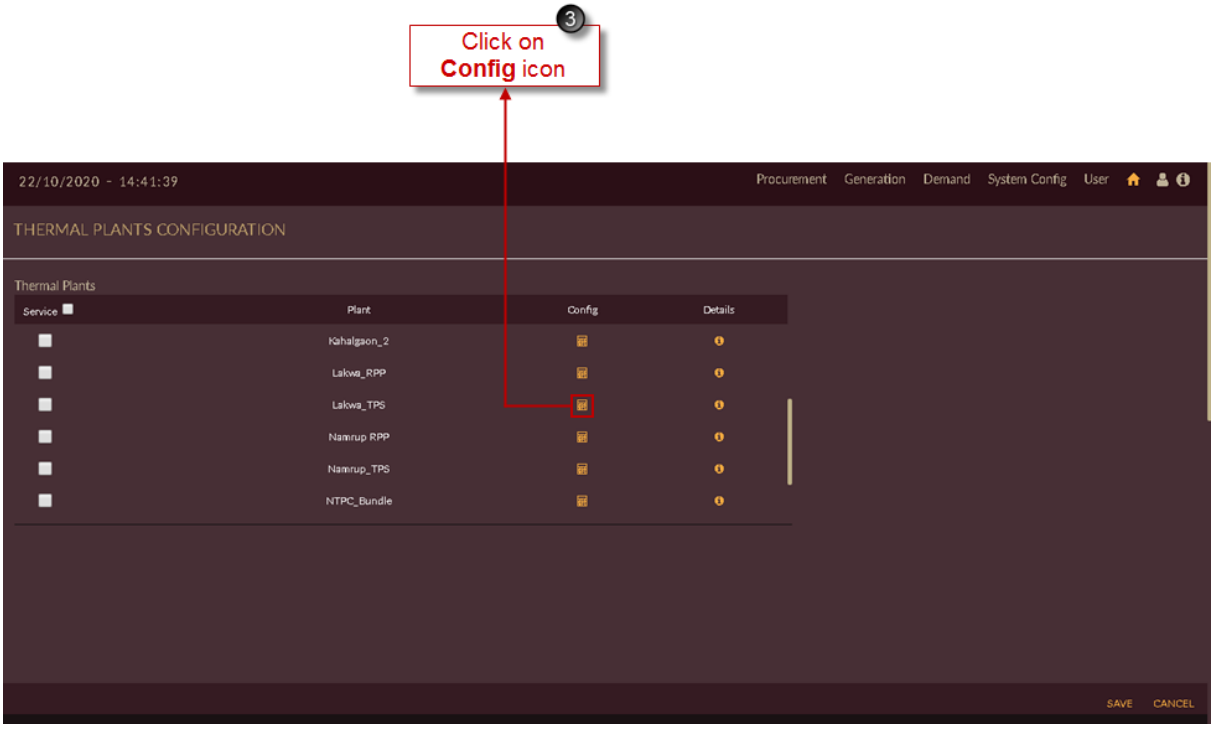


Figure 210. Configuring Thermal Plants for IRM Scenario

Once you click on **Config** icon of respective plant, unit information of selected plant page will appear as shown in Figure 211.

4. You can edit the unit information here if required, the fields like;
    - Minimum and Maximum generation of unit in MW.
    - Ramp up and Ramp down rate in MW/min.
    - Annual Unavailability (Forced outage rate) in percentage (%).
    - You can change generation cost library and fuel contract library.
    - Percentage (%) reserve allocation.
5. You can make thermal units Out of service or In- service for scenario specific by setting **Out Of Service/In Service** Out of Service In Service toggle icon, can make Fuel status **Off/On** Fuel Status Off On by setting toggle at suitable position and can set **Maintenance Schedule** for selected unit if required.

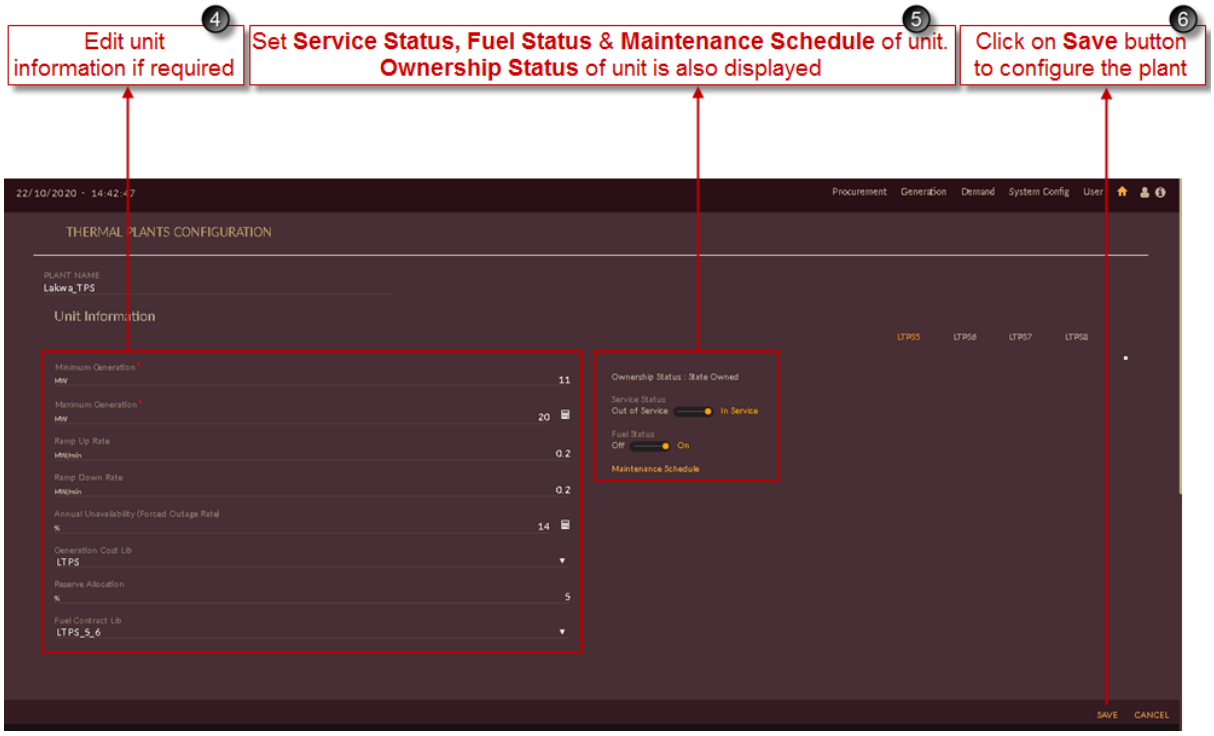
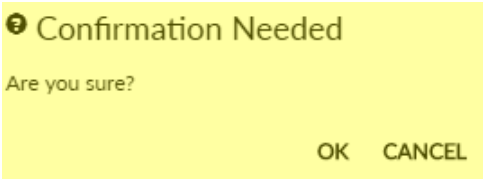


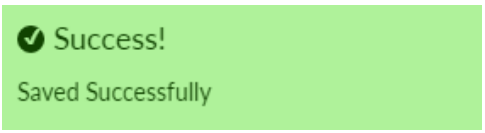
Figure 211. Saving Configured Thermal Plant

6. Click on the **SAVE** SAVE button to save and configure Thermal plant data settings.

   The **"Are you sure?"** confirmation message appears.



   Click on the **OK** icon to save the scenario. The "Saved Successfully" message appears.



7. Figure 212 shows configured thermal plant into the IRM Base case scenario. Blue tick indication appears for the plant which is configured or partcipating into the scenario for IRM studies.

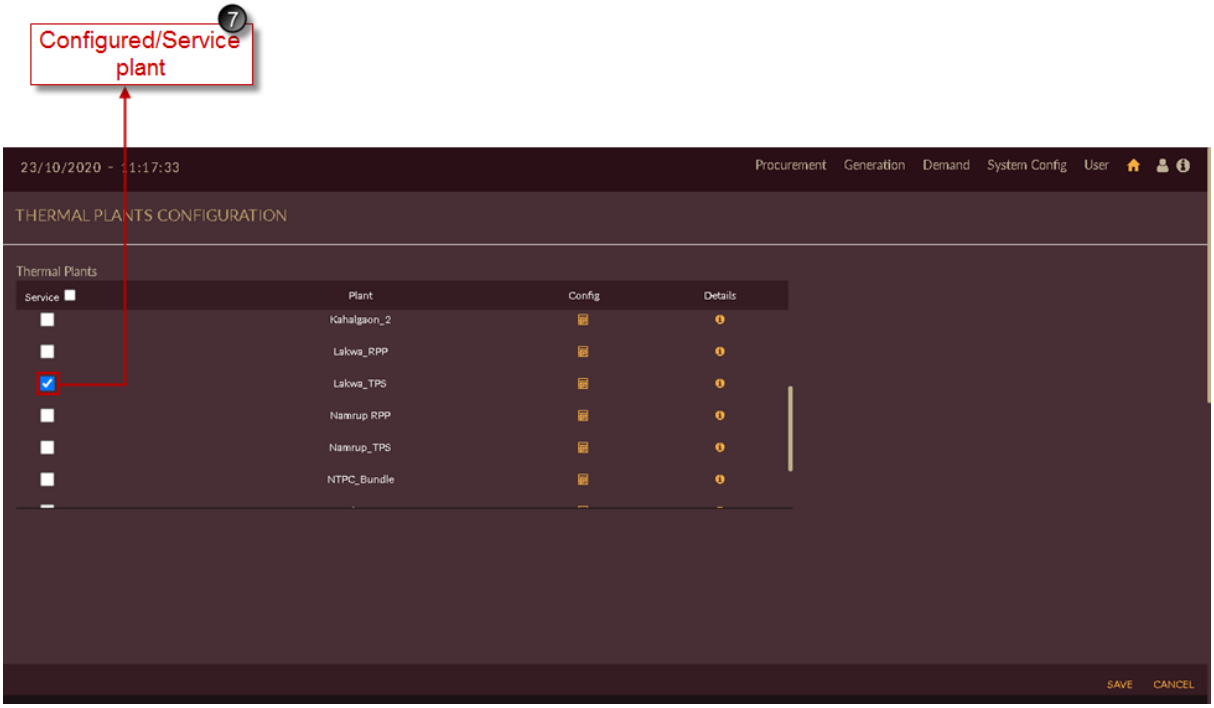
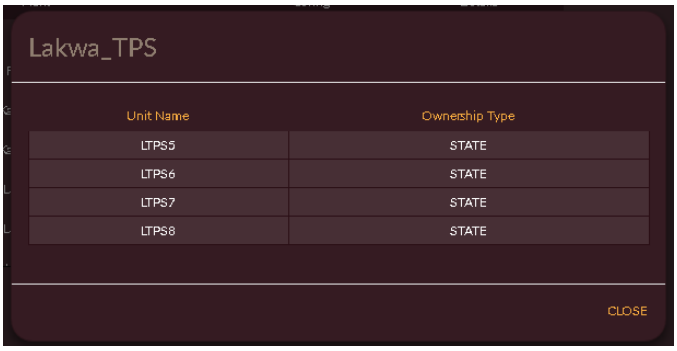


Figure 212. Successfully Configured Thermal Plant

Repeat above steps for configuring other thermal plants into the IRM Base case scenario for IRM studies.

You can see the ownership status of each unit by clicking on **Details** icon.



Once all the Thermal plants are configured into the IRM Base case scenario the final Thermal Plant Configuration page will appear as shown in Figure 213.

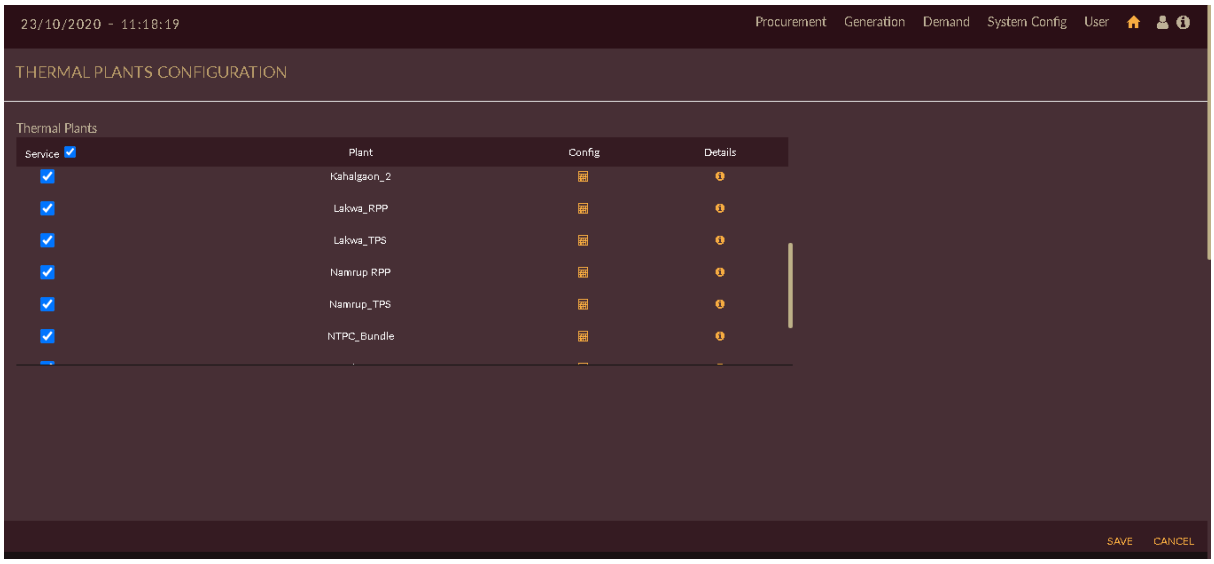


Figure 213. List of Successfully Configured Thermal Plants

STEPS TO EDIT/CONFIGURE RE PLANT DATA INTO IRM_BASECASE:

1. Click on Manage Demand Forecast Data icon in IRM Base case scenario.
2. Select **RE Plant Data** from the drop-down list as shown in Figure 214.

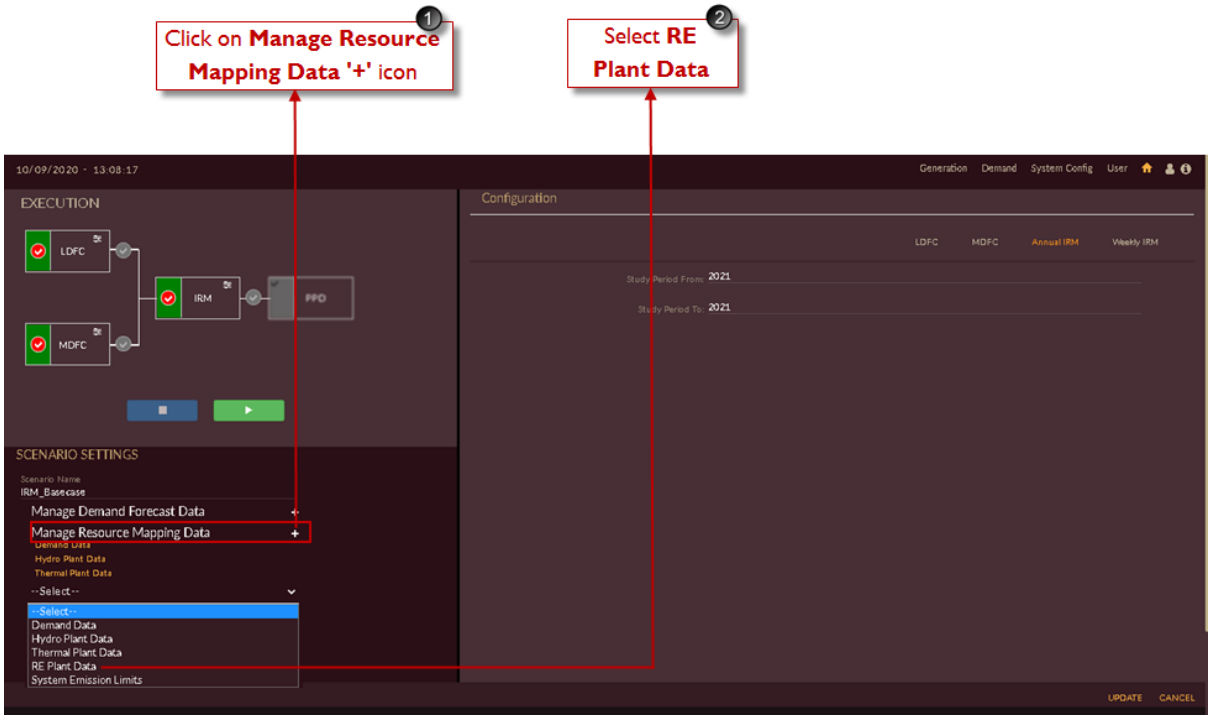


Figure 214. Manage RE Plant Data

Once you click **RE Plant Data**, software will take user to **RE Plant Configuration** page of **IRM Basecase** senario as shown in Figure 215.

3. Click on **Upload RE Portfolio** icon to configure RE generation profiles.

Figure 215. Uploading RE Generation Portfolio to RE Plants

Once you click on **Upload RE Portfolio** icon software will appear as shown in Figure 216.

4. You have to select **RE Generation Portfolio** from drop-down list. The RE generation portfolio configured in RE GENERATION PORTFOLIO section will appear in drop-down list.

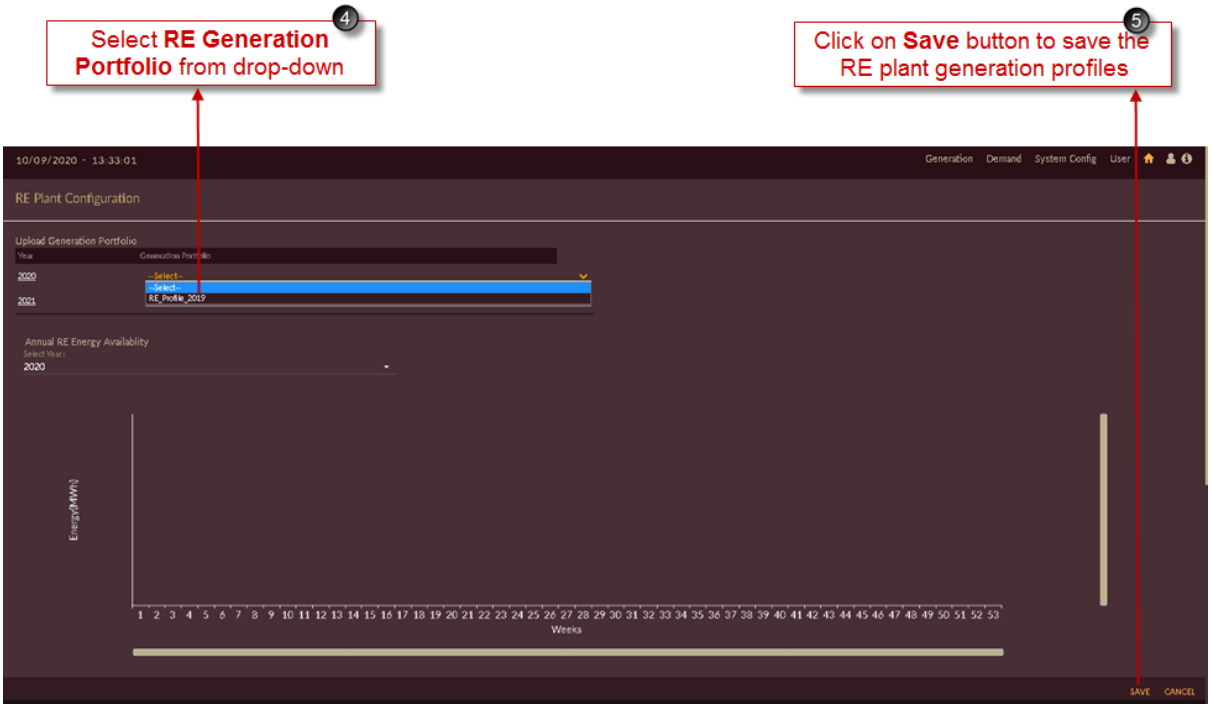
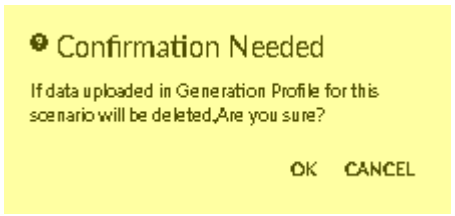


Figure 216. Selecting RE Generation Portfolio

5. Click on the **SAVE** SAVE button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

Once RE generation portfolio is successfully inserted into the IRM Base case graph will get updated as shown in Figure 217.

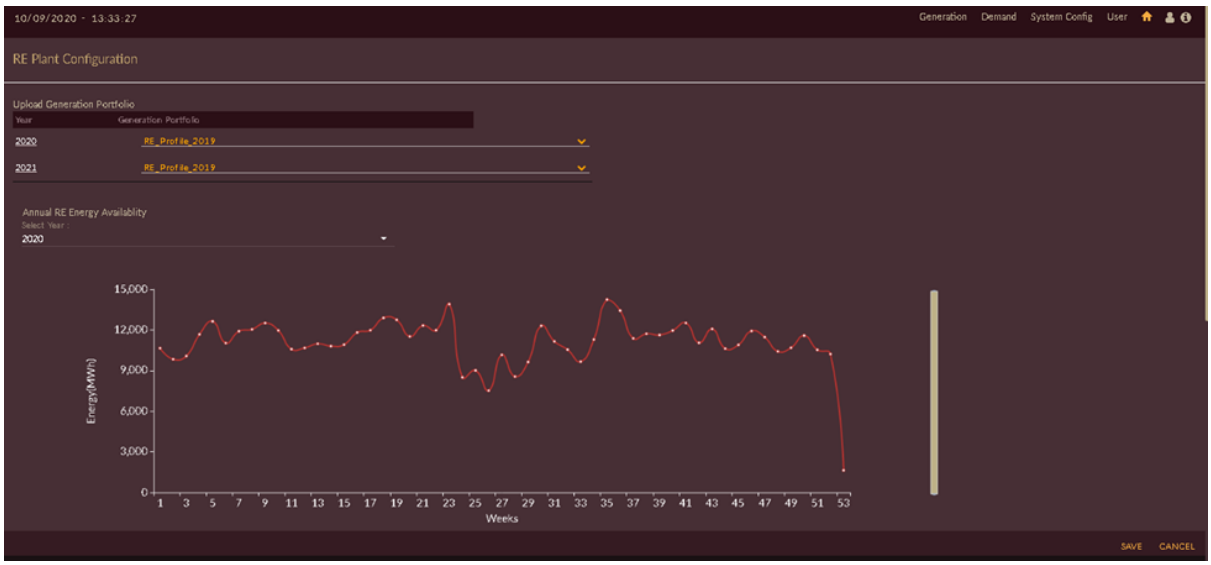


Figure 217. Successful Configuration of RE Generation Portfolio

Once RE generation portfolio is successfully inserted into the IRM Base case, we have to check whether generation profile is updated into each RE plant. For doing so;

6. Click on **Edit** icon of respective plant for which you want to see or edit the data. Here **NVVN Solar** plant is selected in Figure 218.

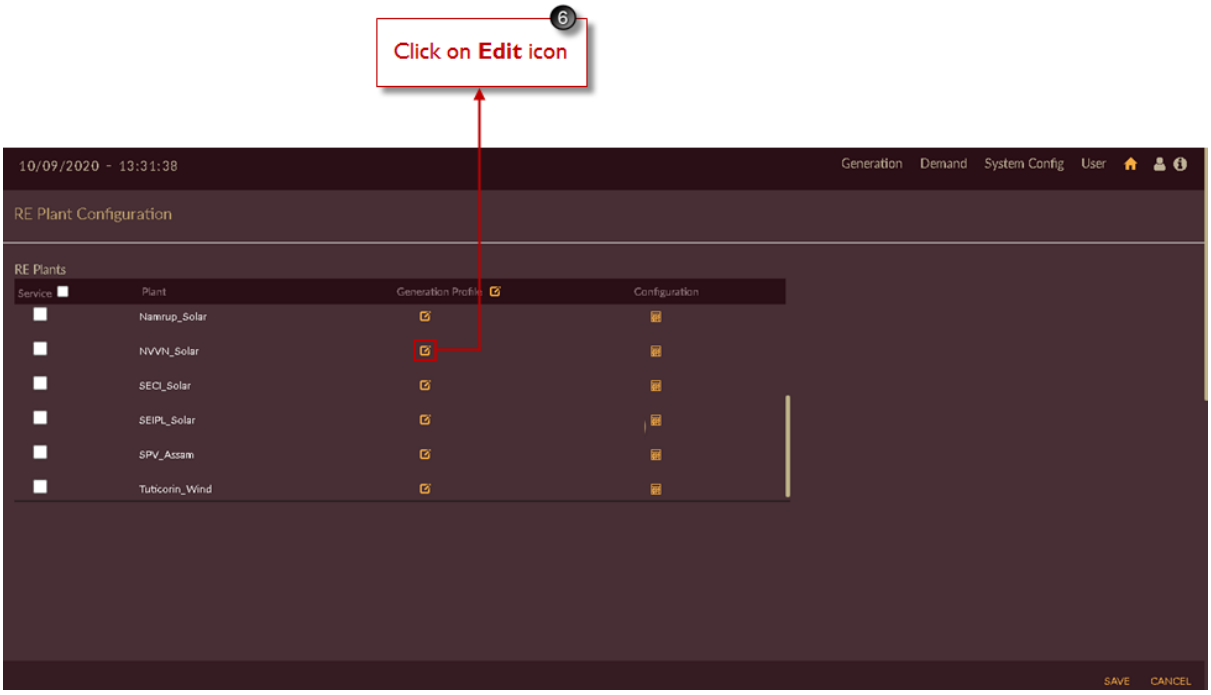


Figure 218. Edit/View Configured RE Generation Portfolio for Plant

Once you click on **Edit** icon of respective plant, the generation profile page appears as shown in Figure 219.

7. Table is displayed containing RE generation profile imported for respective plant. Here NVVN Solar plant is shown.
8. Hourly graph of respective plant will be displayed below table according to generation profile. You can also edit the generation profile data by just double clicking the row and click on **Refresh** icon to update the graph.

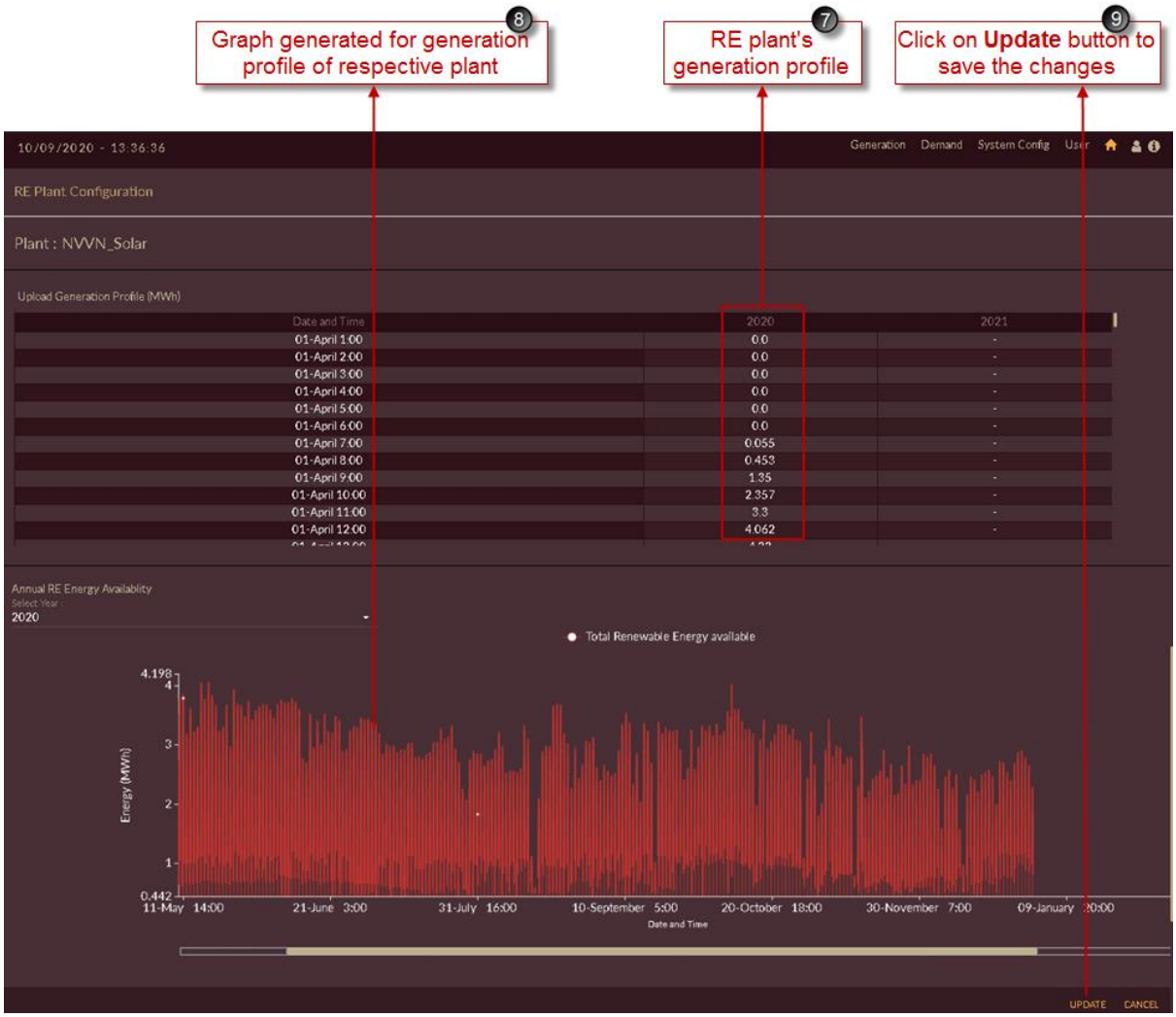
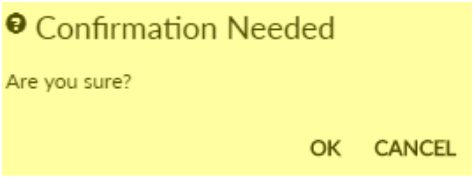


Figure 219. Updated RE Generation Profile of RE Plant

9. Click on **UPDATE** UPDATE button to save the changes.

   The "Are you sure?" confirmation message appears.



   Click on **OK** to accept the changes made. The "Updated successfully" message appears.

   Once RE generation portfolio is updated successfully we have to configure each RE plant into the IRM Base case scenario.

10. Click on **Configuration** icon of respective RE plant to configure it into IRM Basecase scenario. Here NVVN Solar plant is selected in Figure 220.

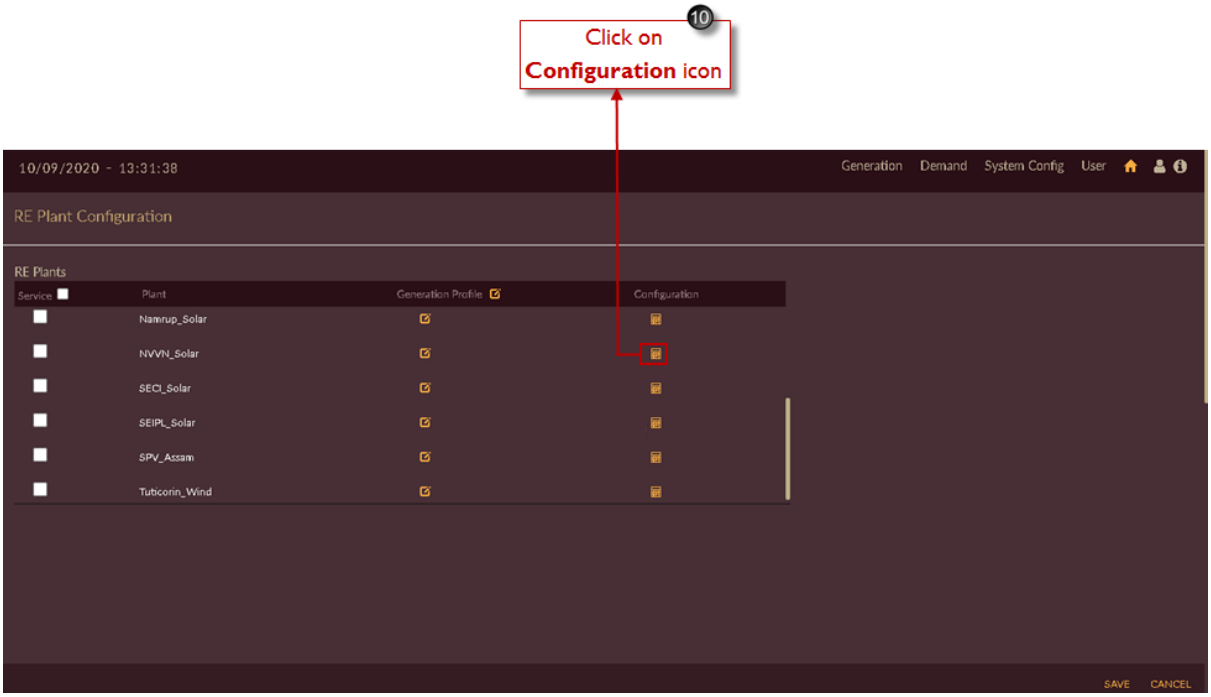


Figure 220. Configuring RE Plants for IRM Scenario

Once you click on **Configuration** icon of respective plant, plant information of selected plant page will appear as shown in Figure 221.

11. You can edit the plant information here if required, the fields like;
    - Percentage (%) uncertainity.
    - Feed in Tariff in INR/MWh.
12. You can make Re plant Out of service or In- service for scenario specific by setting **Out Of Service/In Service** Out of Service In Service toggle icon.

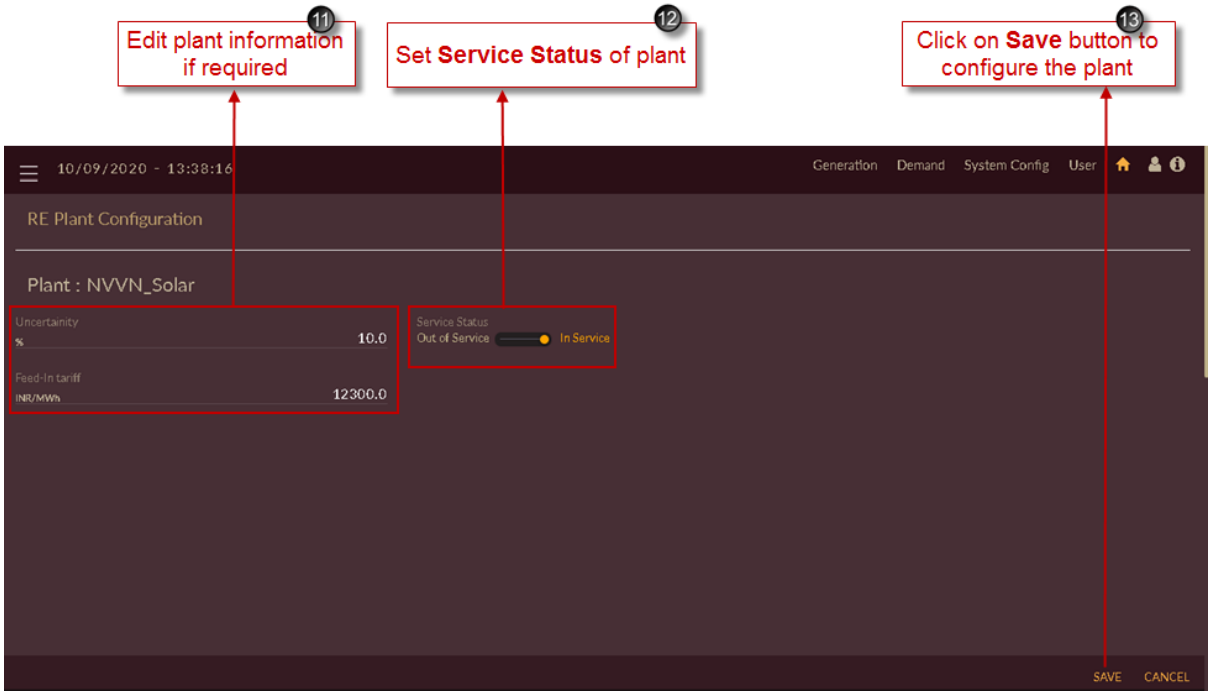
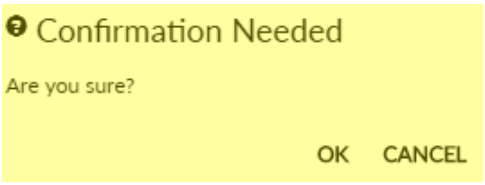


Figure 221. Saving Configured RE Plant

13. Click on the **SAVE** SAVE button to save and configure RE plant data settings.

    The **"Are you sure?"** confirmation message appears.



    Click on the **OK** icon to save the scenario. The "Saved Successfully" message appears.

14. Figure 222 shows configured RE plant into the IRM Base case scenario. Blue tick indication appears for the plant which is configured or partcipating into the scenario for IRM studies.

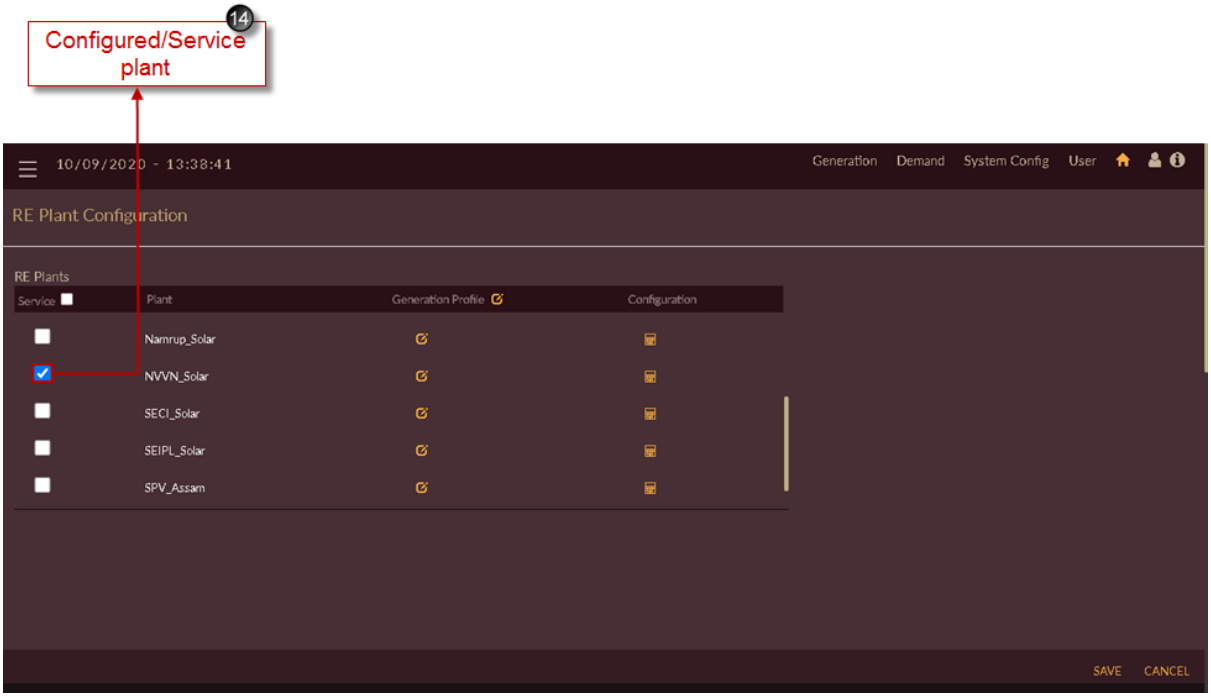


Figure 222. Successful Configuration of RE Plant

Repeat above steps for configuring other RE plants into the IRM Base case scenario for IRM studies.

Once all the RE plants are configured into the IRM Base case scenario the final RE Plant Configuration page will appear as shown in Figure 223.

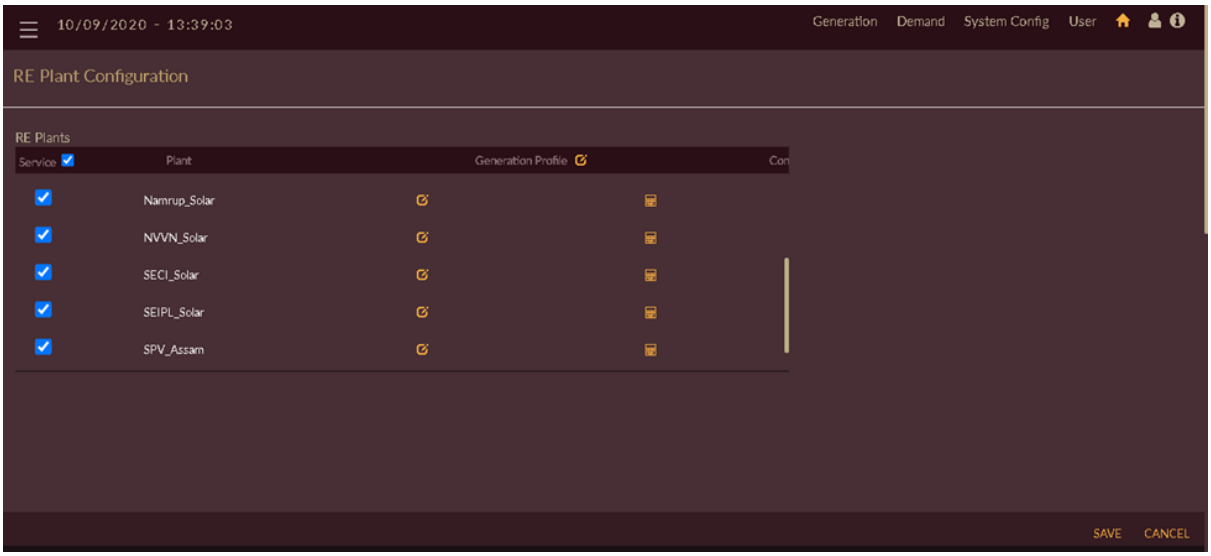


Figure 223. List of Successful Configured RE Plants

15. After managing all resource data like Demand Data, Hydro Plant Data, Thermal Plant data and RE Plant Data into the IRM Base case scenario, you will see the page as shown in Figure 224.

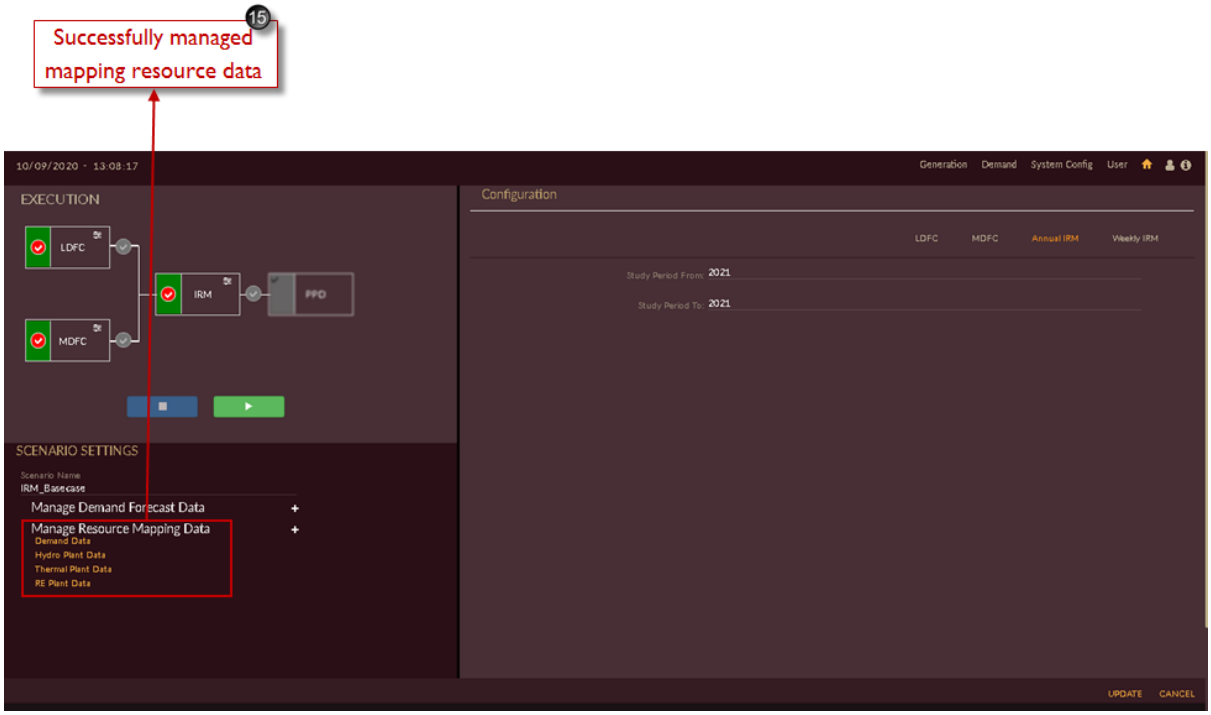


Figure 224. Finalized IRM Scenario

2.2.3.3 EXECUTE IRM SCENARIO

This section gives you the steps to execute the scenario created.

1. Go to scenario list page as shown in Figure 225 and click on **Edit Scenario** icon for the scenario which you need to execute. Here we are executing IRM Base case scenario.

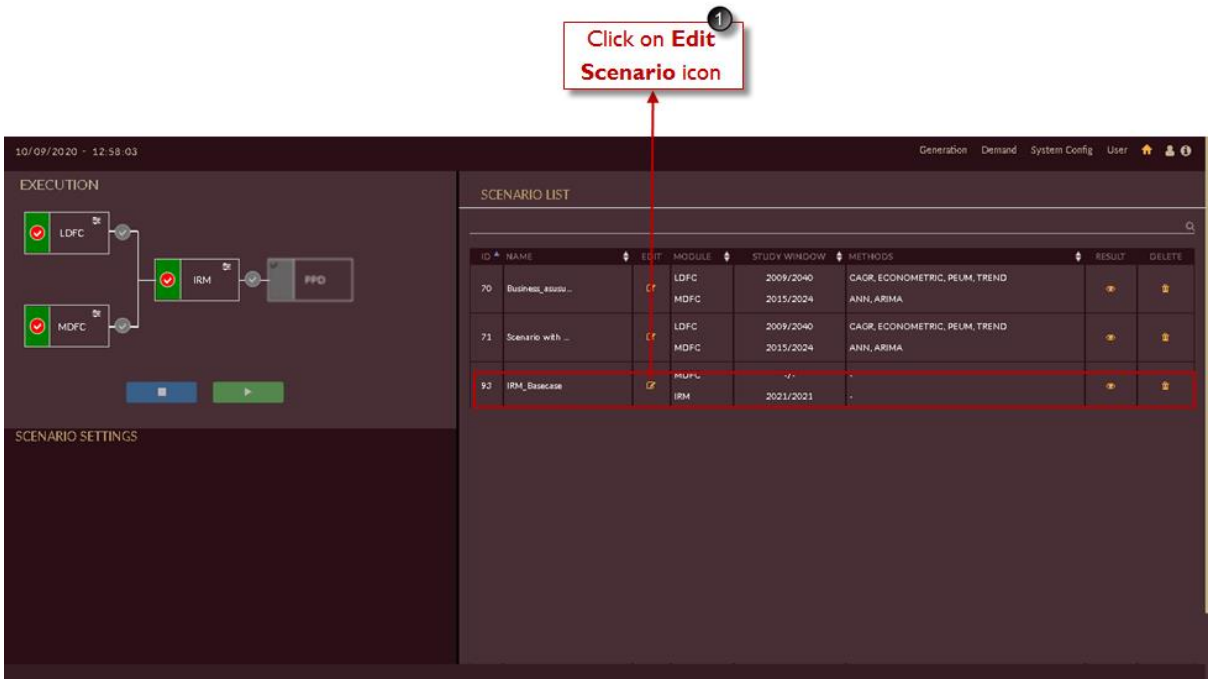


Figure 225. Select IRM Scenario to Execute

2. Select the method i.e, **IRM function**  by clicking the red  tick mark of respective method.
3. Click on the **Execute**  icon on the left-side shown in Figure 226.
4. Orange line appears on the top of the software page indicating that scenario is getting executed.

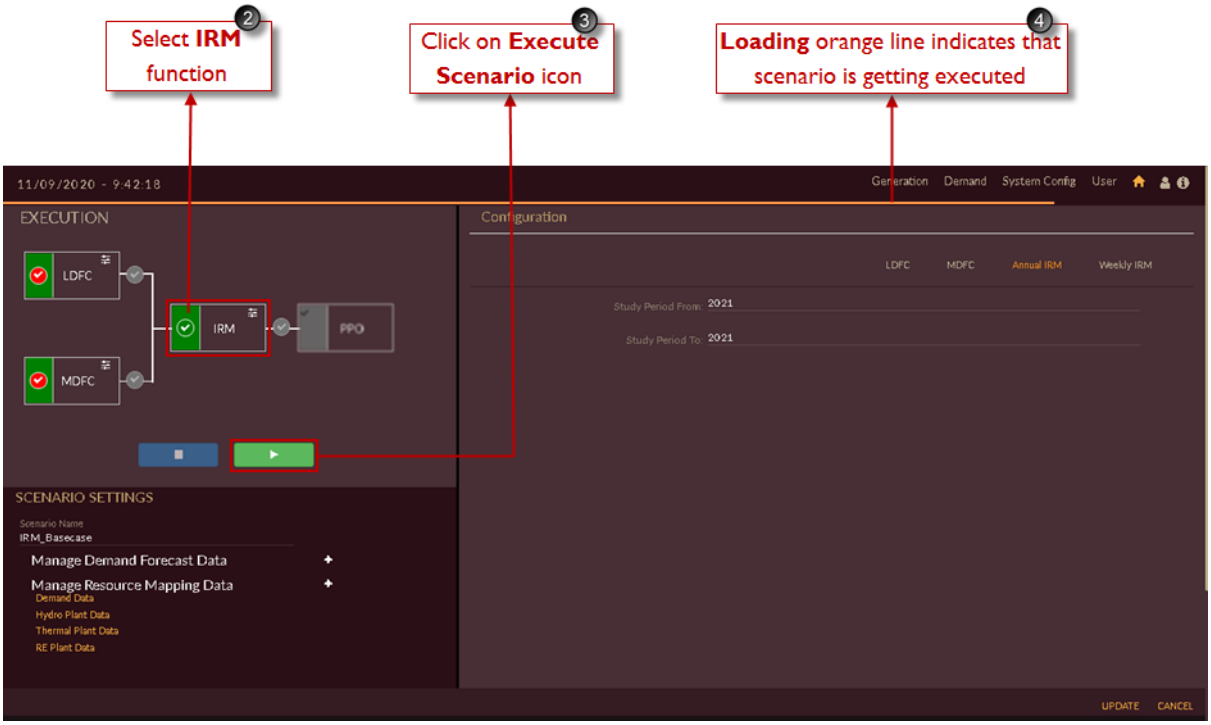
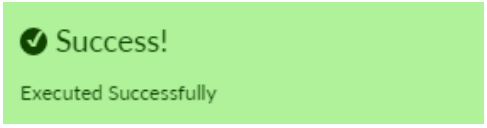


Figure 226. Execution of IRM

The "Executed Successfully" message appears.



The software page will navigate to results page as shown in Figure 227.

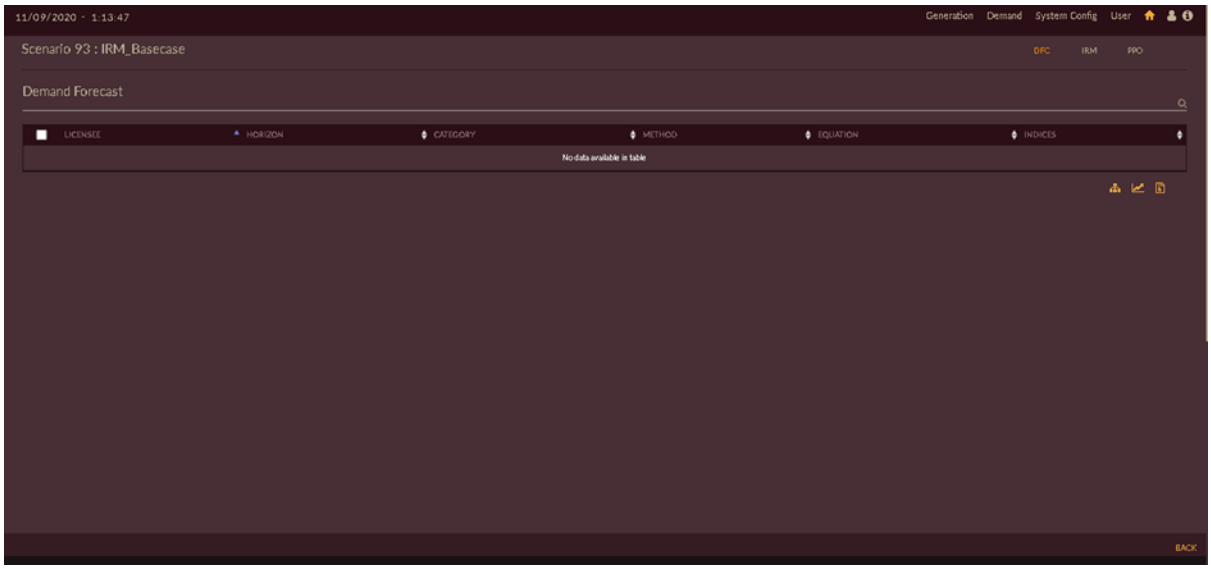


Figure 227. Result Page

2.2.3.4 DOWNLOAD/EXPORT/VIEW IRM SCENARIO RESULTS

This section gives the steps to view, export and download IRM Scenario Execution Results.

STEPS TO VIEW & EXPORT IRM RESULTS:

Login to the software. The **Dashboard/Home** page appears. The **Scenario List** appears on the right of the home page.

1. Click on the **View Result** icon on the scenario that you wish to view. In this example, we see the results of the scenario 93, IRM Base case.

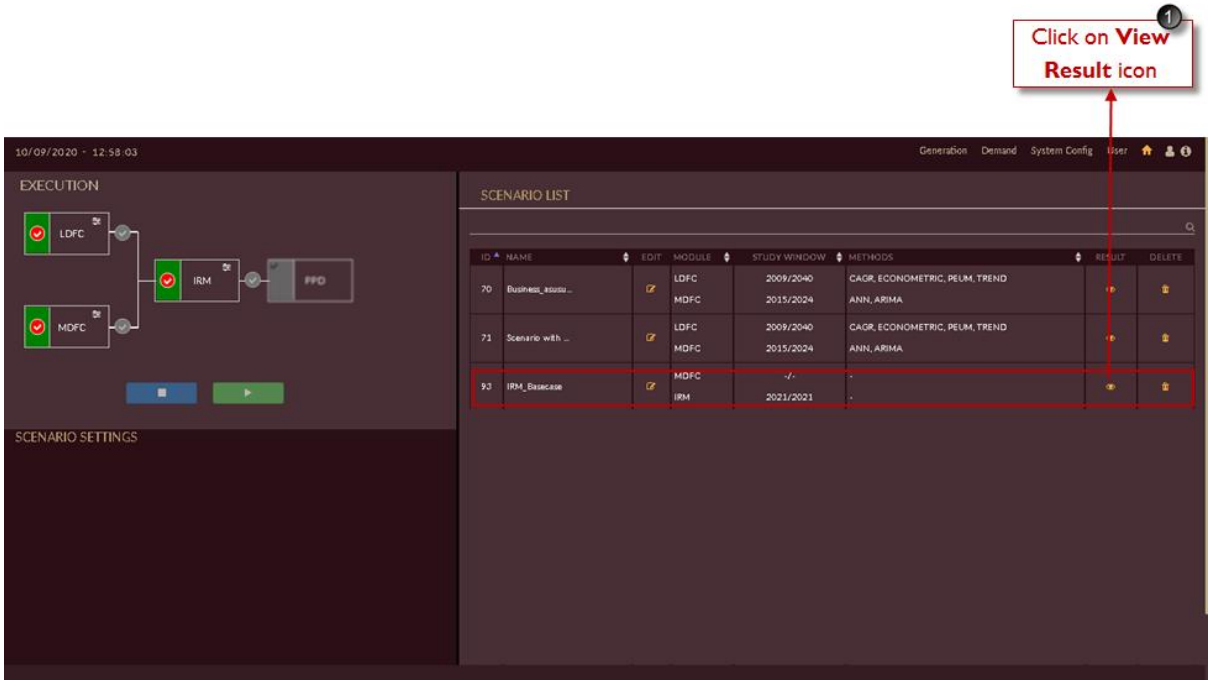


Figure 228. View IRM Scenario

Once you click **View Result** icon, the result page of selected scenario, IRM Base case will open as shown in Figure 229.

In result page by-default **DFC** DFC icon will be selected.

2. Click on **IRM** IRM tab, to view IRM results.

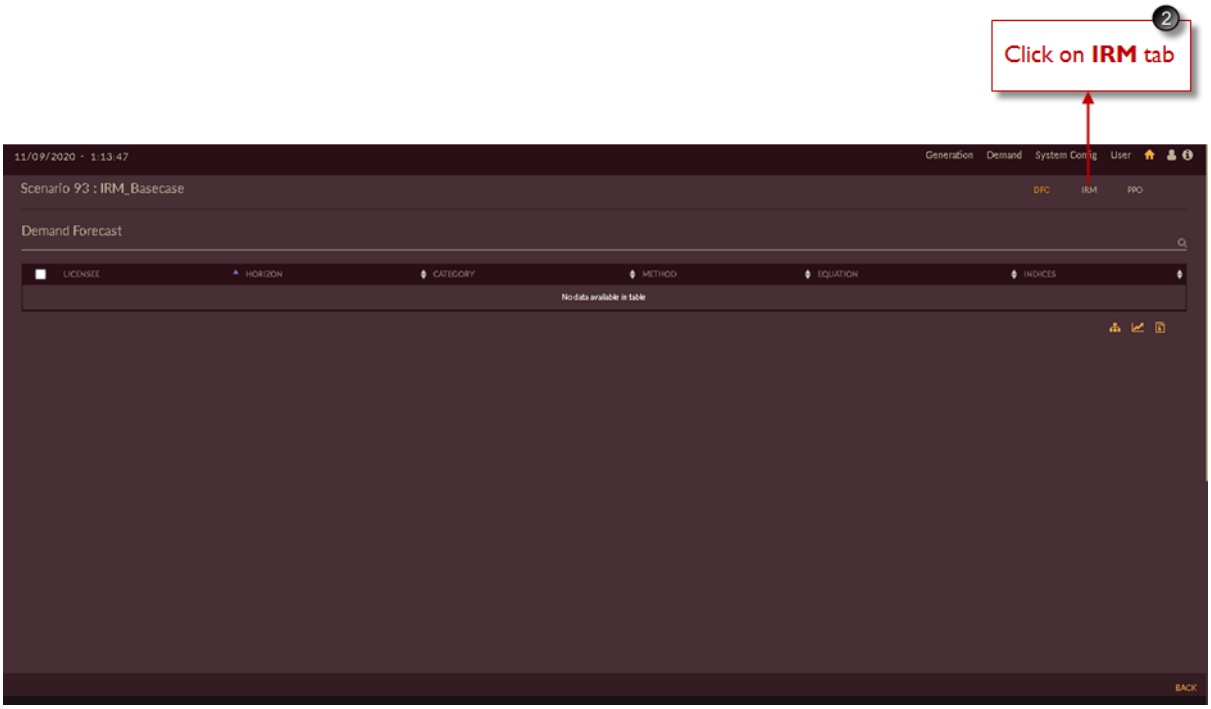


Figure 229 Result Page of IRM Scenario

Once you click **IRM** IRM icon, in the result page by-default results will appear in the form of graphical representation and slider will be on graphical option as shown in Figure 230.

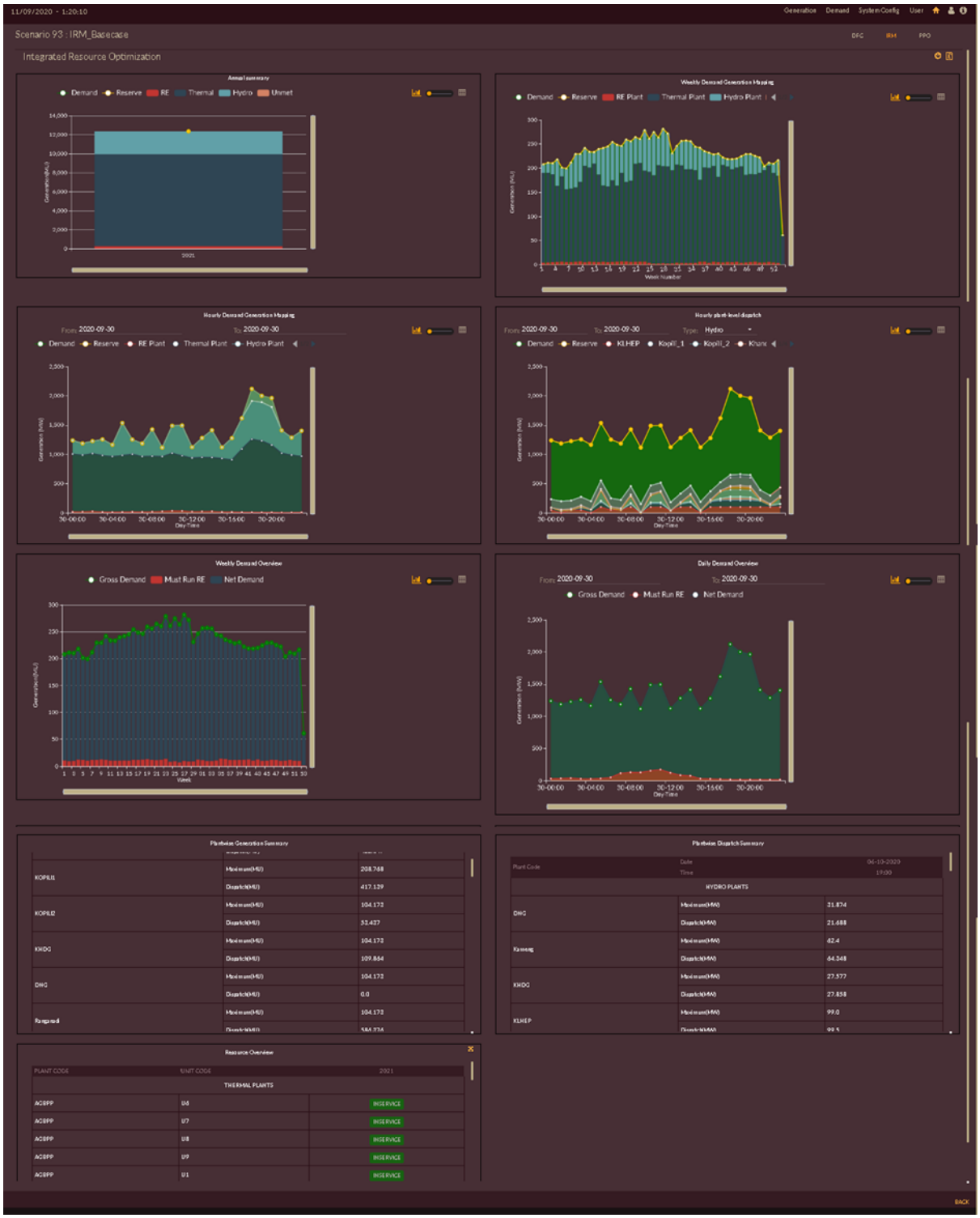


Figure 230. Results in Graphical Form

3. You can also view the graphical results in tabular form just by setting **Graph or Table**  data slider to Tabular option. The same data appears as table as shown in Figure 231.

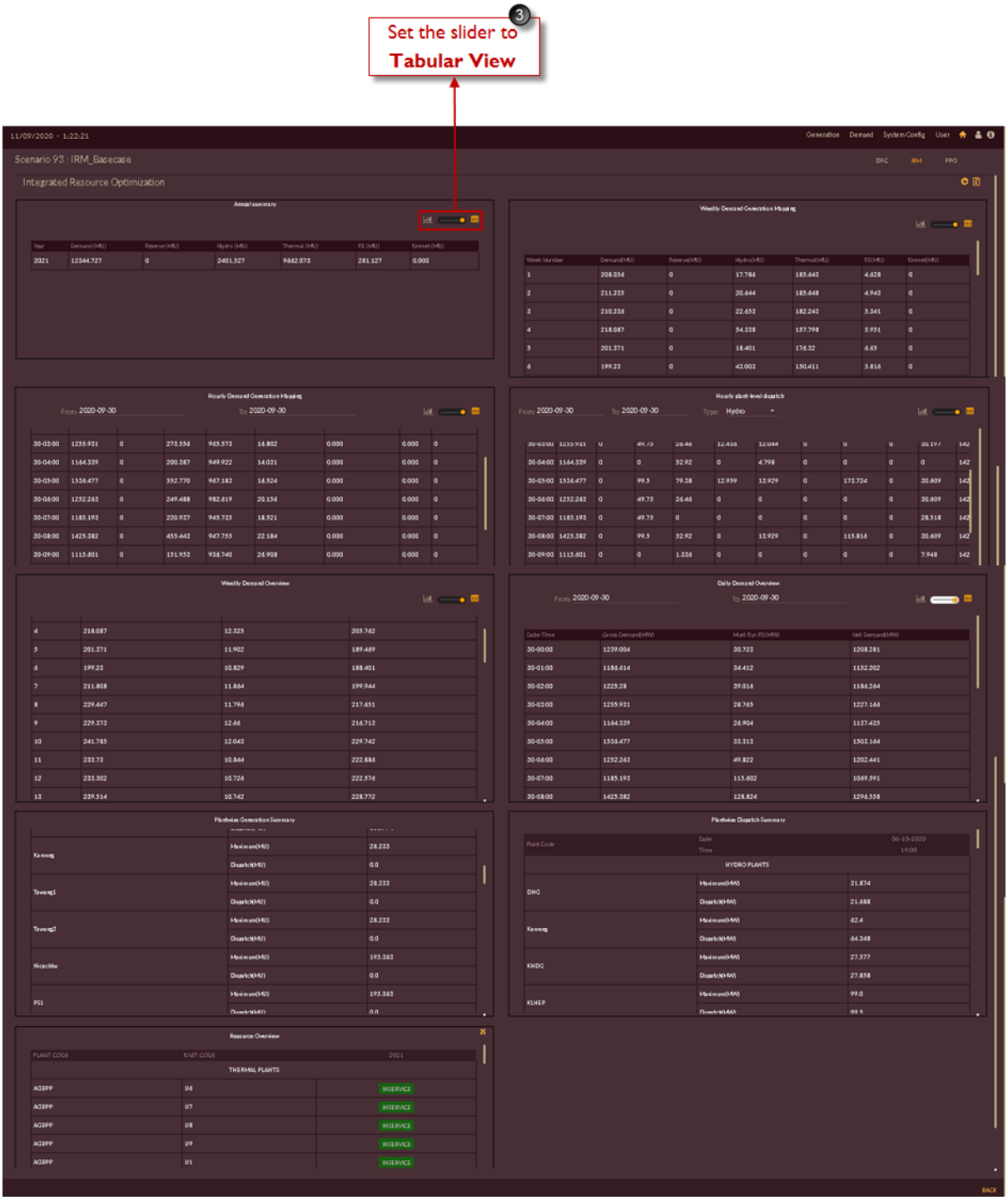


Figure 231. Results in Tabular Form

STEPS TO DOWNLOAD IRM RESULTS:

This section gives you the steps to download results.

Repeat steps from 1 to 3 from **STEPS TO VIEW & EXPORT IRM RESULTS**:.

4. Click on the **Download RO PDF REPORT** icon to download the PDF report file to see detailed IRM results along with input data. A screenshot of the PDF report IRM Base case is shown in Figure 232.

Figure 232. Resource Mapping Report IRM Base Case PDF Report

5. Click on **Download Text Reports** icon to download CSV files to view detailed IRM results along with input data.

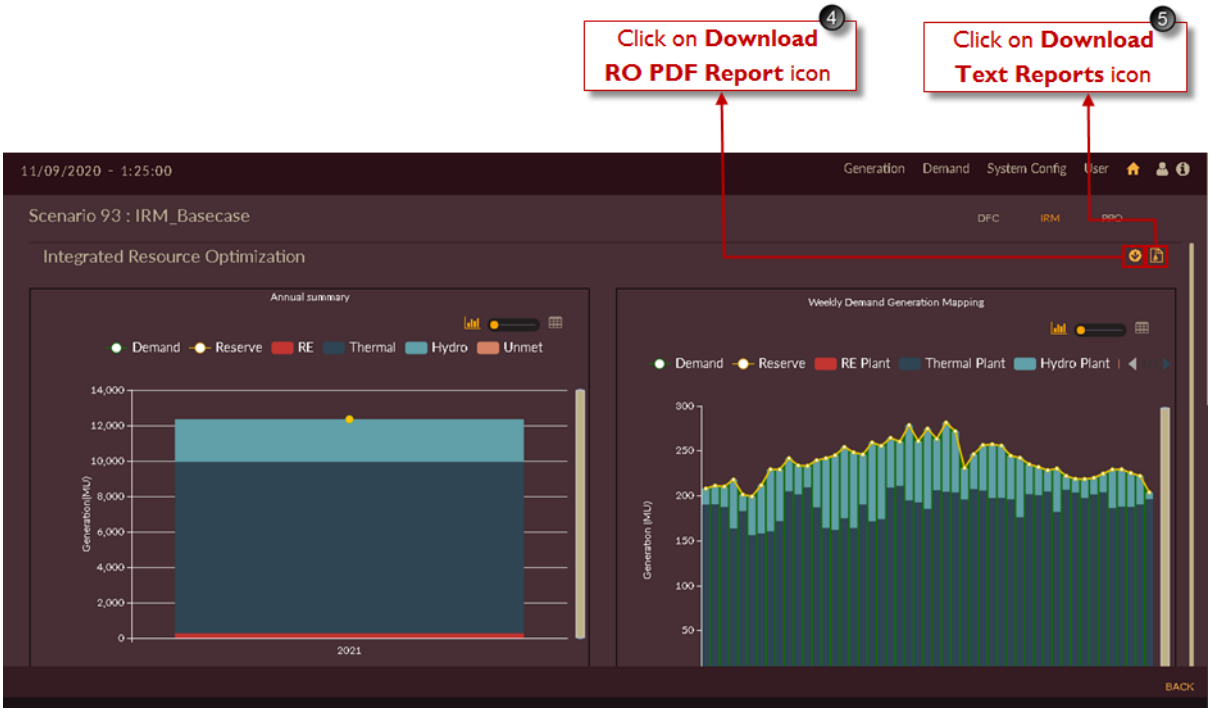


Figure 233. Downloading PDF and Text Reports

Once you click on **Download Text Reports** icon to download CSV files the ZIP folder gets downloaded as shown in Figure 234 which contains detailed IRM annual & weekly results in CSV formats.

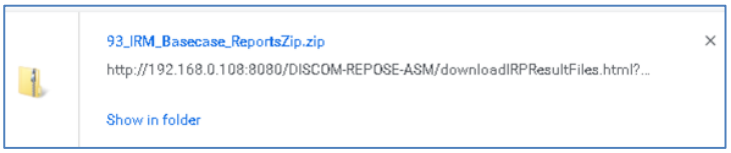


Figure 234. Downloaded Text Report in Zip File Format

6. Once detailed Annual and Weekly IRM studies are made you can permanently delete the scenarion just by clicking **Delete Scenario** icon.

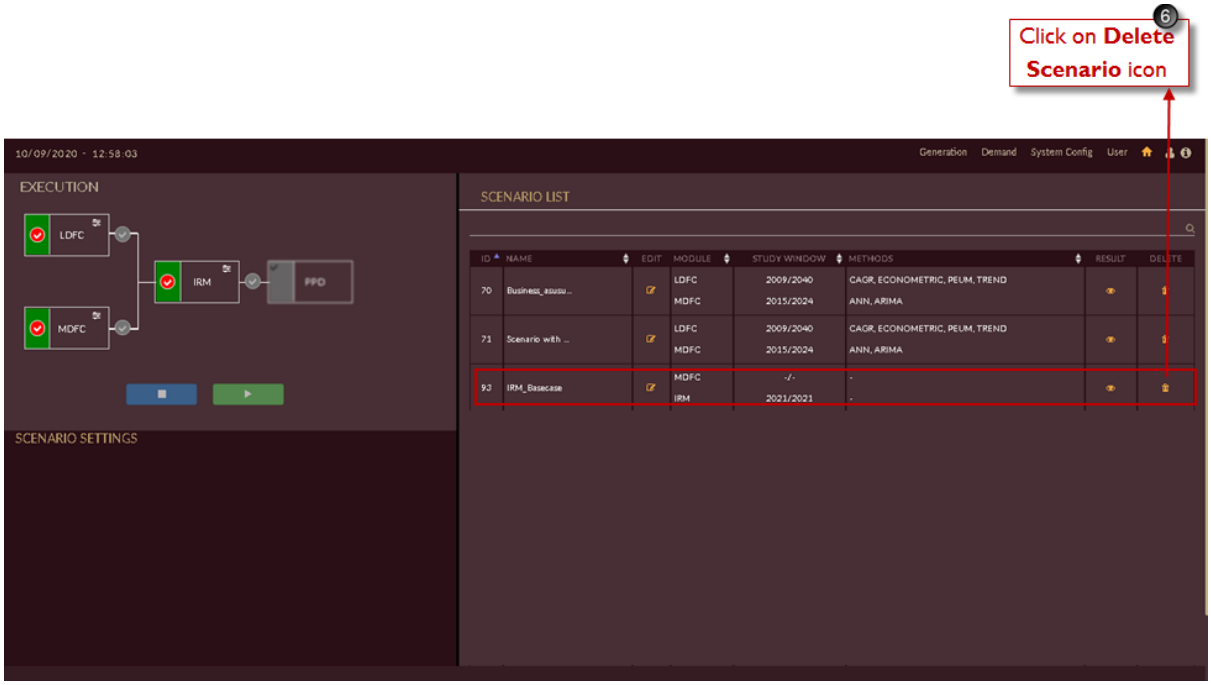
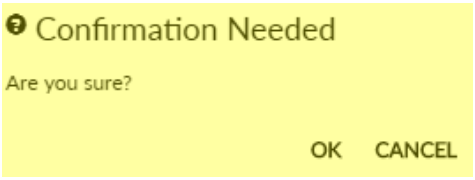


Figure 235. Delete IRM Scenario

Once you click on **Delete Scenario** icon to remove the scenario. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Deleted successfully" message appears. Click on **CANCEL** to discard the task.

2.3 MODULE 3: POWER PROCUREMENT OPTIMIZATION

2.3.1 Introduction

Power Procurement Optimization is the third component in DISCOM-REPOSE software using which we can perform the optimization studies.

In IRM studies we perform the planning studies without considering the procurement data like, contracts, exchange, RPO targets etc. In PPO module all procurement data like contracts, exchange, RPO targets, storages are considered for studies.

Once you login to the software, you will see the page as shown in Figure 236.

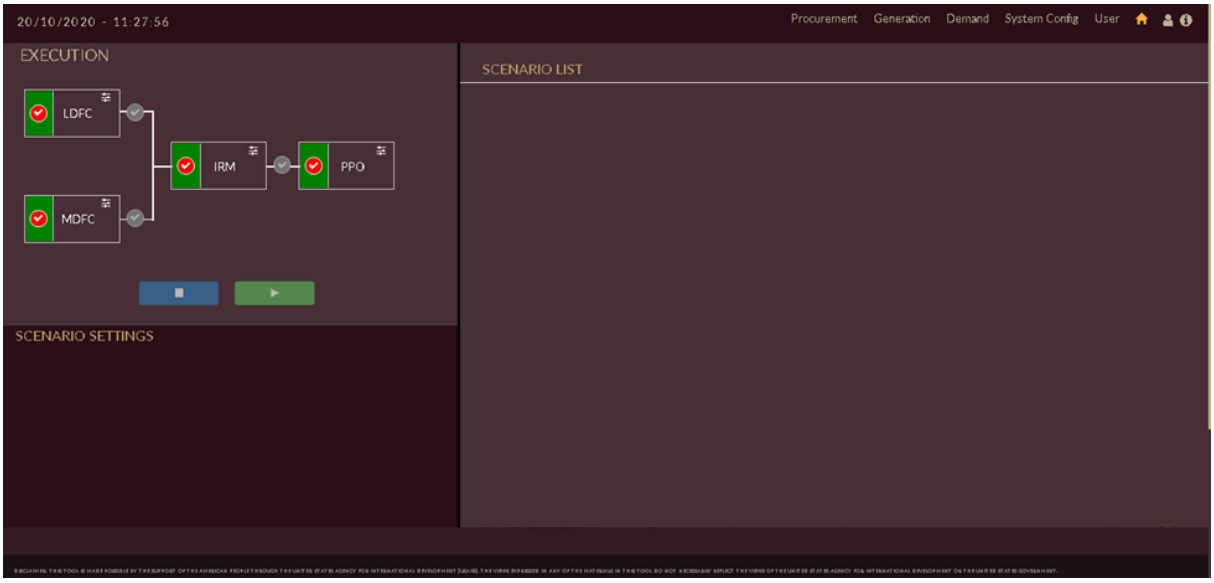


Figure 236. DISCOM – REPOSE Home page

Let us see what input parameters are required, how to model the database and how to obtain the results in next sections.

2.3.2 Input Parameters

For performing integrated resource mapping, we have to collect the following data which will be considered as input for the studies.

Inputs to be considered are the following:

- Contract data
  - Short term exchange
  - Medium term/Long term procurement
- Library
  - Generation profiles for contracted RE plants
- Storage data
- RPO targets data

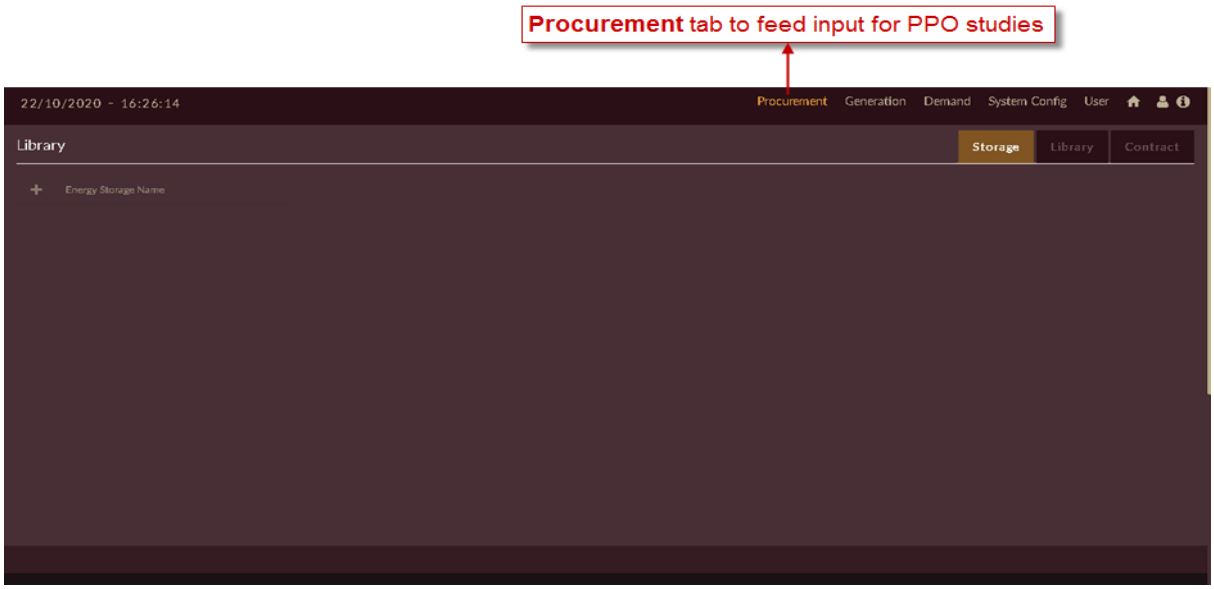


Figure 237. Procurement Page

The sequence to be followed to feed input data for PPO studies is given as follows

1. Configure the ST Exchange and MT/LT Procurement data under Contract tab.
2. Configure the generation profiles for RE contract plants under Library tab.
3. Configure Storage details data under Storage tab.
4. Add RPO targets under System Config tab.

2.3.2.1 SHORT TERM EXCHANGE

This section helps you to configure shot term exchange data. Follow below steps to add ST Exchange data,

1. Click on **Procurement** tab. The **Procurement** tab appears as shown in Figure 238.
2. Click on **Contract** tab.
3. By-default **Exchange** option will be selected.

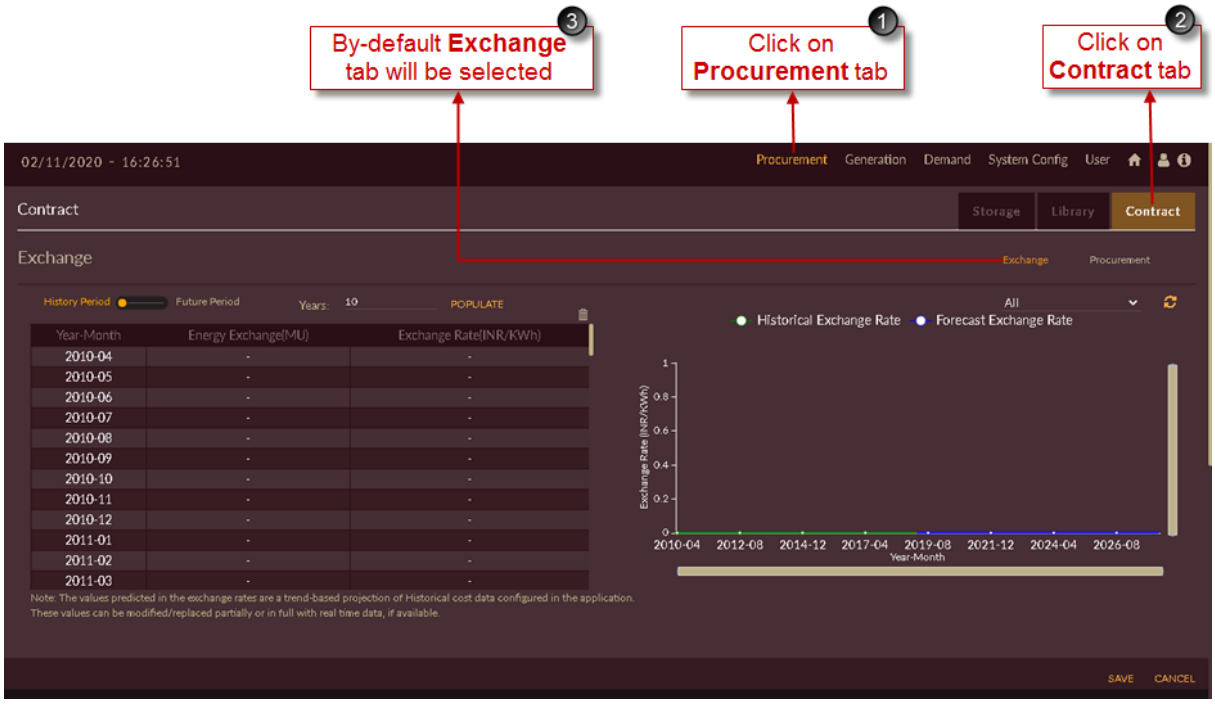


Figure 238. Blank record to add ST exchange data

4. Set the toggle to **History Period**  and **Populate** the history period for number of years data available.
5. Enter Short term **Energy Exchange (MU)** and **Exchange Rate (INR/KWh)** data in the table as shown in Figure 239.

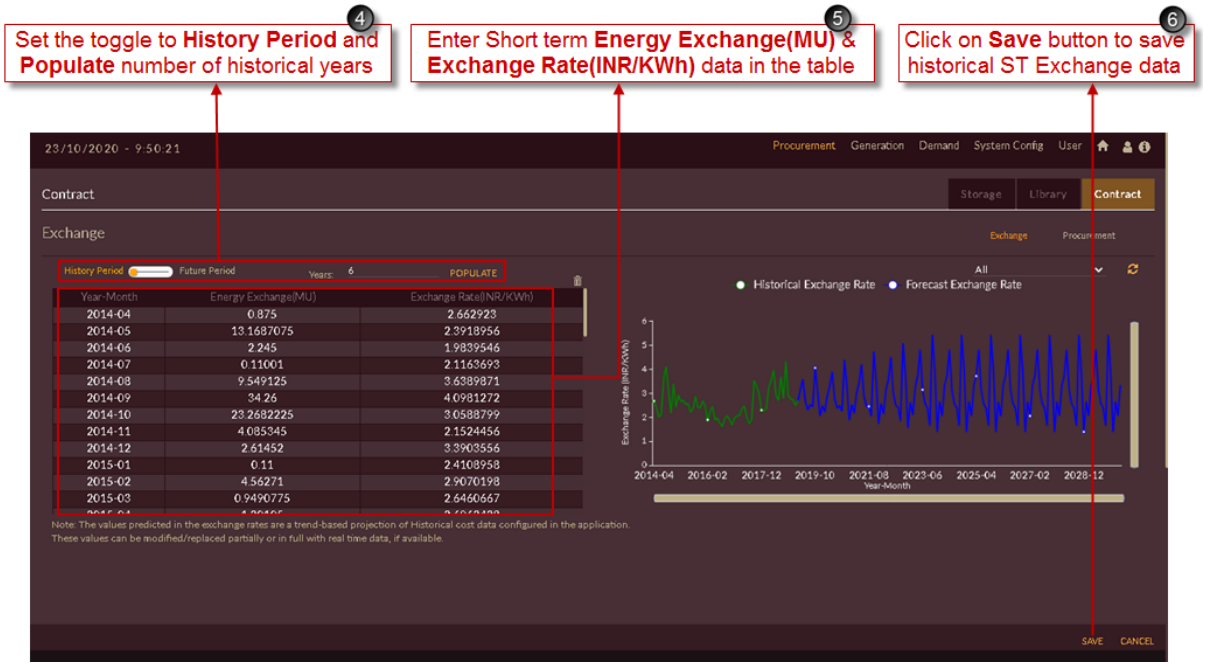
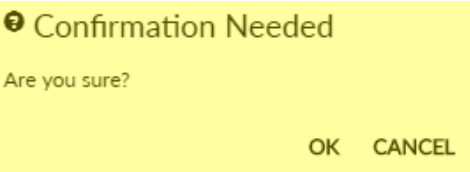


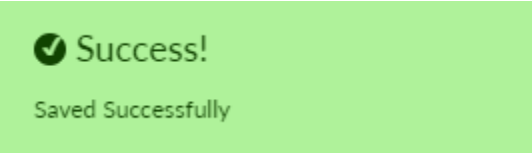
Figure 239. Uploading Historical Exchange Data

6. Click on **SAVE** button SAVE to save historical ST Exchange data.

The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Saved Successfully" message appears. Click on **CANCEL** to discard the task.



7. Set the toggle to **Future Period** History Period Future Period and **Populate** the number of years as per the study period.
8. Enter Short term **Energy Exchange (%)** as per your requirement for PPO studies as shown in Figure 240.
9. Click on **Predict** PREDICT button to predict future **Exchange Rate (INR/KWh)**.
   [Note: The values predicted in the exchange rates are a trend-based projection of historical cost data configured in the application. These values can be modified/replaced partially or in full with real time data, if available.]

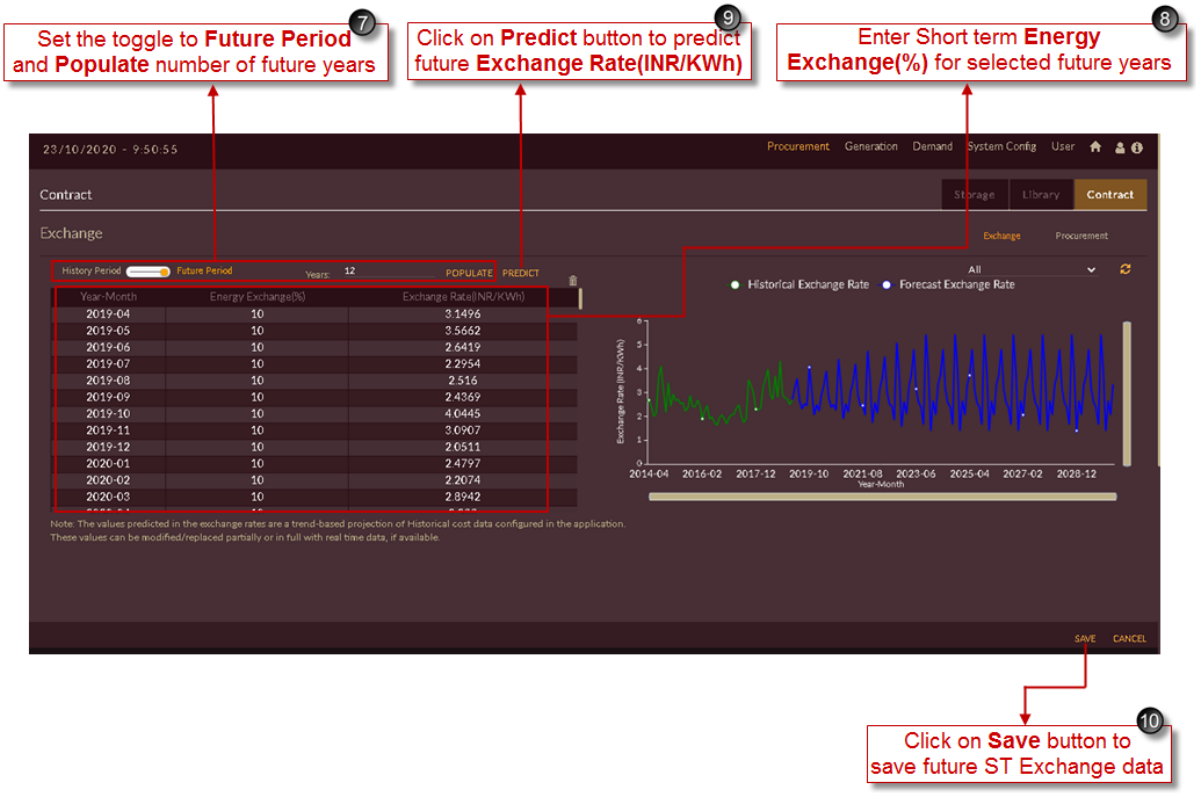
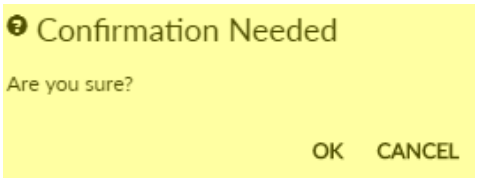


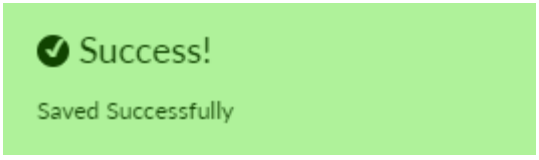
Figure 240. Uploading Future Exchange Data

10. Click on **SAVE** button  to save future ST Exchange data.

The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Saved Successfully" message appears. Click on **CANCEL** to discard the task.



2.3.2.2 MT/LT PROCUREMENT

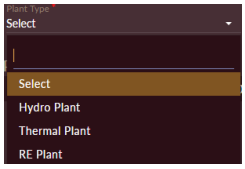
This section helps you to configure medium/long term procurement data. Follow below steps to add MT/LT Procurement data,

1. Click on **Procurement** tab. The **Procurement** tab appears.
2. Click on **Contract** tab. The **Contract** tab appears.
3. Click on sub **Procurement** tab.
4. Click on  **Contract Name** icon to add contract plant into the application.

Once you click on **Contract Name** icon, you will see the blank record appeared on page as shown in Figure 241.

5. Enter the information's like;

- **Contract Information**
  - Enter contract name in **Name** field
  - Enter code in **Code** field
- **Associated Plant/Unit Selection**
  - Select the plant type like Hydro/Thermal/RE from the **Plant Type** drop-down



  - Select the contract plant name from **Plant Name** drop-down and unit name form **Unit Name** drop-down.

    [Note: Only the plants which has ownership status as contract will be displayed in the drop-down]
- **Periodic Contract Details**
  - Select contract period i.e **From Date** and **To Date** from the calender drop-down.

[Note: If the study period is less than or equal to five years, toggle will be automatically set to **MT Contract** MT Contract LT Contract .If the study period is greater than ten years, toggle will be automatically set to **LT Contract** MT Contract LT Contract .]

  - Enter **Capacity Share (MW)** and **EnergyShare (MWh)** of a contract.
  - Enter cost details of contract plant like **Fixed Cost (INR/MW)** and **Variable Cost (INR/MWh).**

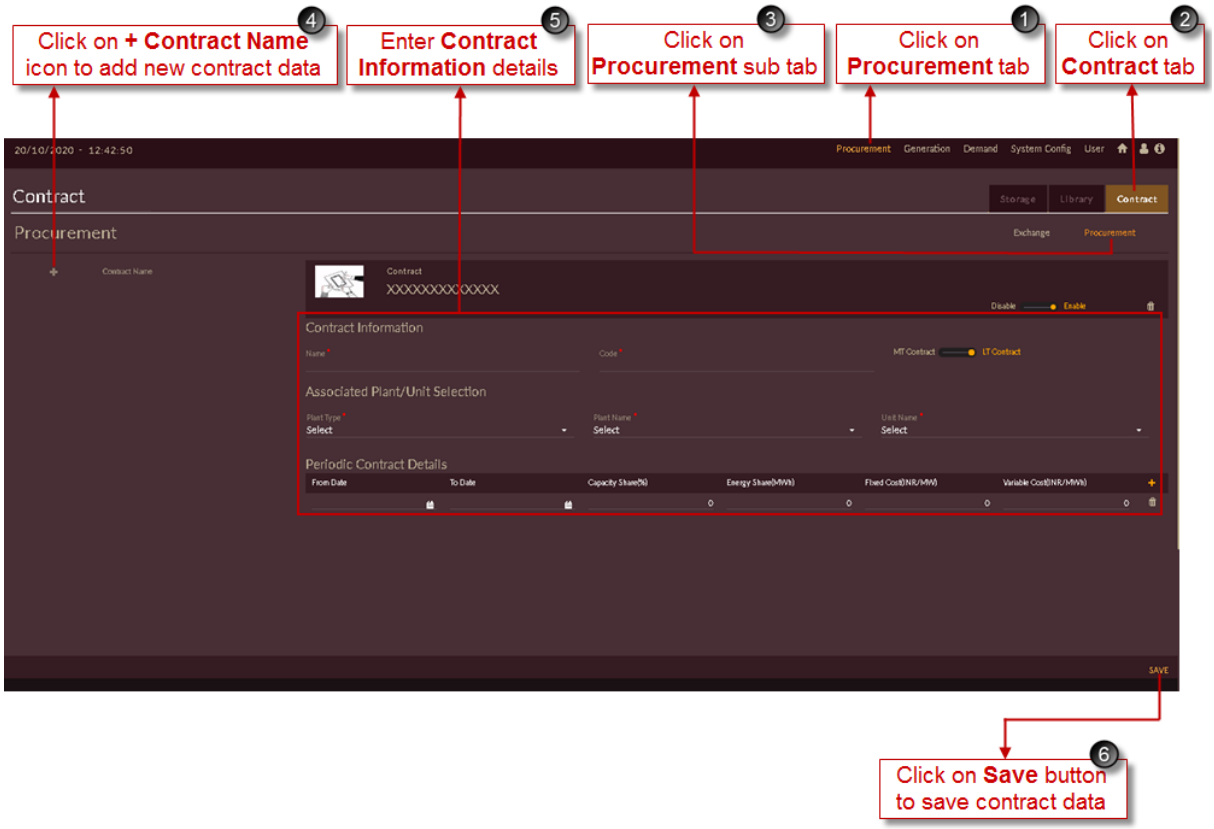
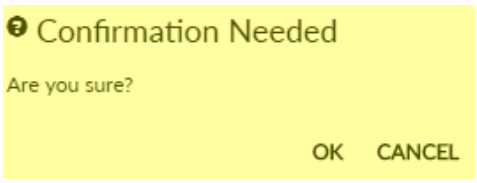


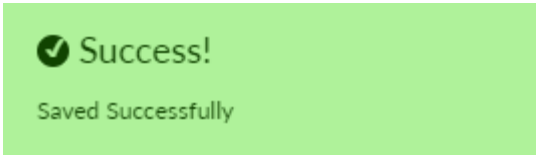
Figure 241. Blank Record to add Contract plant

6. Click on **SAVE** button SAVE to save contract plant.

The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Saved Successfully" message appears. Click on **CANCEL** to discard the task.



7. List of successfully added contract plants will appear on left side of the screen as shown in Figure 242.
8. You can view the contract information of selected contract and you can also edit the details if required.

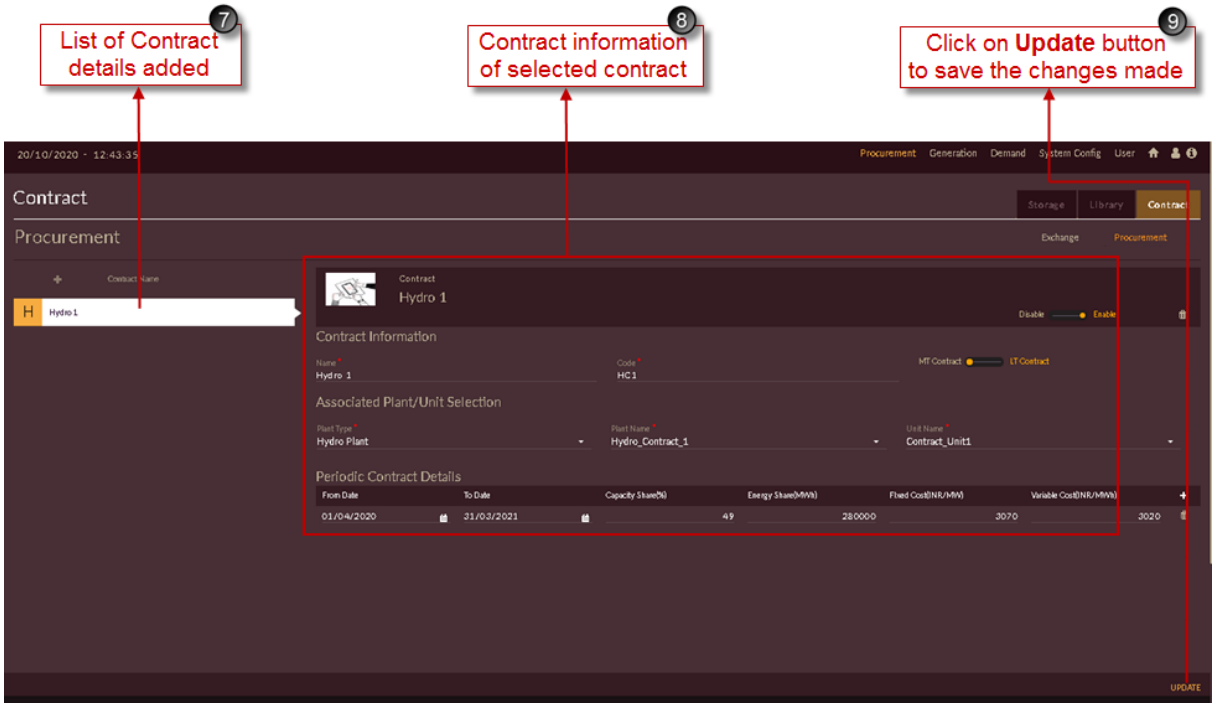
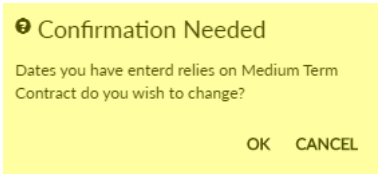


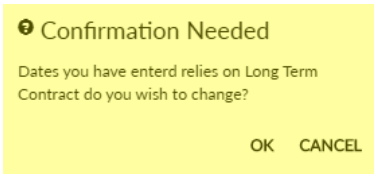
Figure 242. Added Contract Plant

9. Click on **UPDATE** UPDATE button to save the changes.

   Based on study period edited following message appears.

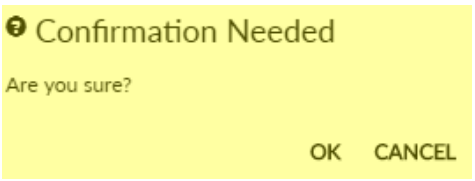


OR

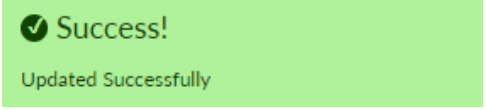


   Click on **OK**

   The "Are you sure?" confirmation message appears.



   Click on **OK** to accept the changes made. The "Updated successfully" message appears.



Repeat above steps to add and update new Contract plants into the software.

10. Once all the Contract plants are added and configured the final Contract > Procurement page will appear as shown in Figure 243. List of all the Procurement/Contract plants will appear on left of the applicication page.

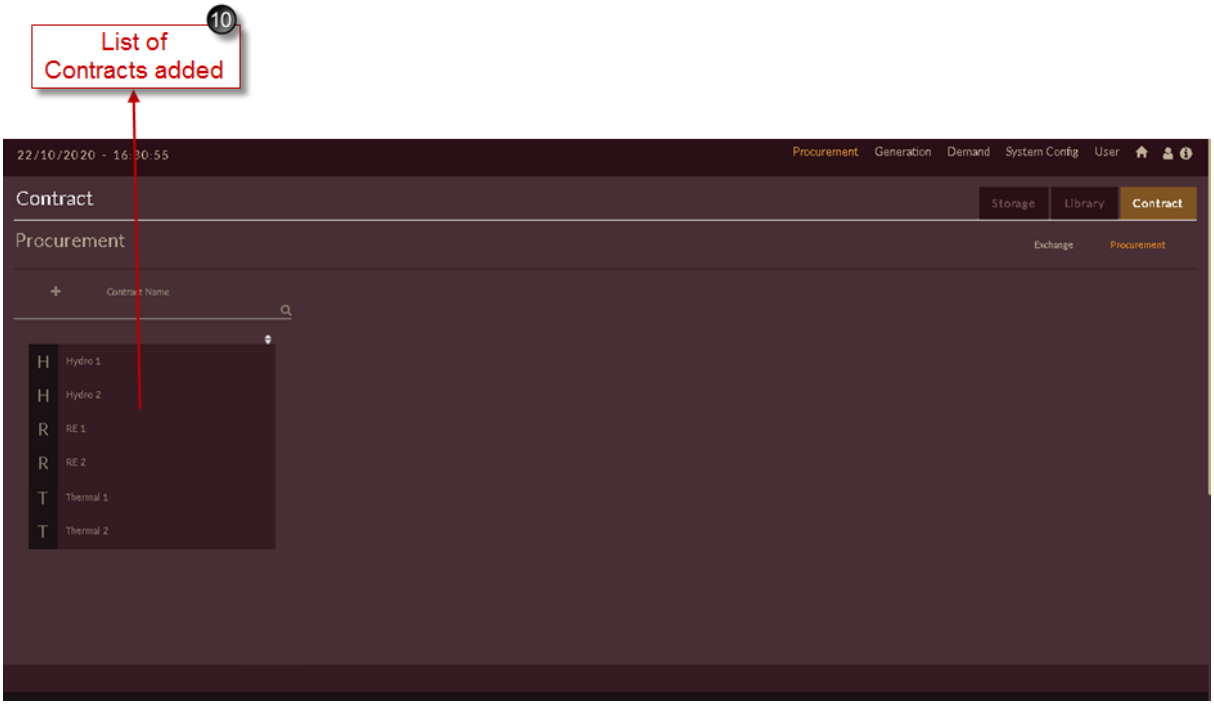


Figure 243. List of Configured Contract Plants

2.3.2.3 RE GENERATION PORTFOLIO FOR RE CONTRACTS

Once all available RE contracts are configured into the software for PPO studies, we need reference generation profile for the plant energy dispatch.

You may get the generation profile for RE plants/contracts from SLDC data of respective state.

You can consider previous year's generation/dispatch pattern as reference generation profile.

Hourly RE generation profile is required for PPO – Studies in DISCOM – REPOSE software.

Once you gather generation profiles for all RE contracts, we need to configure them into the software.

This section helps us to configure/upload RE contract generation profile.

STEPS TO CREATE RE CONTRACT PORTFOLIO:

1. Click on **Procurement** tab. The **Procurement** tab appears as shown in Figure 244.
2. Click on **Library** tab.
3. Click on **Add RE Contract Portfolio** icon to add new RE Contract Generation Portfolio.

Once you click on **Add RE Contract Portfolio** icon, you will see the blank record appeared on page as shown in Figure 244.

4. Enter appropriate RE contract generation portfolio name in **Name** field and reference year of which profile you are uploading in **Year** field.

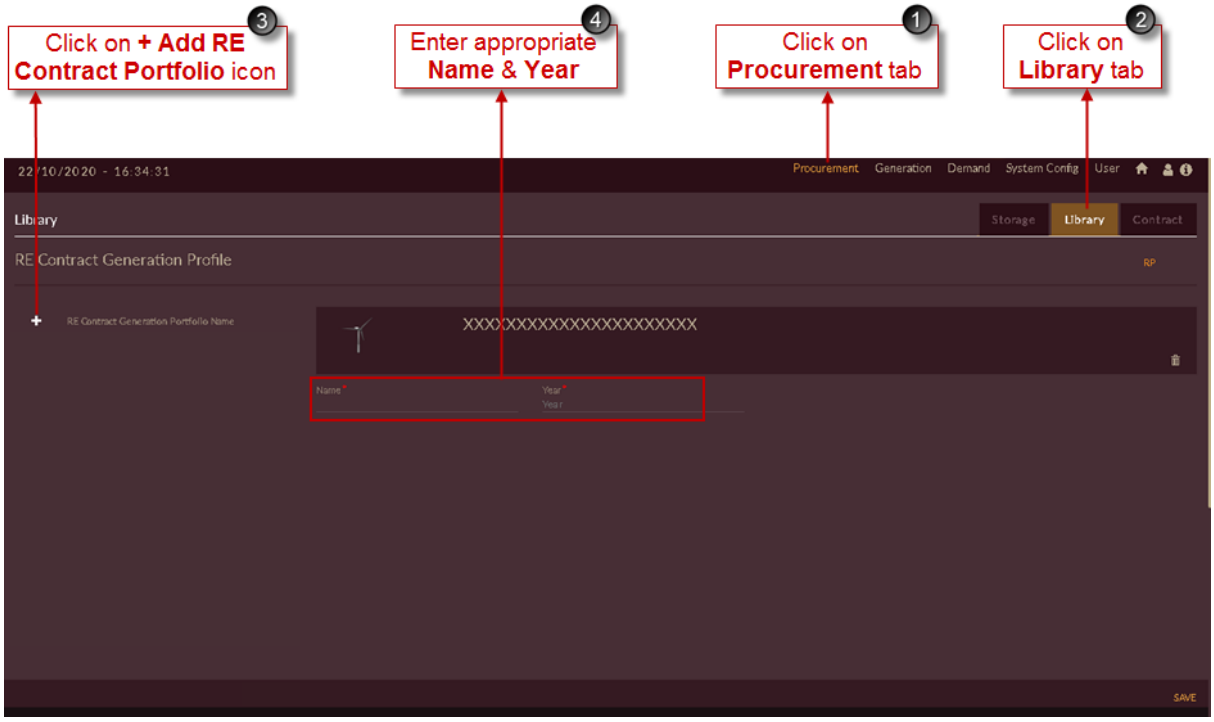
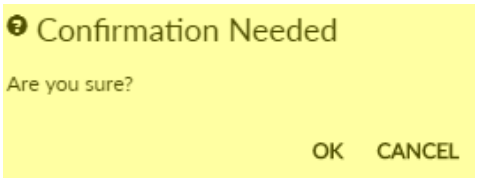


Figure 244. Steps to add RE Contract Portfolio

5. Figure 245 shows sample name and year entered to create the RE contract generation portfolio.

Figure 245. Saving RE Contract Generation Portfolio

6. Click on the **SAVE** SAVE button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

STEPS TO UPLOAD RE CONTRACT GENERATION PROFILE:

Successfully added/configured RE contract generation portfolio reflects on left of the page as shown in Figure 246.

7. Select configured RE portfolio.
8. RE contracts added in MT/LT PROCUREMENT section appears as list showing **Pending** Pending indication as RE contract generation profile is not uploaded.
9. To upload RE contract generation profile, click on **Upload** icon for which RE contract plant you need to upload. Here **RE 2** contract is shown.

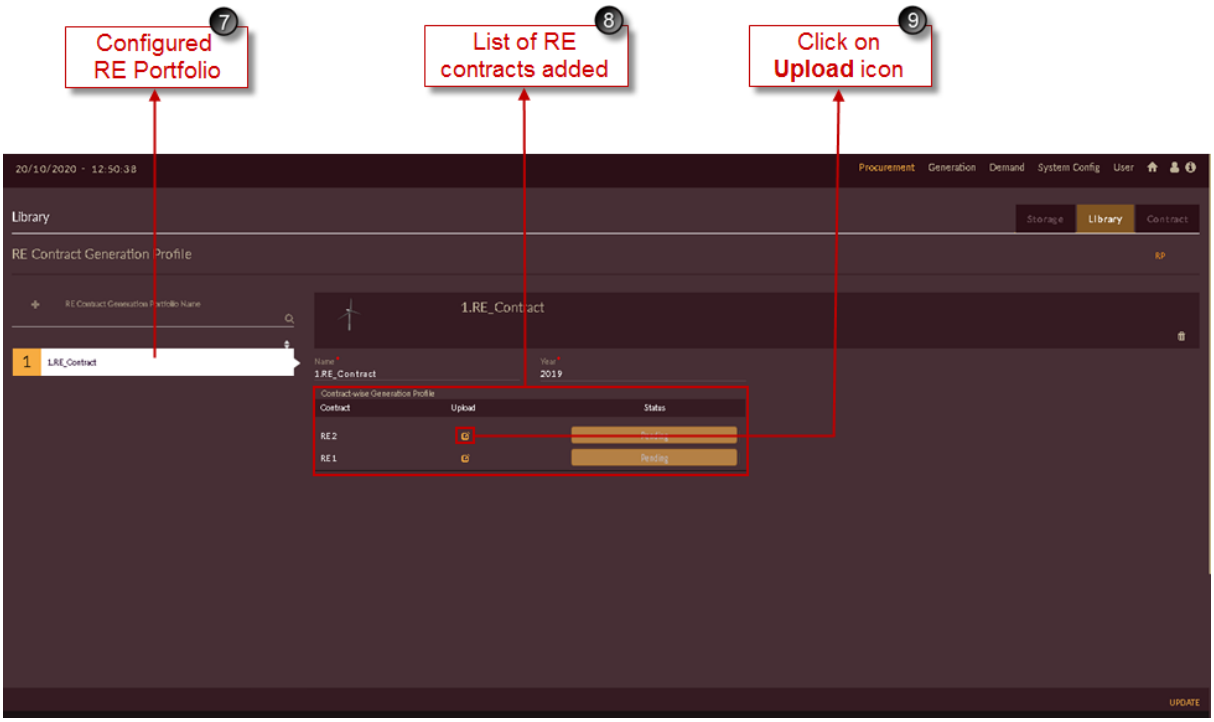


Figure 246. Configured RE Contract Generation Portfolio

Once you click on **Upload** icon for selected RE contract, page will appear as shown in Figure 247.

10. Click on **Download Template** icon.

11. Template gets downloaded in **.xlsx** format and appears in taskbar of your browser.

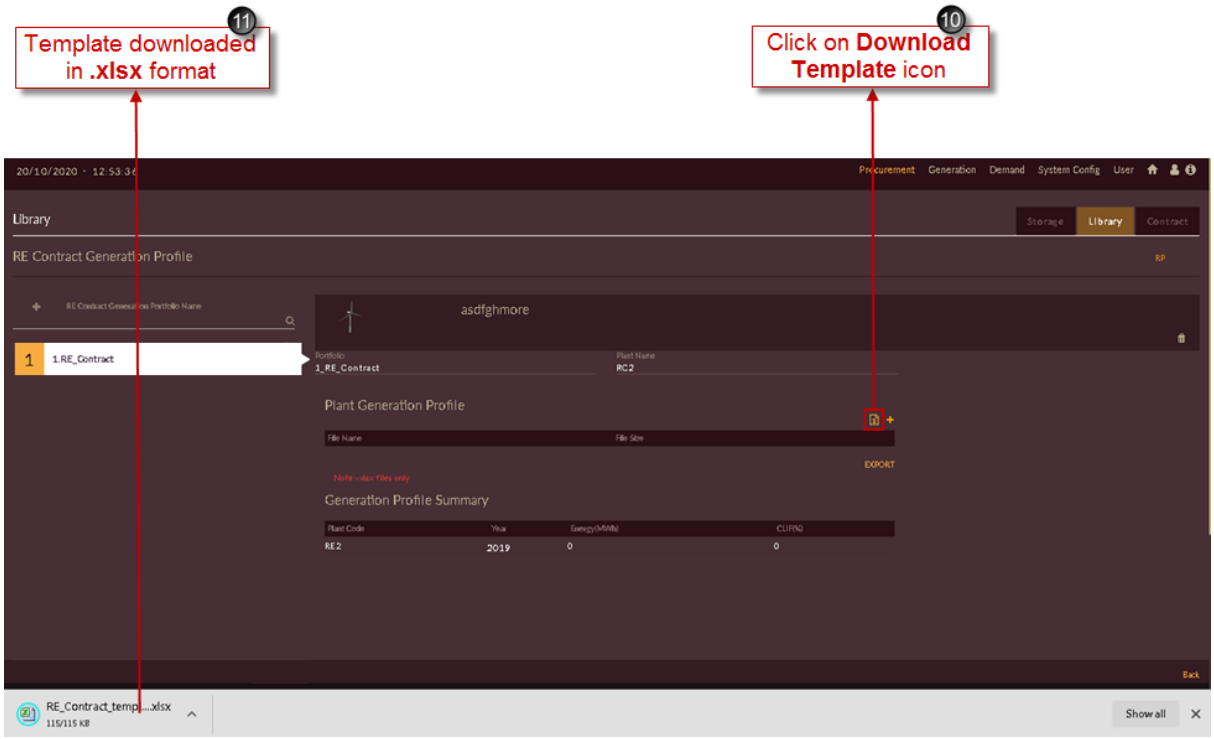
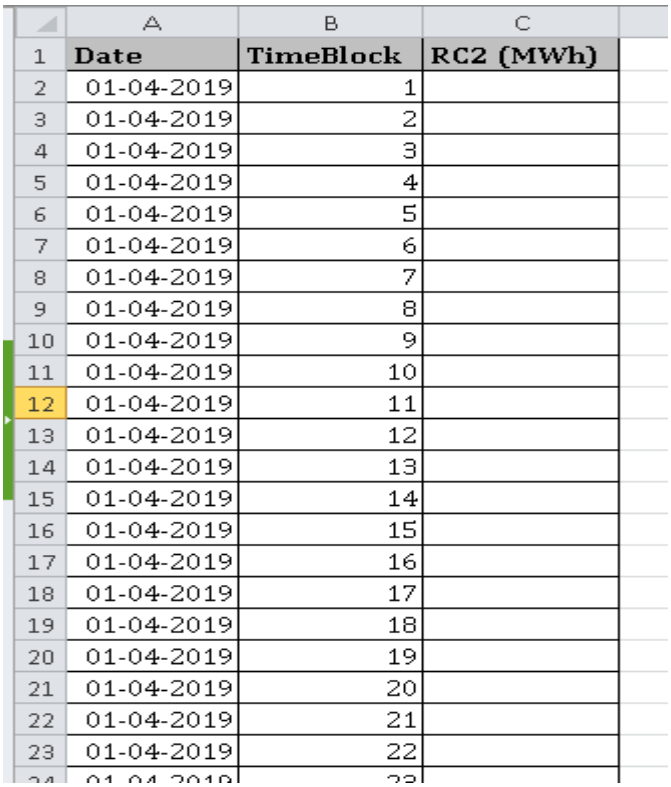


Figure 247. Downloading RE Contract Generation Profile Template

Template will be downloaded for hourly (in time block) in **.xlsx** format with selected RE contract name (here RE 2) as shown in Figure 248.

Upload the generation profile available for respective RE contract and save the file in **.xlsx** format only.



	A	B	C
1	Date	TimeBlock	RC2 (MWh)
2	01-04-2019	1	
3	01-04-2019	2	
4	01-04-2019	3	
5	01-04-2019	4	
6	01-04-2019	5	
7	01-04-2019	6	
8	01-04-2019	7	
9	01-04-2019	8	
10	01-04-2019	9	
11	01-04-2019	10	
12	01-04-2019	11	
13	01-04-2019	12	
14	01-04-2019	13	
15	01-04-2019	14	
16	01-04-2019	15	
17	01-04-2019	16	
18	01-04-2019	17	
19	01-04-2019	18	
20	01-04-2019	19	
21	01-04-2019	20	
22	01-04-2019	21	
23	01-04-2019	22	

Figure 248. Downloaded RE Contract Generation Profile Template

After file is saved with actual data, you have to upload it in software.

12. Click on **Select Files To Upload** icon, select the saved template.
13. Once you select the template, **File Name** will be displayed along with **File Size**.
14. Click on **Import** IMPORT button to upload the profile into the software.

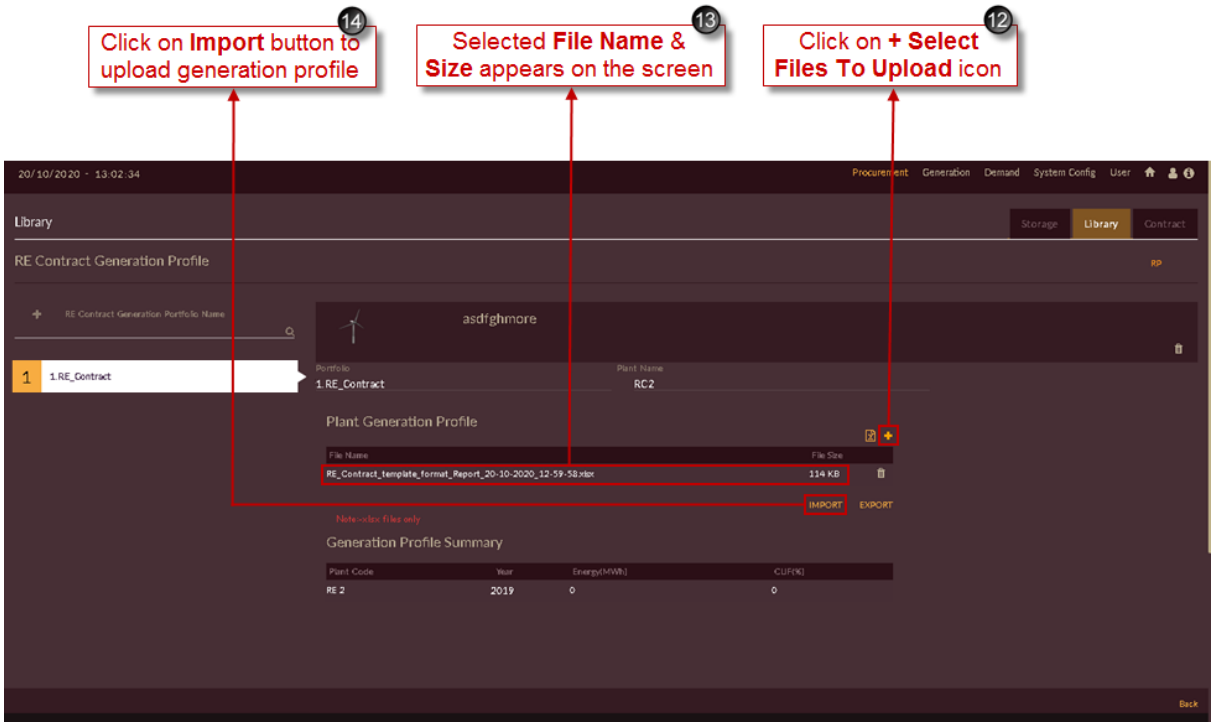


Figure 249. Steps to import RE Contract Generation Profile

15. Once file is imported successfully, **Generation Profile Summary – Energy (MWh)** will display on the page.
16. Click on **Export** EXPORT button to download and view the uploaded or existing genertaion profile for selected plant.

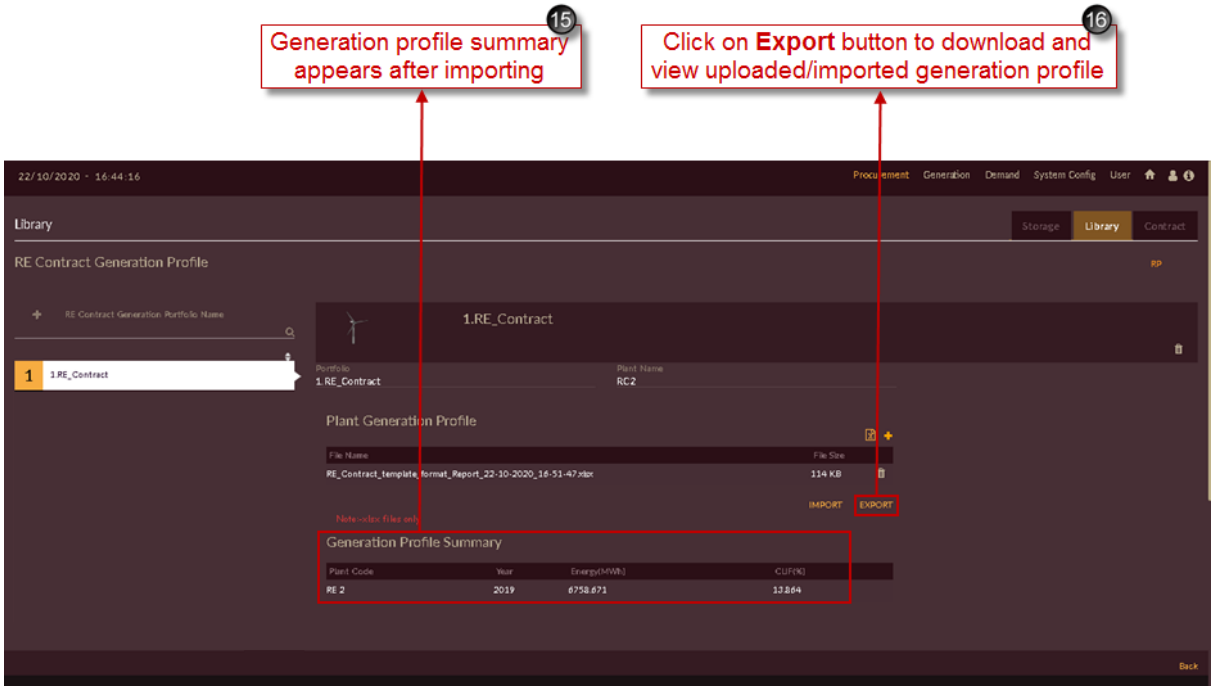


Figure 250. Imported RE Generation Profile

Once you click on **Export** EXPORT button the imported RE contract generation profile will get downloaded in .xlsx format and will appear as shown in Figure 251.

	A	B	C
1	Date	TimeBlock	RC2 (MWh)
2	01-04-2019	1	0.0
3	01-04-2019	2	0.0
4	01-04-2019	3	0.0
5	01-04-2019	4	0.0
6	01-04-2019	5	0.0
7	01-04-2019	6	0.16
8	01-04-2019	7	1.04
9	01-04-2019	8	2.03
10	01-04-2019	9	3.01
11	01-04-2019	10	3.12
12	01-04-2019	11	3.45
13	01-04-2019	12	3.42
14	01-04-2019	13	3.47
15	01-04-2019	14	2.62
16	01-04-2019	15	2.03
17	01-04-2019	16	1.12
18	01-04-2019	17	0.07
19	01-04-2019	18	0.0
20	01-04-2019	19	0.0
21	01-04-2019	20	0.0
22	01-04-2019	21	0.0
23	01-04-2019	22	0.0

Figure 251. Exported RE Contract Generation Profile

17. Once profile is imported succesfully, **Pending** Pending indication will get changed to **Uploaded** Uploaded indication as shown in Figure 252.

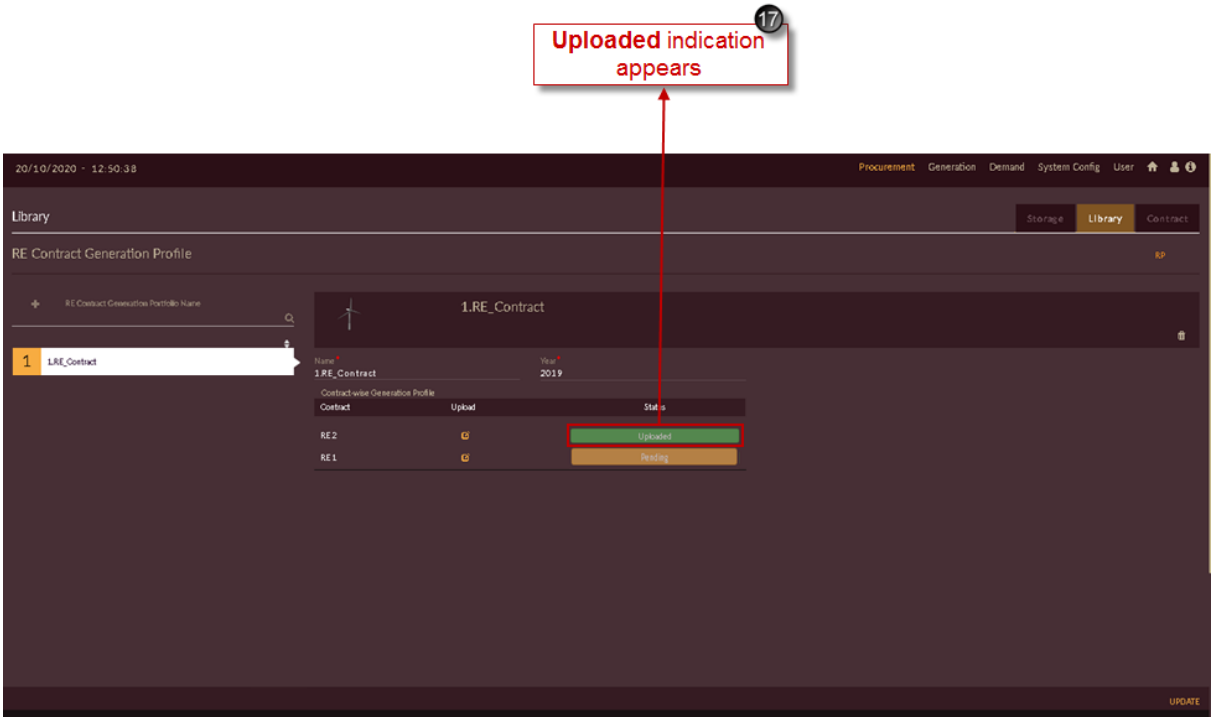


Figure 252. Uploaded Profile Indication

Repeat above steps to add RE contract generation profile for remaining RE contracts.

Once RE contract generation profiles are imported to all RE contracts, page will appear as shown in Figure 253.

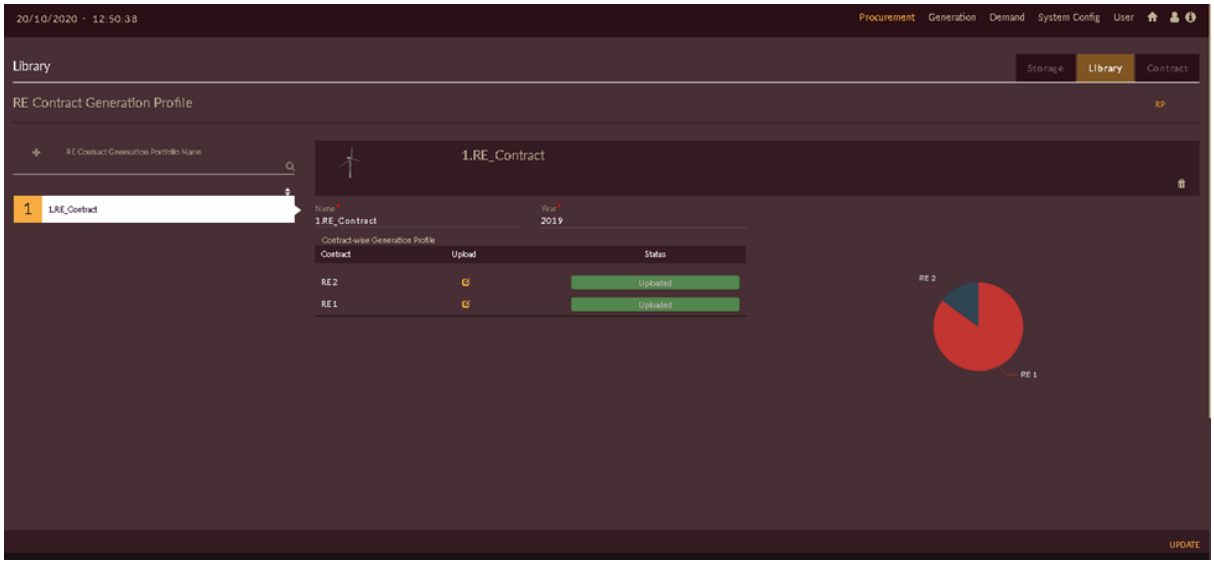


Figure 253. Successfully Created RE Generation Portfolio

2.3.2.4 STORAGE

This section helps you to configure storage plant data. Follow below steps to add Storage data,

1. Click on **Procurement** tab. The **Procurement** tab appears.
2. By-default **Storage** tab will be selected.
3. Click on **Add Storage** icon to add storage plant into the application.

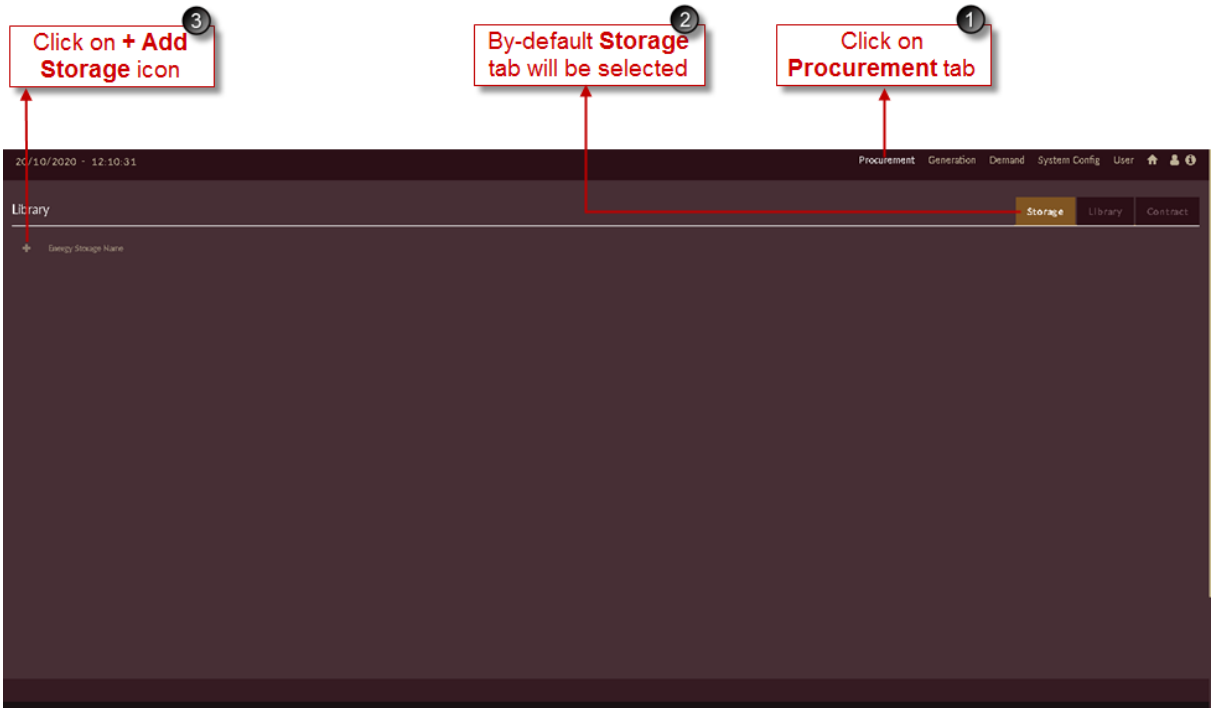
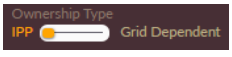


Figure 254. Steps to Add Storage Plant

Once you click on **Add Storage** icon, you will see the blank record appeared on page as shown in Figure 255.

4. Enter the **Storage Information** details like;
    - Appropriate name in **Name** field
    - Appropriate code in **Code** field
    - **Maximum Generation (MW)** and **Energy Availability Per Day (MWh)**
    - **Storage Efficiency (%)**
    - **Ramp Up** and **Ramp Down Rate** in **MW/Min**
    - **Date of Commissioning** and **Retirement** of storage plant
5. Select correct **Ownership Type** of storage plant i.e IPP/Grid Dependent using 

toggle.
6. Fill the **Cost Details** like **Fixed Cost (INR/MW)** and **Variable Cost (INR/MWh)** along with **From** and **To Dates**.
7. If you have selected ownership type as **IPP** for storage plant, you need to enter the houlry **Generation Profile** in **MWh**.

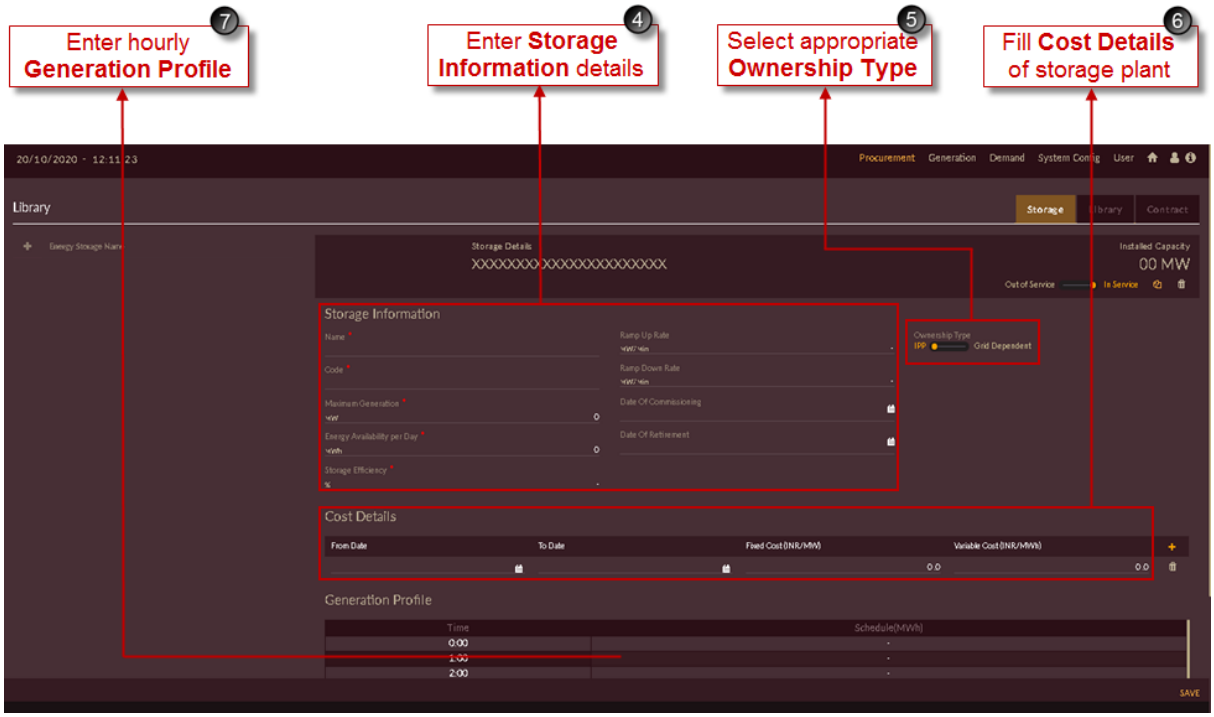


Figure 255. Blank Record for Adding Storage Plant

Figure 256 shows the sample storage data added.

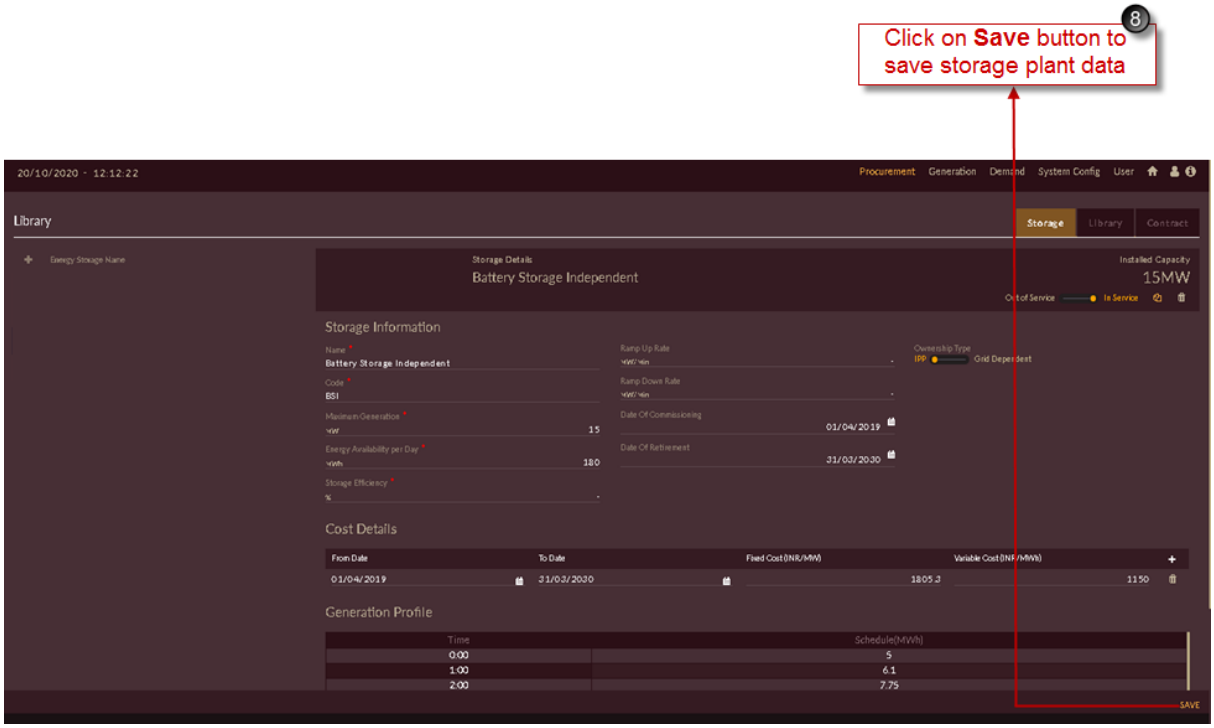
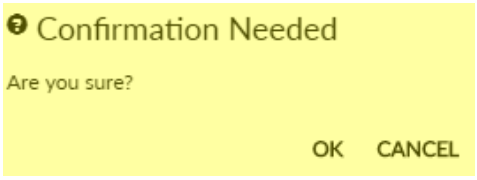


Figure 256. Saving Sample Storage Plant

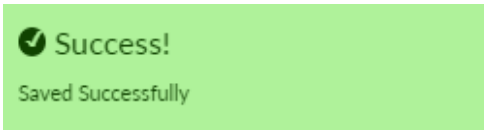
8. Click on the **SAVE** SAVE button to add storage plant into the software.

   The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Saved successfully" message appears.

Click on **CANCEL** to discard the task.



Repeat above steps to add multiple storage plants into the application.

The list of successfully added storage plants will appear on left of the screen as shown in Figure 257.

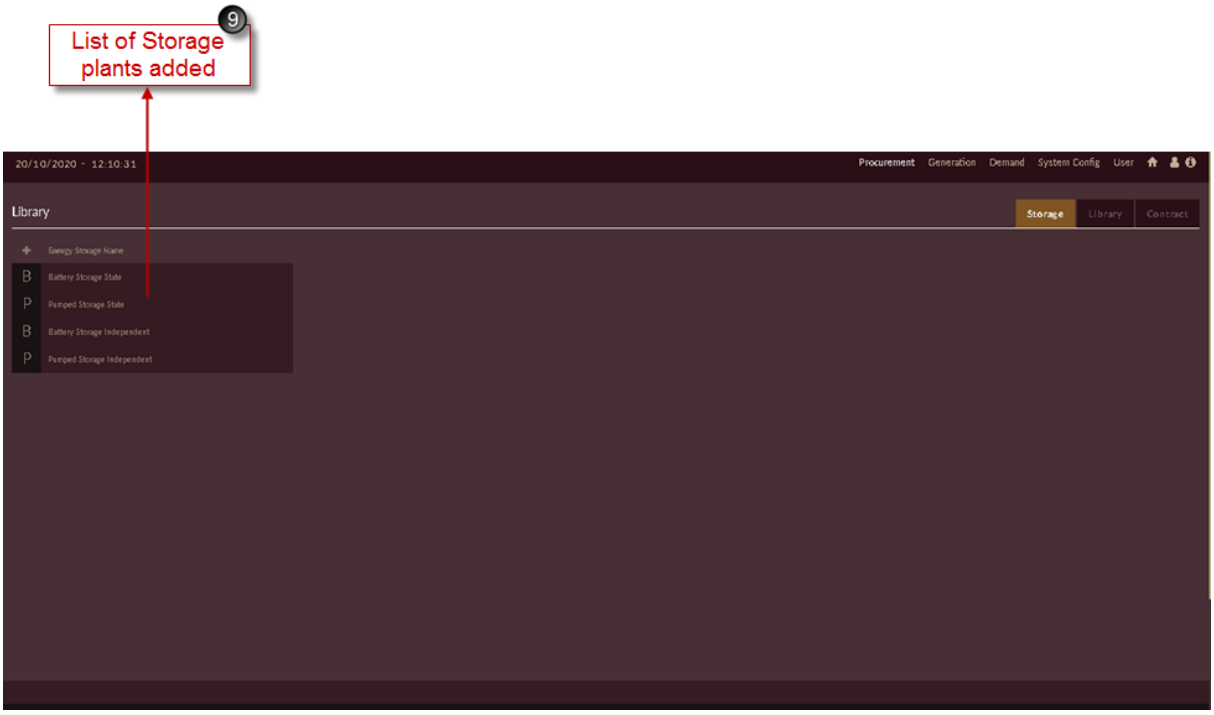


Figure 257. List of Configured Storage Plants

2.3.3 Additional Parameters

The additional parameters include the system configuration information such as seasons and Transmission & Distribution Losses which we have seen in module 1. Apart from those parameters we have RPO – Renewable Purchase Obligation to be added for PPO studies as this parameter is observed to have higher impact on the power procurement optimization studies. The RPO module is provided under **SYSTEM CONFIG** tab.

2.3.3.1 RENEWABLE PURCHASE OBLIGATION (RPO)

Renewable Purchase Obligation (RPO) mandates that all electricity distribution licensees should purchase or produce a minimum specified quantity of their requirements from Renewable Energy

Sources. This is as per the Indian Electricity Act, 2003. The State Electricity Regulatory Commissions fix the minimum RPO for the State.

STEPS TO CONFIGURE RENEWABLE PURCHASE OBLIGATION (RPO) INTO THE SOFTWARE:

1. Login to the software and access **System Config** tab. The **System Config** tab appears.
2. Click on the **RPO** tab. The **RPO** tab appears.

   After you click on RPO tab the software page looks like as shown in Figure 258.

3. Enter year wise RPO targets in % for Solar, Wind, Biomass, Small Hydro and Other Renewables in the table.

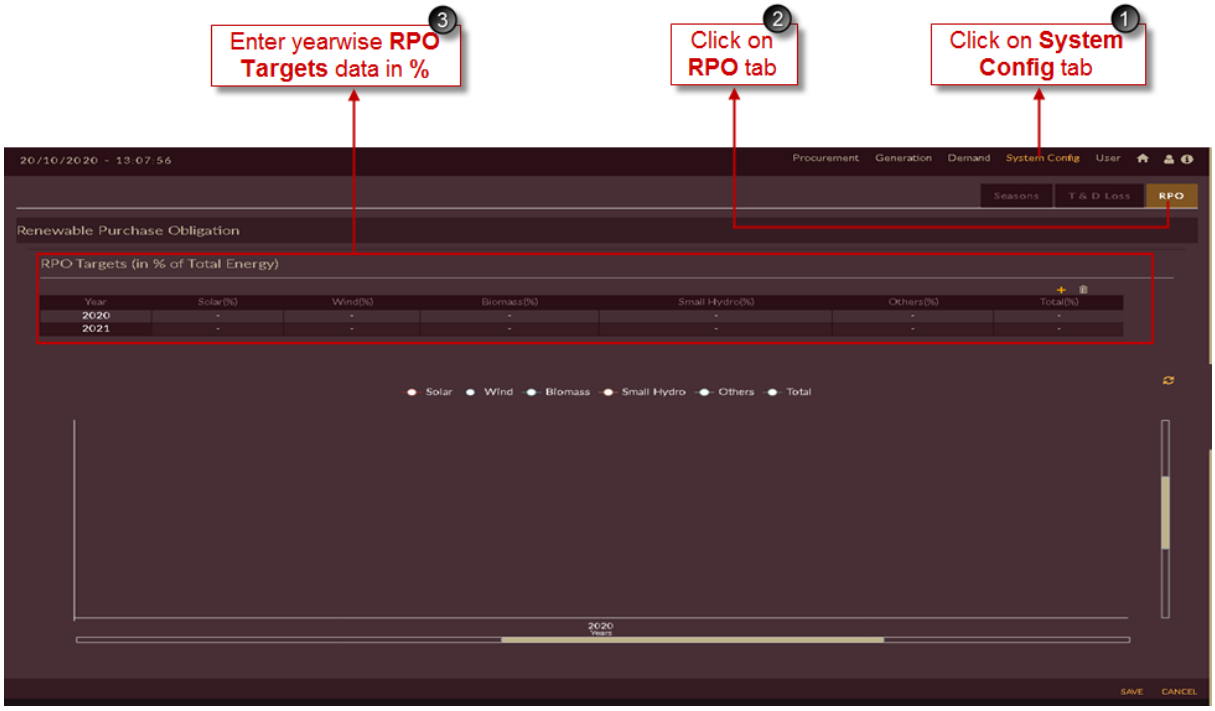
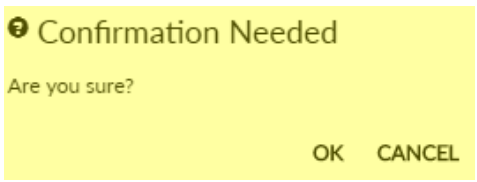


Figure 258. Steps to Add RPO Targets Data

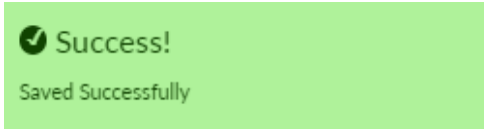
4. Click on the **SAVE**  button to add RPO targets into the software.

   The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Saved successfully" message appears.

Click on **CANCEL** to discard the task.



5. Once RPO targets are saved corresponding graph appears on the screen as shown in Figure 259.

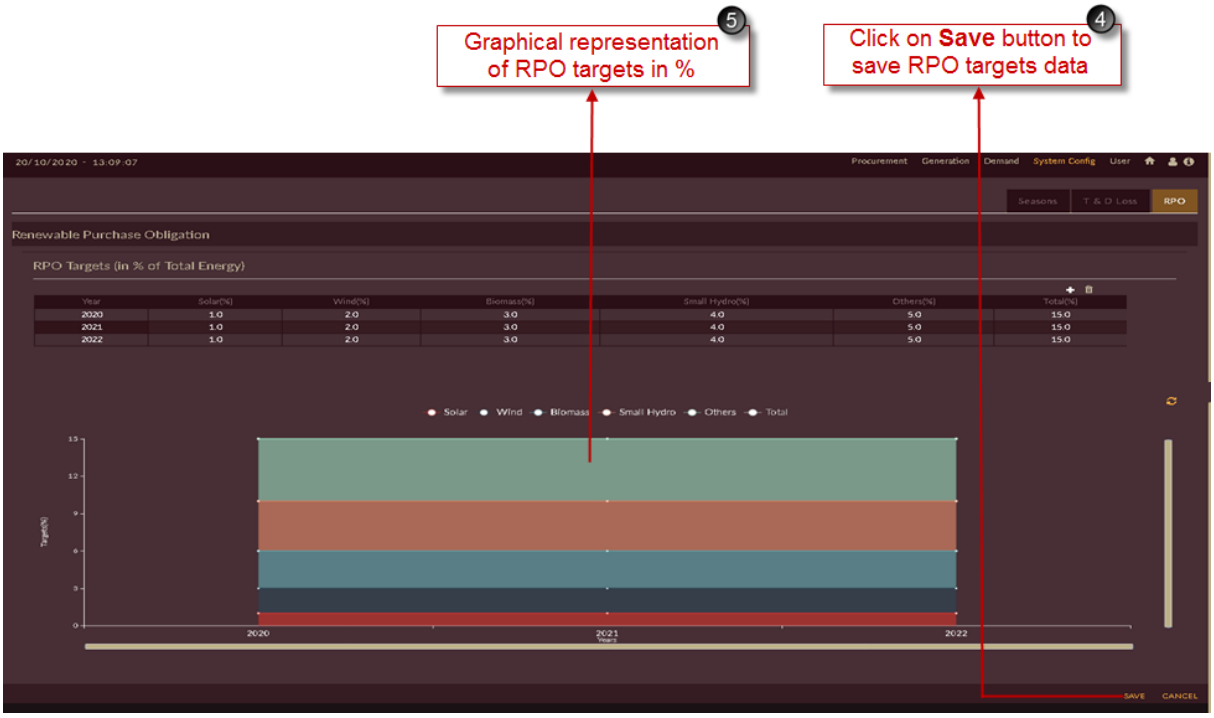


Figure 259. Saving RPO Target Data

2.3.4 Building Scenarios for Power Procurement Optimization Studies

Once you feed all the inputs to the software now it's time to perform the **Power Procurement Optimization Studies.**

For performing studies of power procurement optimization in DISCOM – REPOSE software you have to create study scenarios.

For performing PPO – Power Procurement Optimization studies you have to give demand data as input.

Since we have created **Business As usual (BAU)** scenario for Demand forecast studies we have demand data as output from that BAU scenario we can use as input for PPO studies.

2.3.4.1 CREATE PPO SCENARIO

This section gives you the steps to access and create PPO scenario.

Follow these steps to add a scenario.

1. Login to the software. The **Dashboard/ Home** page appears.

   Alternatively, click on **Home** icon to access the execution page. The page will appear as shown in Figure 260.

(The scenarios which we created i.e. **Business As usual (BAU)** and **Scenario with Drivers** in **BUILDING SCENARIOS FOR DEMAND FORECAST STUDIES** section and **IRM Base case BUILDING SCENARIOS FOR INTEGRATED RESOURCE MAPPING STUDIES** section appears in the scenario list).

2. Click on **settings** option provided on PPO block 

to add the scenario creation page.

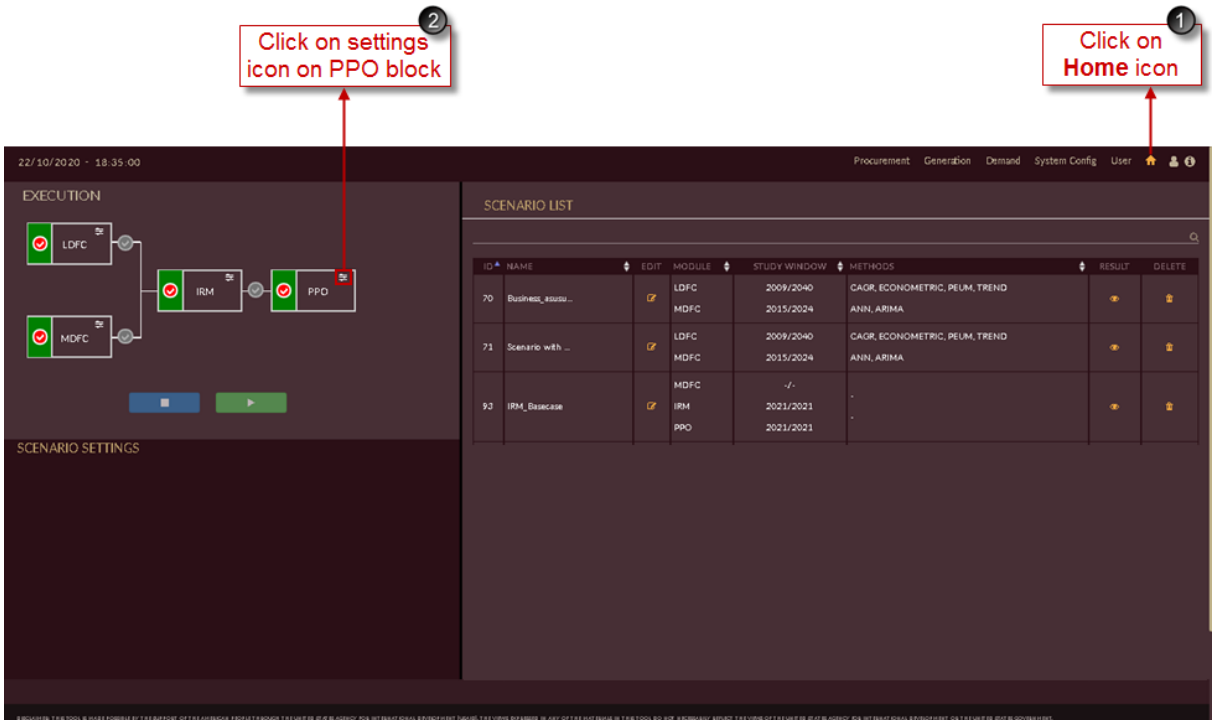


Figure 260. DISCOM – REPOSE Home Page

Once you click settings icon blank record will appear on the page as shown in Figure 261.

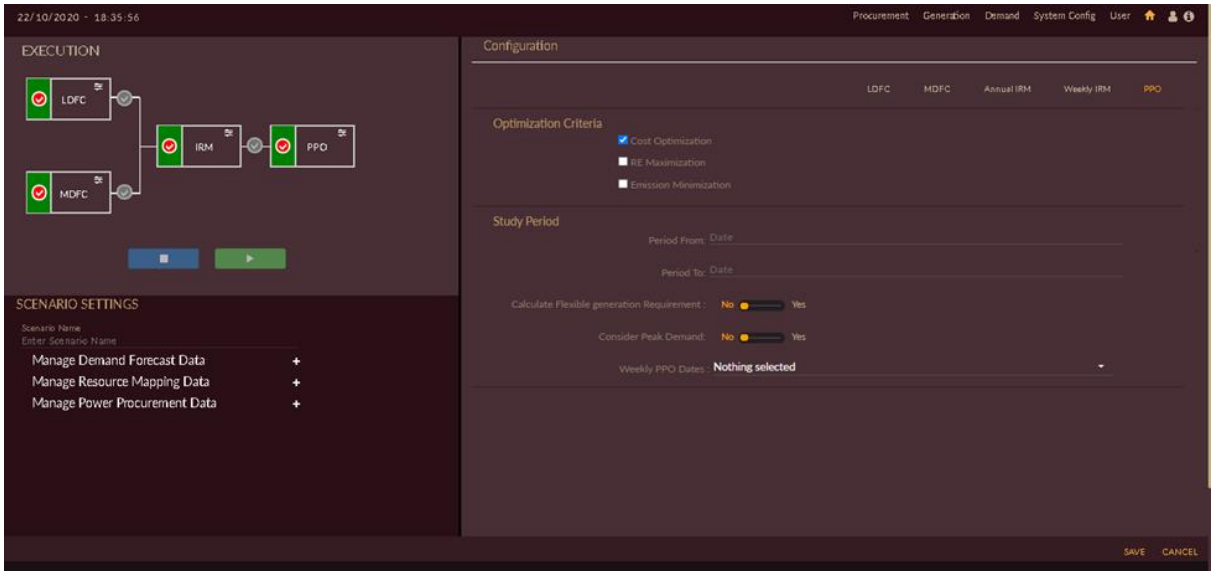


Figure 261. Blank Record to Create Scenario for PPO Studies

3. By default **PPO** PPO option will be selected.
4. Give appropriate scenario name in **Scenario Name** field, here we have named as **'PPO_Basecase'**.
5. Select required **Optimization Criteria**, study period for PPO studies by choosing **Period From** and **Period To** from the calender drop-down and other options required for PPO studies.

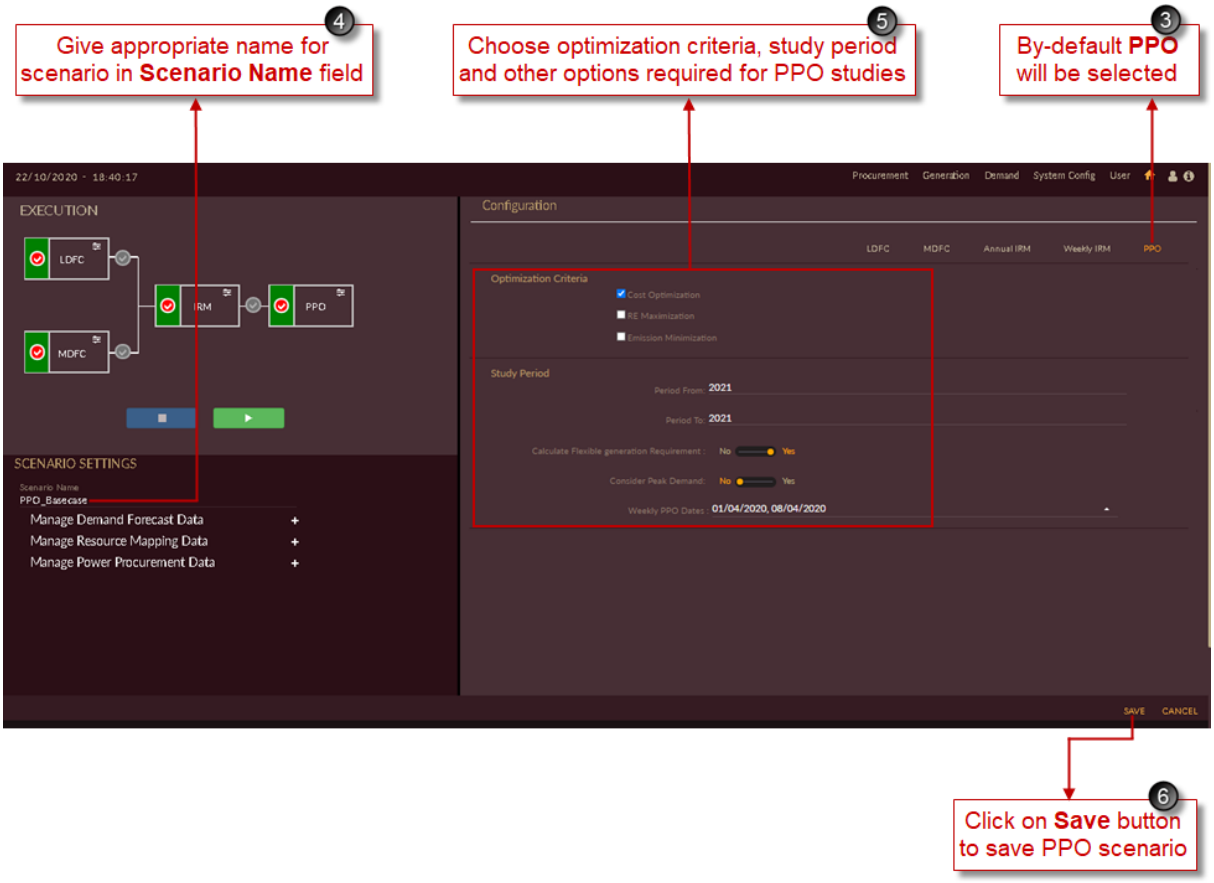
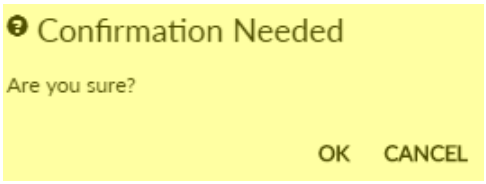


Figure 262. Creating PPO Study Period

6. Click on the **SAVE** SAVE button to save the PPO scenario settings.

   The **"Are you sure?"** confirmation message appears.



   Click on the **OK** icon to save the scenario.

   The "Saved Successfully" message appears.

7. The scenario appears in the scenario list as shown in Figure 263.

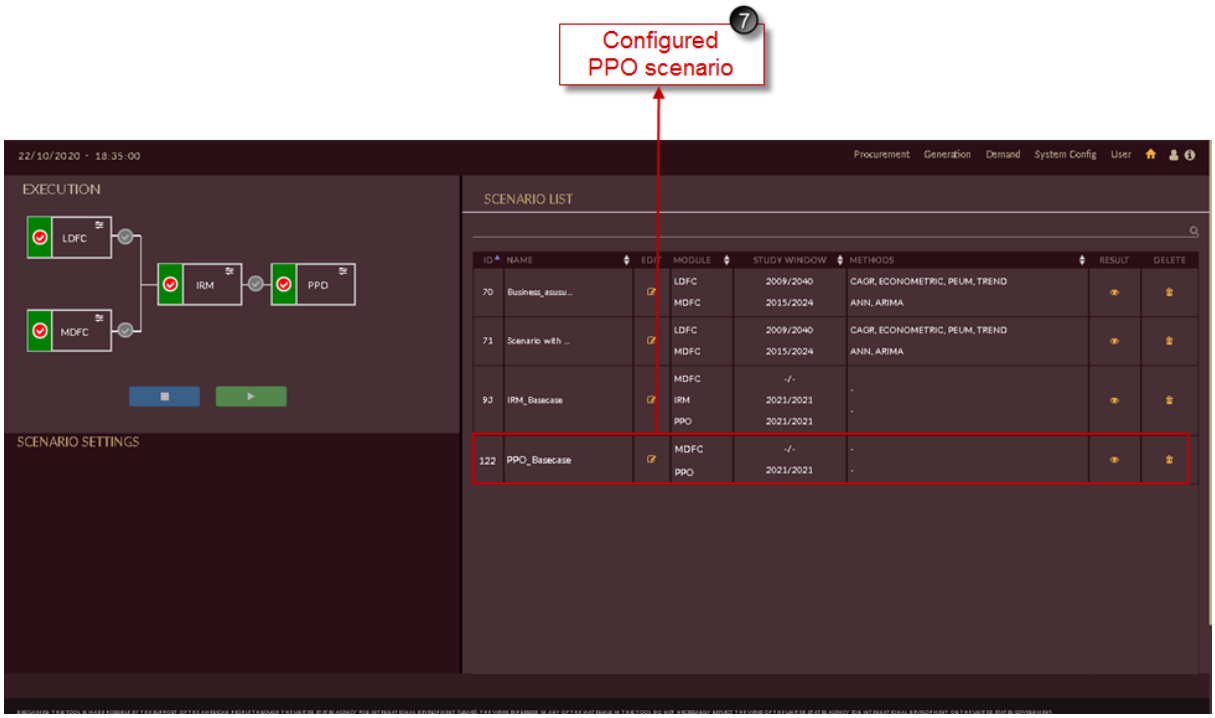


Figure 263. PPO Scenario in Scenario List Page

The scenario page and the scenario will be having following features;

-  icon to sort the records.
- **View Result**  icon to view the results.
- **Edit Scenario**  icon to edit the scenario.
- **Delete**  icon to remove the scenario from the list.

2.3.4.2 EDIT IRM SCENARIO

Once scenario is created and it appears on the page it will not be having any data, you have to configure all the data which you have given as input.

This section gives explains how to edit and configure the scenario.

Follow these steps to edit a scenario.

1. In the scenario list shown in Figure 264 click on the Edit scenario  icon for PPO_Basecase scenario.

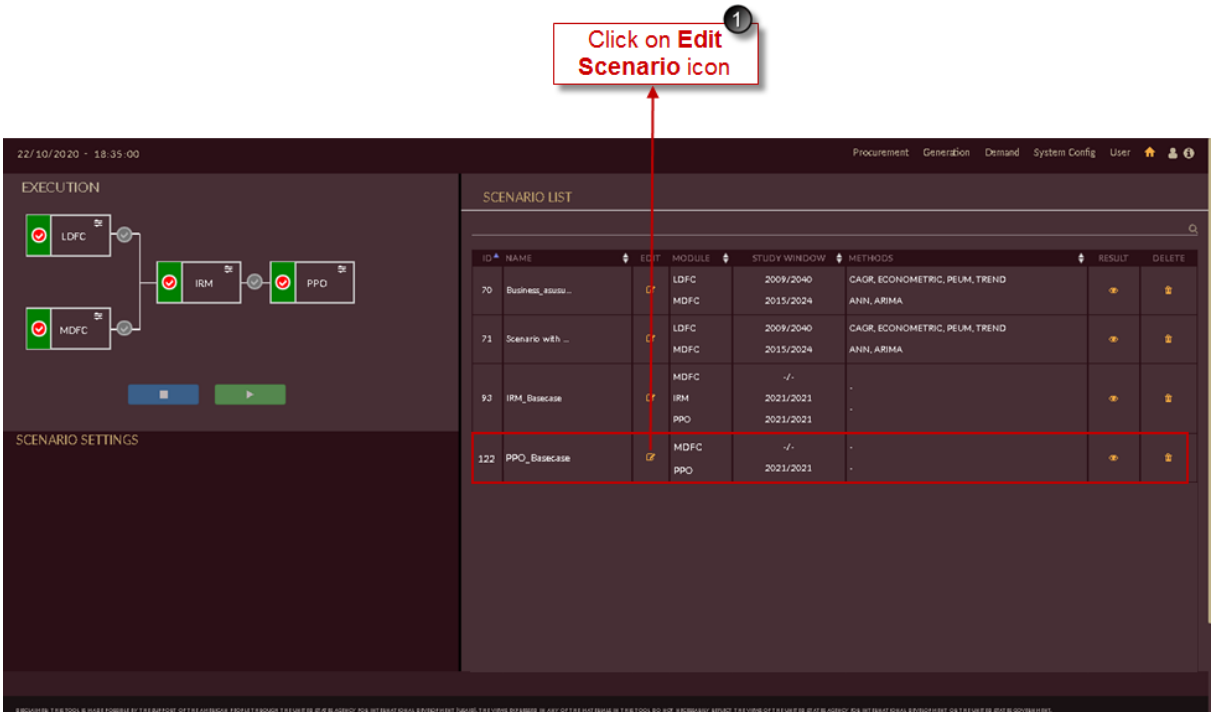


Figure 264. Editing PPO Scenario

Once Scenario is created you need add the required data for studies from raw data section by selecting required data's from **Manage Power Procurement Data** drop-down list.

Once you click **Edit scenario** icon page will appear as shown in Figure 265.

2. Click on **Manage Power Procurement Data** icon in PPO Base case scenario.
3. Once you click **Manage Power Procurement Data** icon, list of data to be configured will appear as list. If we see Figure 265 there are eight different data to be configured to the scenario, they are;
    - Demand Data
    - Hydro Plant Data
    - Thermal Plant Data
    - RE Plant Data
    - Procurement
    - Exchange
    - RPO Targets
    - Energy Storage

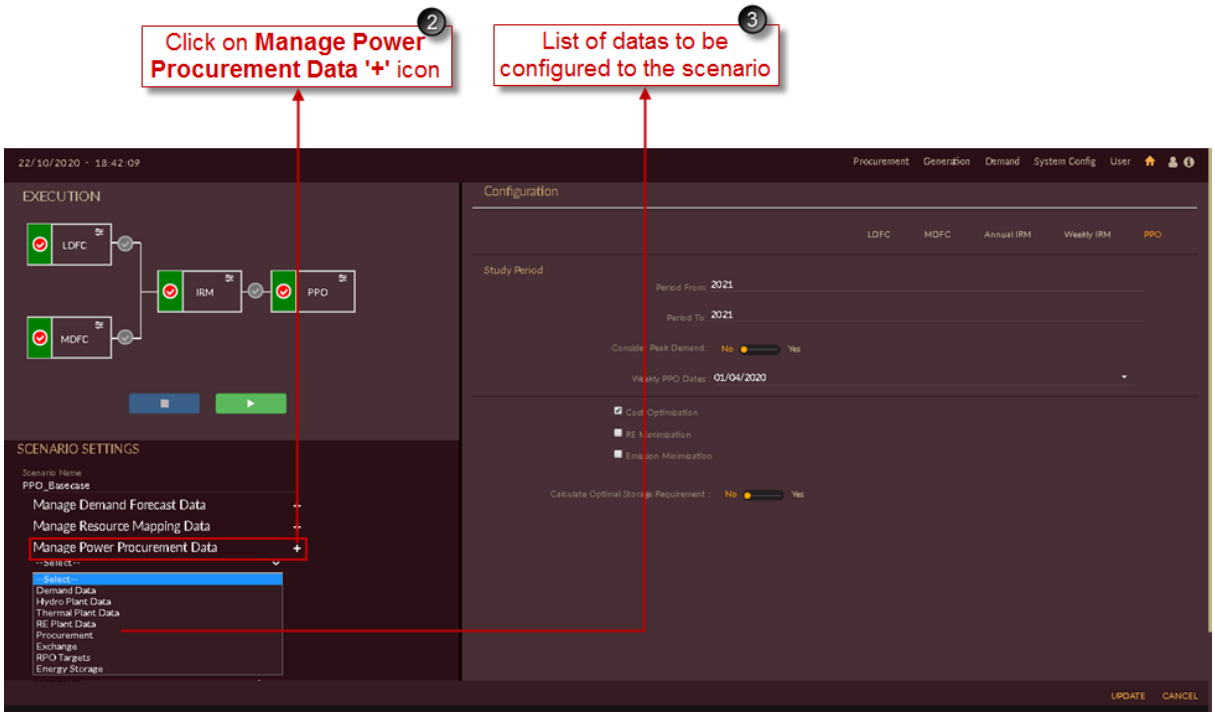


Figure 265. Managing Power Procurement Data

STEPS TO EDIT/CONFIGURE DEMAND DATA INTO PPO_BASECASE:

Editing/Configuring demand data into PPO_Basecase scenario is similar as we configured demand data to IRM_Basecase.

So, you can follow the same steps as shown in **STEPS TO EDIT/CONFIGURE DEMAND DATA INTO IRM_BASECASE**: for configuring demand data into PPO_Basecase.

STEPS TO EDIT/CONFIGURE HYDRO PLANT DATA INTO PPO_BASECASE:

Editing/Configuring hydro plant data into PPO_Basecase scenario is similar as we configured hydro plant data to IRM_Basecase.

So, you can follow the same steps as shown in **STEPS TO EDIT/CONFIGURE HYDRO PLANT DATA INTO IRM_BASECASE**: for configuring demand data into PPO_Basecase.

STEPS TO EDIT/CONFIGURE THERMAL PLANT DATA INTO PPO_BASECASE:

Editing/Configuring thermal plant data into PPO_Basecase scenario is similar as we configured thermal plant data to IRM_Basecase.

So, you can follow the same steps as shown in **STEPS TO EDIT/CONFIGURE THERMAL PLANT DATA INTO IRM_BASECASE**: for configuring demand data into PPO_Basecase.

STEPS TO EDIT/CONFIGURE RE PLANT DATA INTO PPO_BASECASE:

Editing/Configuring RE plant data into PPO_Basecase scenario is similar as we configured RE plant data to IRM_Basecase.

So, you can follow the same steps as shown in **STEPS TO EDIT/CONFIGURE RE PLANT DATA INTO IRM_BASECASE**: for configuring demand data into PPO_Basecase.

Once you successfully configure demand, hydro, thermal and RE data to the scenario the scenario screen will appear as shown in Figure 266.

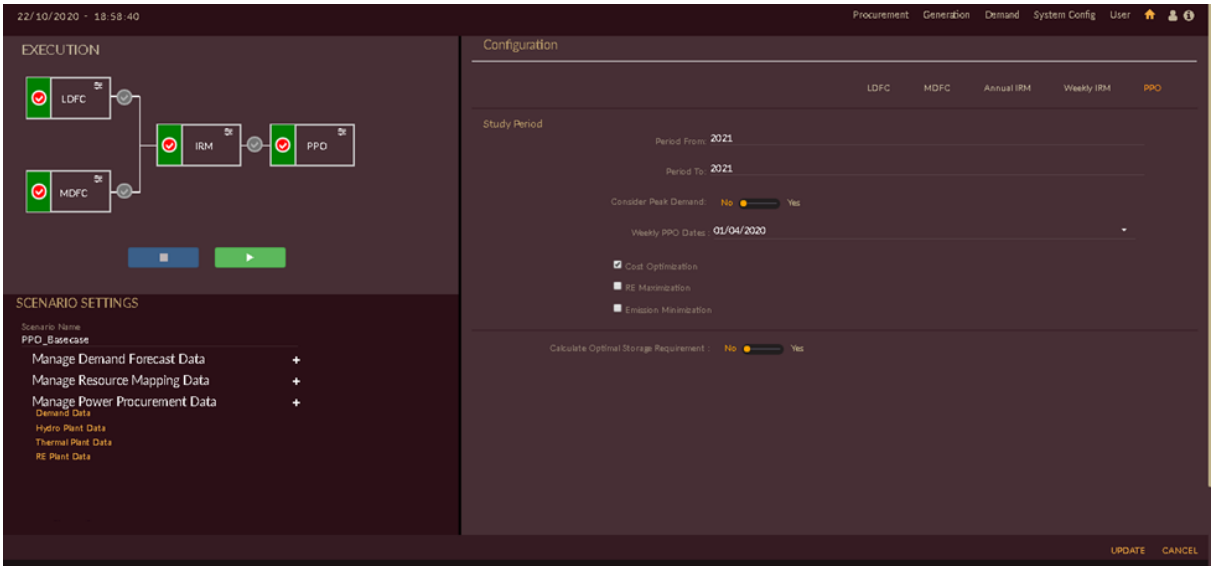


Figure 266. Demand, Hydro, Thermal, RE Data configured to PPO Scenario

STEPS TO EDIT/CONFIGURE PROCUREMENT DATA INTO PPO_BASECASE:

1. Click on **Manage Power Procurement Data** + icon in PPO Base case scenario.
2. Select **Procurement** from the drop-down list as shown in Figure 267.

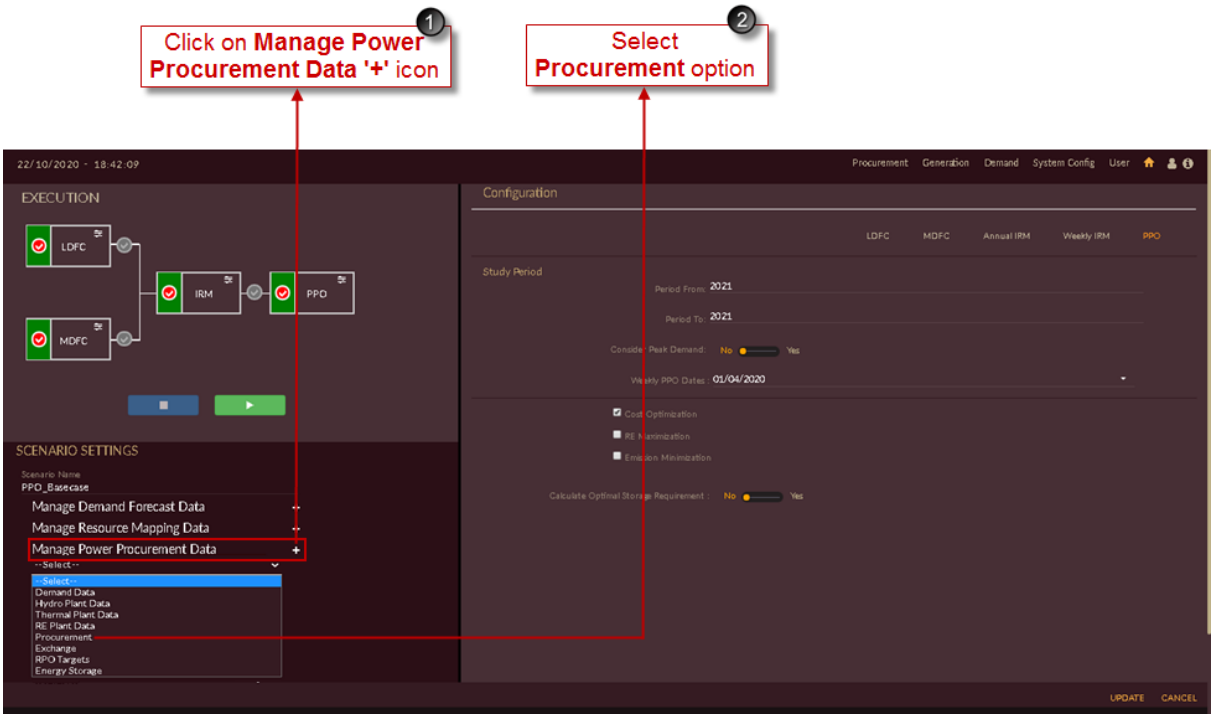


Figure 267. Manage Procurement Data

Once you click **Procurement**, you are navigated to the **Procurement** page of **PPO Basecase** senario as shown in Figure 268.

3. Click on **Upload mtlt Portfolio** icon to configure RE contract generation profiles.

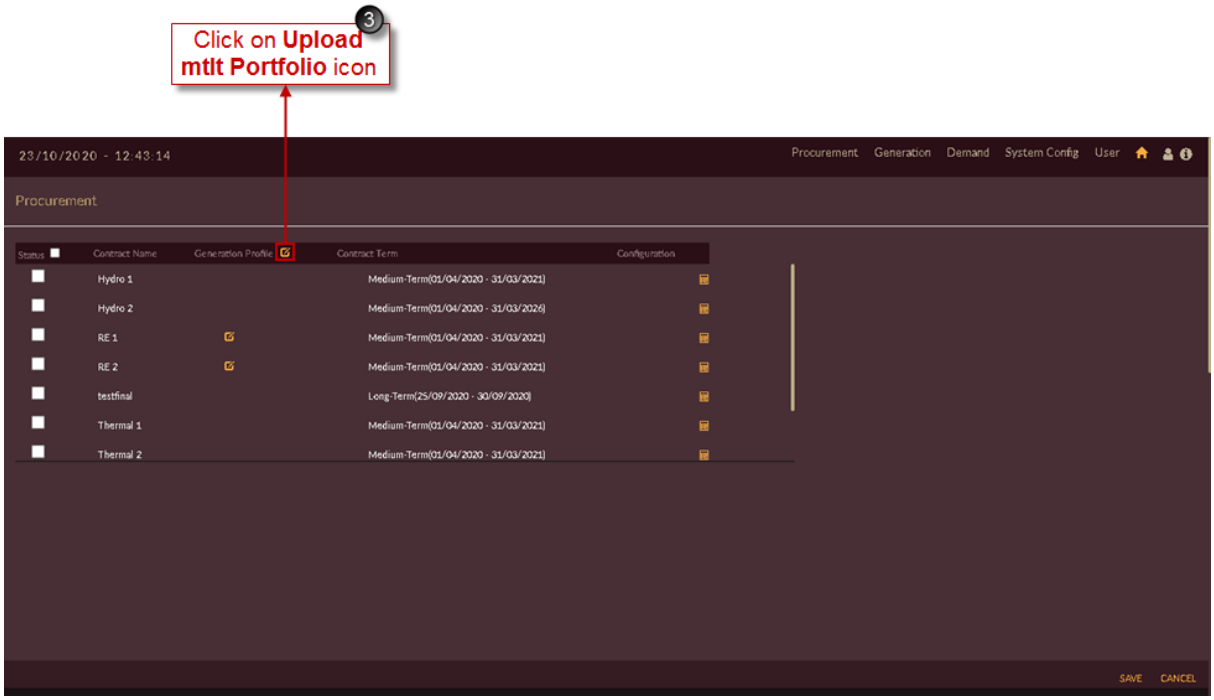


Figure 268. Uploading mtlt Portfolio for RE Contracts

Once you click on **Upload mtlt Portfolio** software will appear as shown in Figure 269.

4. You have to select **RE Contract Portfolio** from drop-down list. The RE contract generation portfolio configured in RE GENERATION PORTFOLIO FOR RE CONTRACTS section will appear in drop-down list.

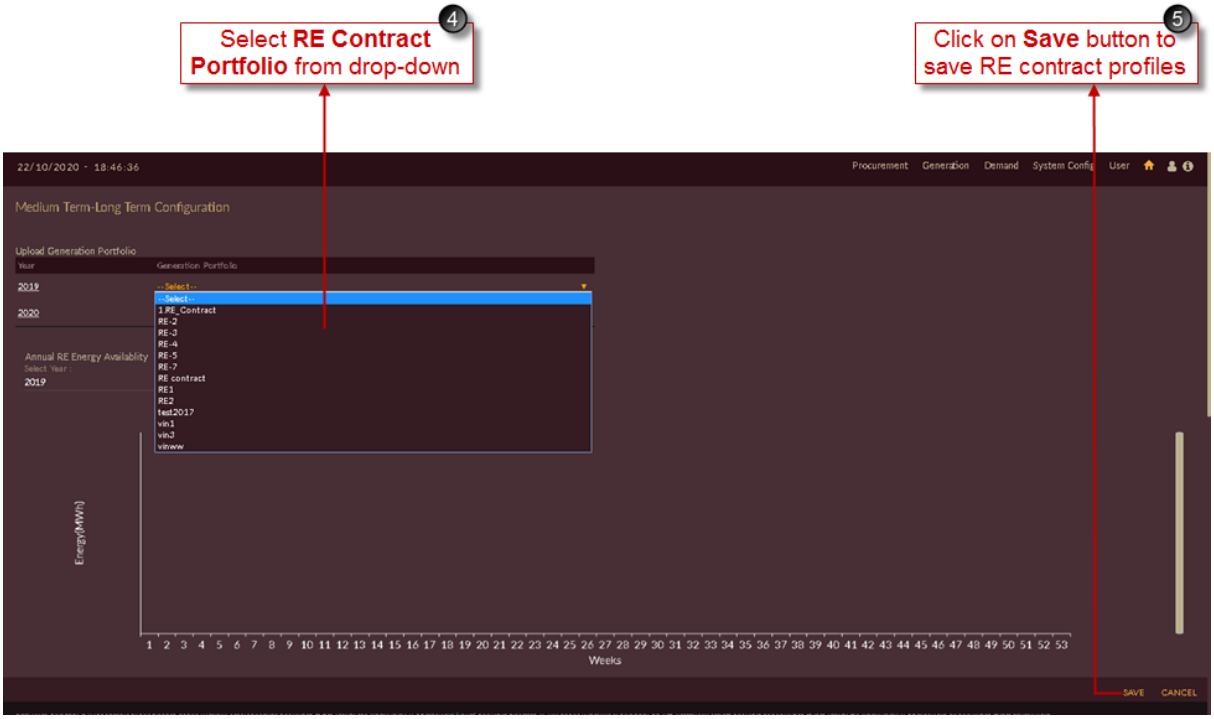
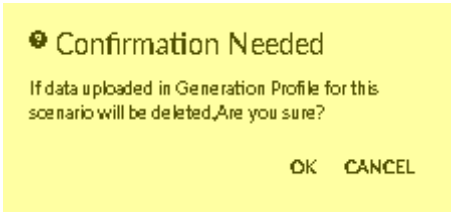


Figure 269. Selecting RE Contract Generation Portfolio

5. Click on the **SAVE** SAVE button. The "Are you sure?" confirmation pop-up appears.



Click on **OK**. The "Inserted successfully" message appears.

Click on **CANCEL** to discard the task.

Once RE contract generation portfolio is successfully inserted into the PPO Base case graph will get updated as shown in Figure 270.

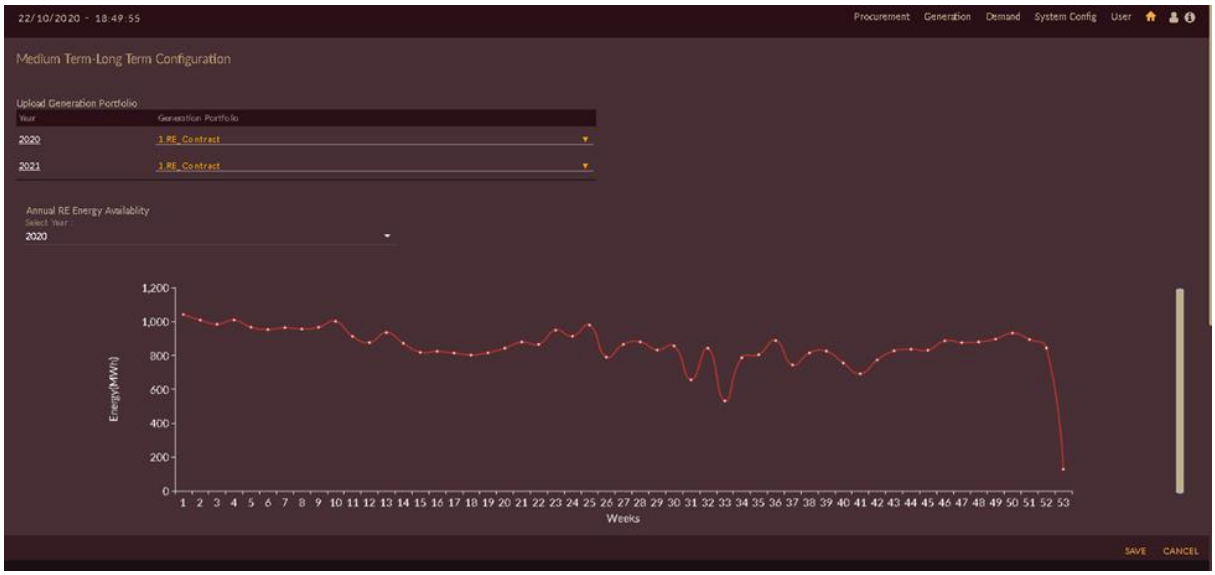


Figure 270. Successfully Configured RE Contract Generation Portfolio

Once Re contract generation portfolio is successfully inserted into the PPO Base case, we have to check whether generation profile is updated into each RE contract plant. For doing so;

6. Click on **Edit** icon of respective RE contract plant for which you want to see or edit the data. Here **RE 1** contract plant is selected in Figure 271.

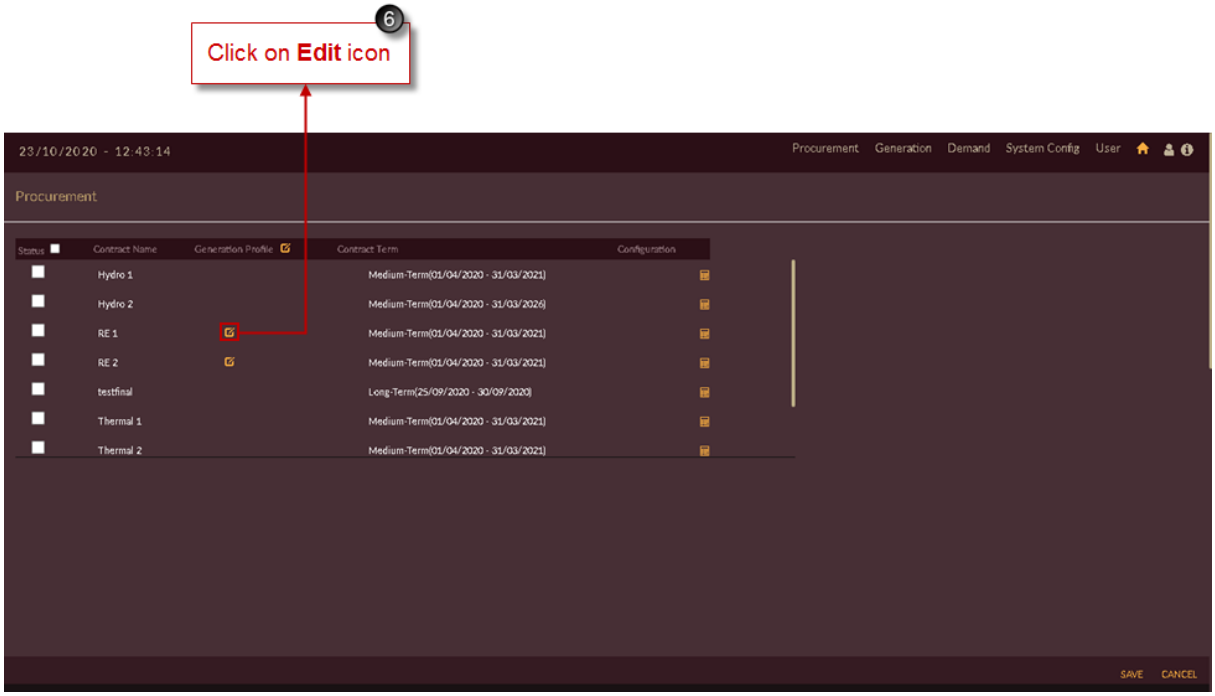


Figure 271. Edit/View Configured RE Contract Generation Portfolio

Once you click on **Edit** icon of respective RE contract plant, page will appear as shown in Figure 272.

7. Table is displayed containing RE contract generation profile imported for respective RE contract. Here RE 1 contract is shown.
8. Hourly graphs of respective contracts will be displayed below table according to generation profile. You can also edit the generation profile data by just double clicking the row and click on **Refresh** icon to update the graph.

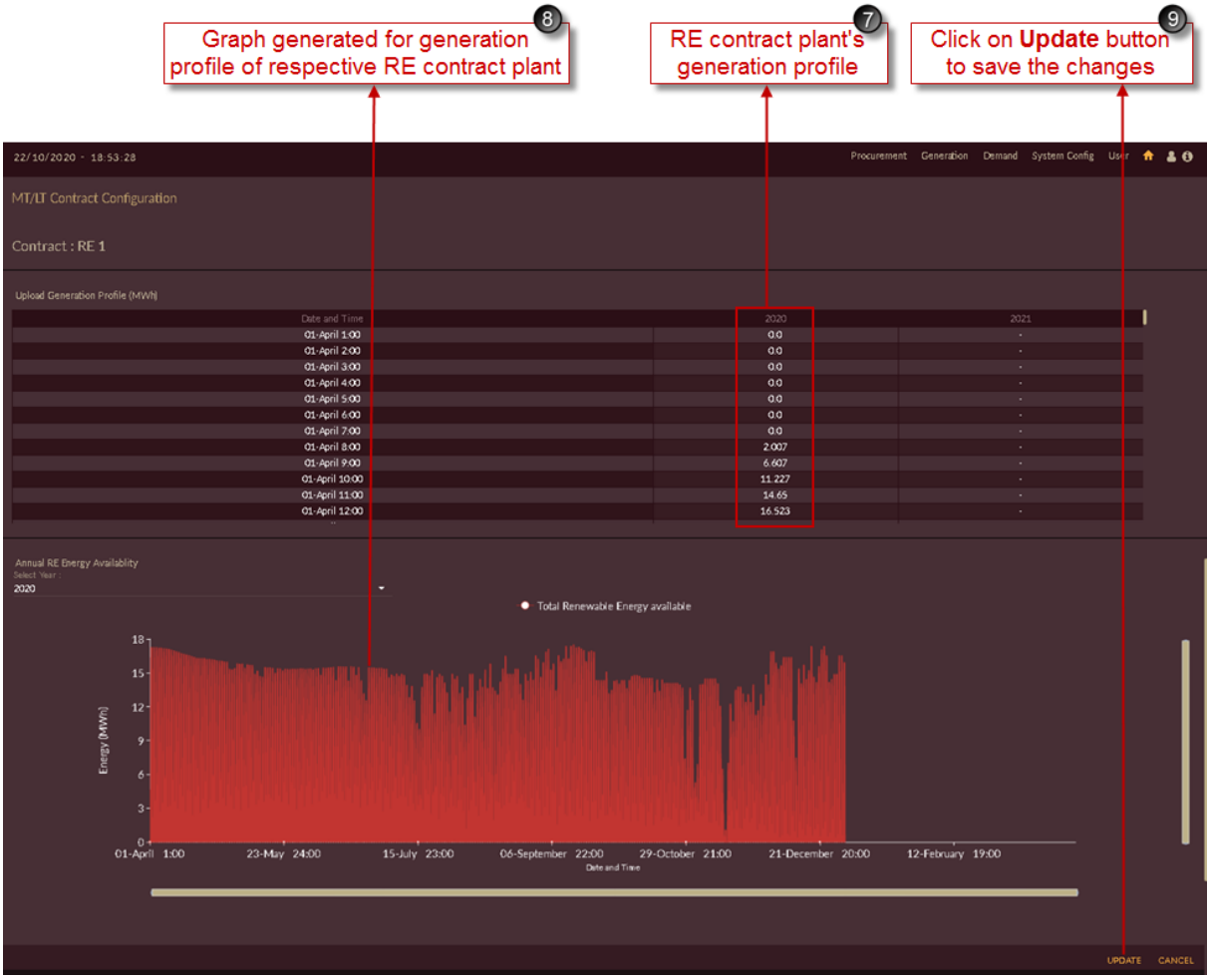
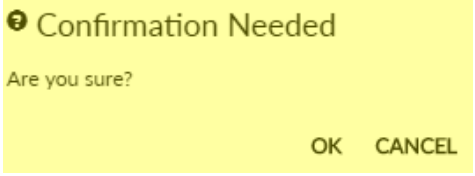


Figure 272. Updated RE Contract Generation Portfolio of RE Contract

9. Click on **UPDATE** UPDATE button to save the changes.

The "Are you sure?" confirmation message appears.



Click on **OK** to accept the changes made. The "Updated successfully" message appears.

Once RE contract generation portfolio is updated successfully we have to configure each contract unit into the PPO Base case scenario.

10. Click on **Configuration** icon of respective contract unit/plant to configure it into PPO Basecase scenario. Here Hydro 1 contract unit is selected in Figure 273.

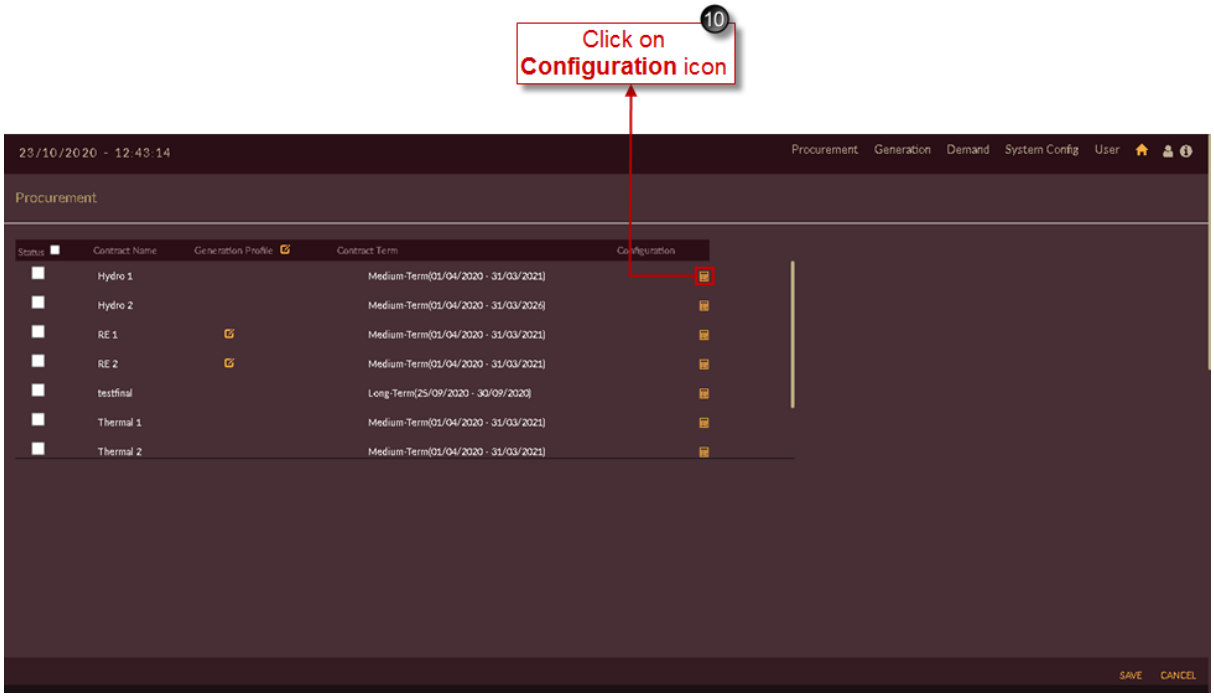


Figure 273. Configuring Contracts for PPO Scenario

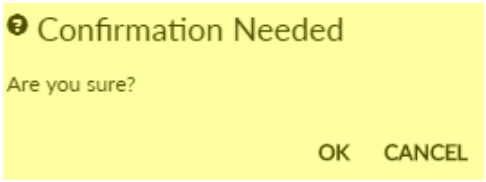
Once you click on **Configuration** icon of respective contract, periodic contract details of selected contract page will appear as shown in Figure 274.

11. You can edit the periodic contract details here if required, the fields like;
    - Contract period (From Date and To date).
    - Capacity Share in MW.
    - Energy Share in MWh.
    - Cost details like Fixed Cost (INR/MW) and Variabke Cost (INR/MWh).

Figure 274. Saving Configured Contracts

12. Click on the **SAVE** SAVE button to save and configure contract unit data settings.

    The **"Are you sure?"** confirmation message appears.



    Click on the **OK** icon to save the scenario. The "Saved Successfully" message appears.

13. Figure 275 shows configured Contract unit into the PPO Base case scenario. Blue tick indication ☑ appears for the contract unit which is configured or partcipating into the scenario for PPO studies.

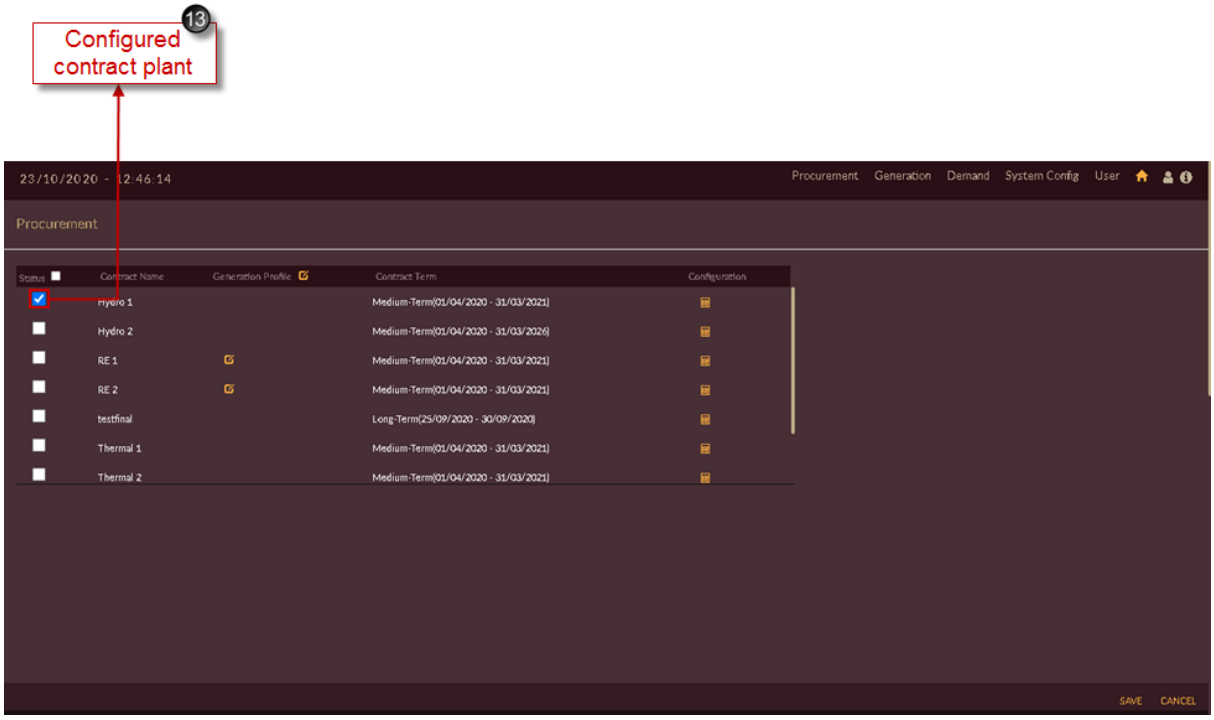


Figure 275. Successfully Configured Contract

Repeat above steps for configuring other contracts into the PPO Base case scenario for PPO studies.

Once all the Contracts are configured into the PPO Base case scenario the final Procurement Configuration page will appear as shown in Figure 276.

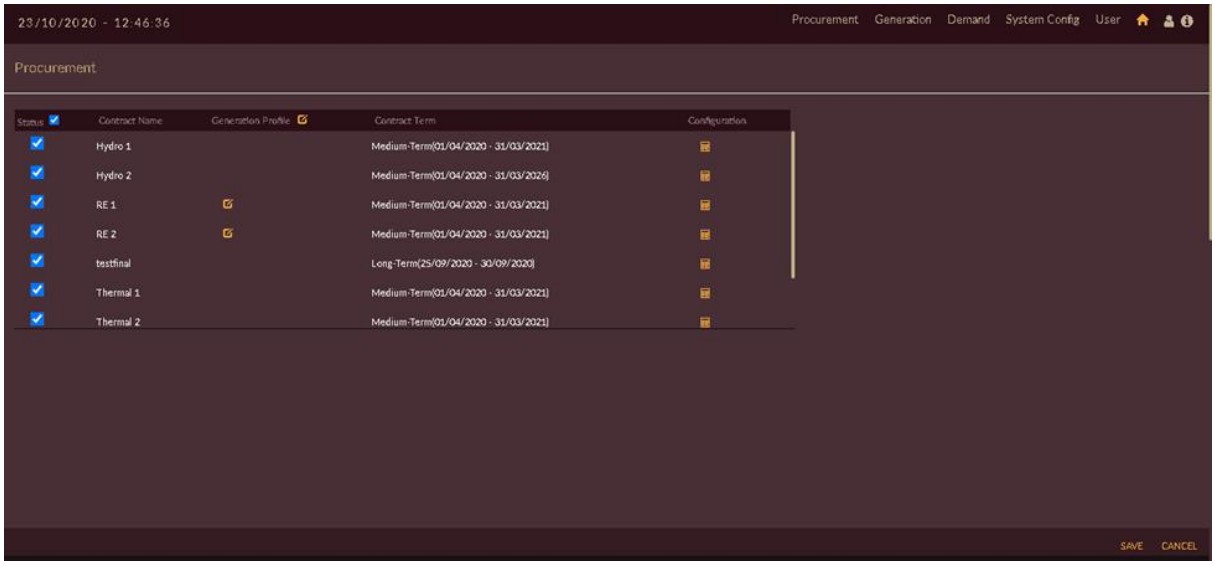


Figure 276. List of Successfully Configured Contracts

STEPS TO EDIT/CONFIGURE EXCHANGE DATA INTO PPO_BASECASE:

1. Click on **Manage Power Procurement Data** + icon in PPO Base case scenario.
2. Select **Exchange** from the drop-down list as shown in Figure 277.

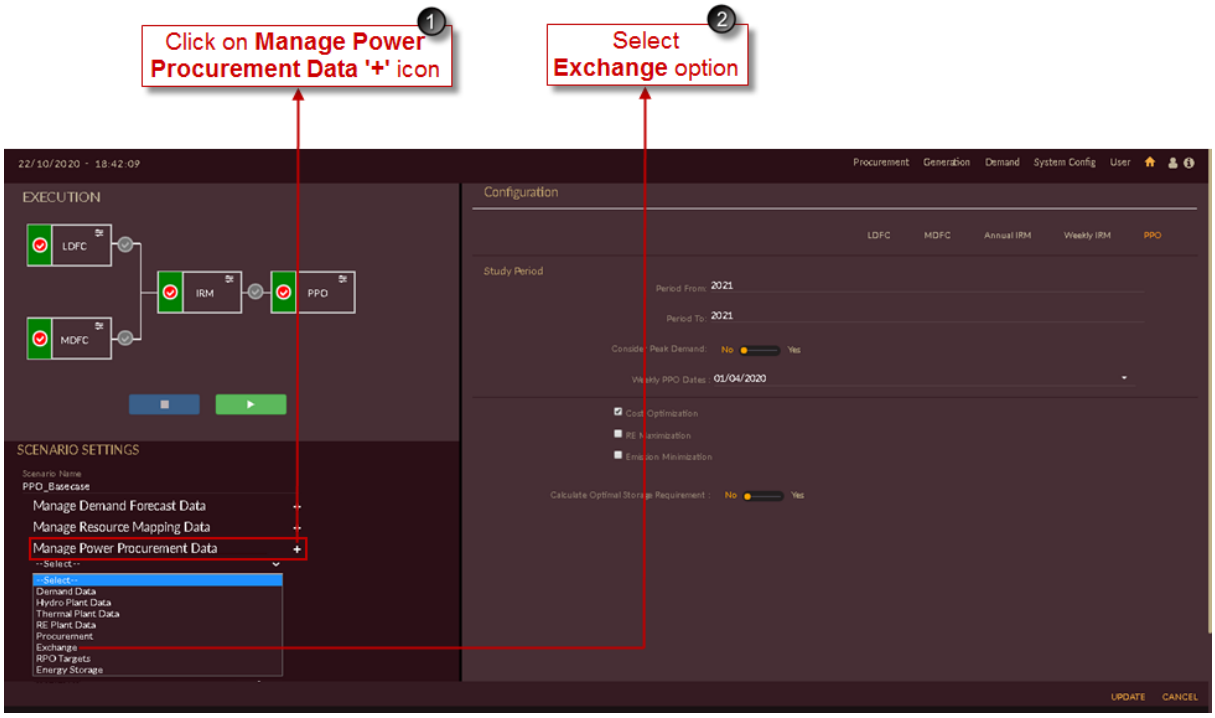


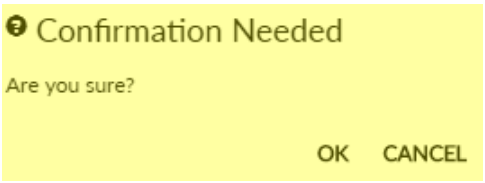
Figure 277. Manage Exchange Data

3. By-default **History Period** will be selected, i.e historical short term exchange data will be displayed as shown in Figure 278.

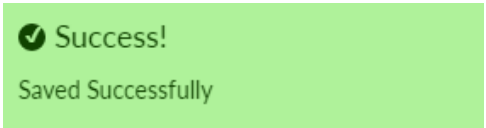
Figure 278. Configuring Historical Exchange Data

4. Click on the **SAVE** SAVE button to save and configure historical exchange data into the PPO scenario.

   The **"Are you sure?"** confirmation message appears.



   Click on the **OK** icon to save the scenario. The "Saved Successfully" message appears.



5. Set the toggle to **Future Period** to save future short term exchange data to the scenario as shown in Figure 279.

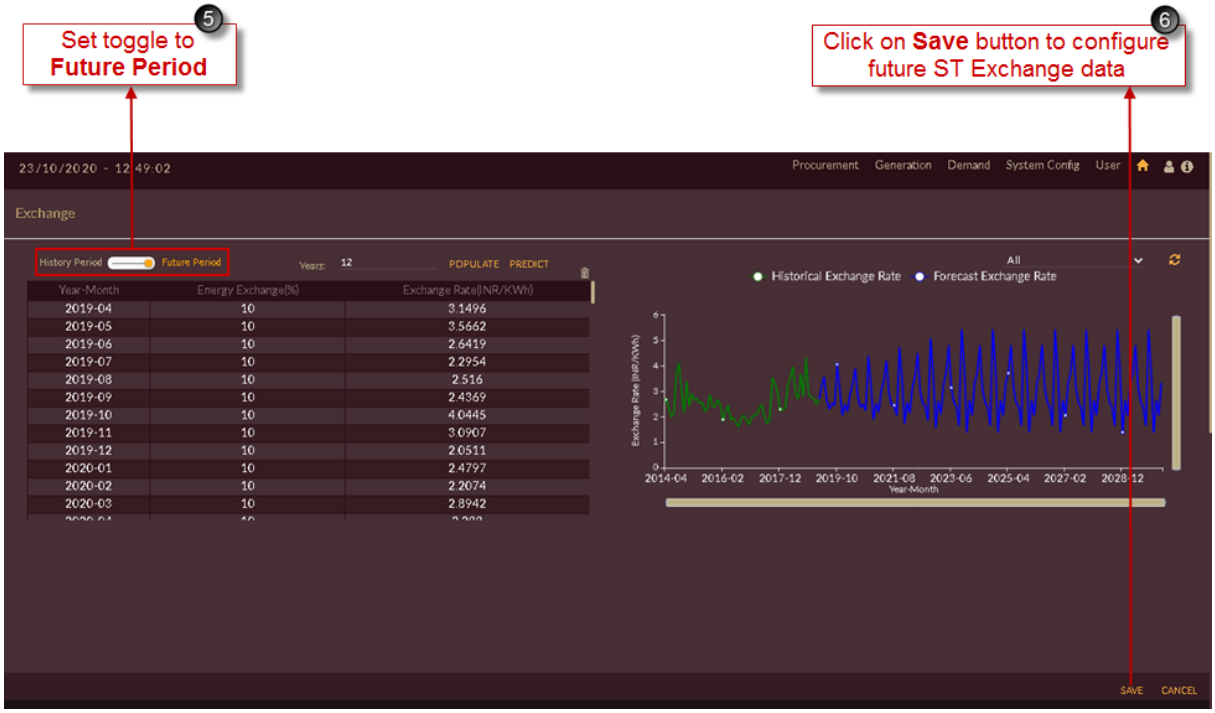
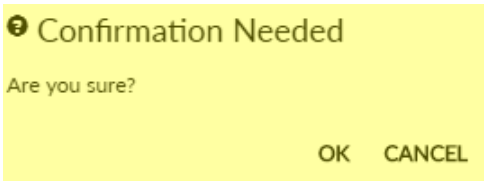


Figure 279. Configuring Future Exchange Data

6. Click on the **SAVE** SAVE button to save and configure future exchange data into the PPO scenario.

   The **"Are you sure?"** confirmation message appears.



   Click on the **OK** icon to save the scenario. The "Saved Successfully" message appears.

STEPS TO EDIT/CONFIGURE RPO TARGETS DATA INTO PPO_BASECASE:

1. Click on **Manage Power Procurement Data** icon in PPO Base case scenario.
2. Select **RPO Targets** from the drop-down list as shown in Figure 280.

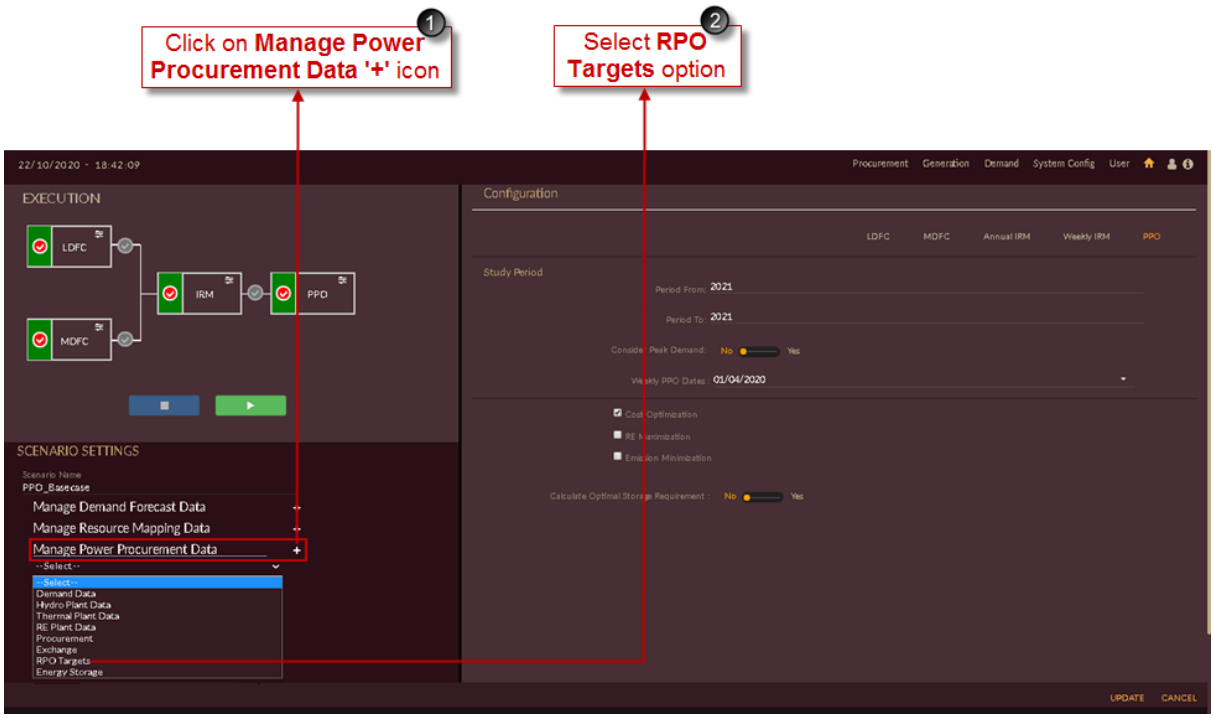
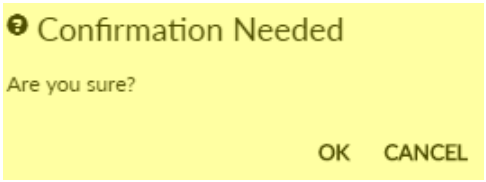


Figure 280. Manage RPO Targets Data

3. The RPO target configured in **STEPS TO CONFIGURE RENEWABLE PURCHASE OBLIGATION (RPO) INTO THE SOFTWARE**: section will appear for selected study year. You can also edit the data if required.

Figure 281. Configuring/Saving RPO Targets

4. Click on the **SAVE** SAVE button to save and configure RPO targets data into the PPO scenario. The **"Are you sure?"** confirmation message appears.



Click on the **OK** icon to save the scenario. The "Saved Successfully" message appears.

STEPS TO EDIT/CONFIGURE ENERGY STORAGE DATA INTO PPO_BASECASE:

1. Click on **Manage Power Procurement Data** icon in PPO Base case scenario.
2. Select **Energy Storage** from the drop-down list as shown in Figure 282.

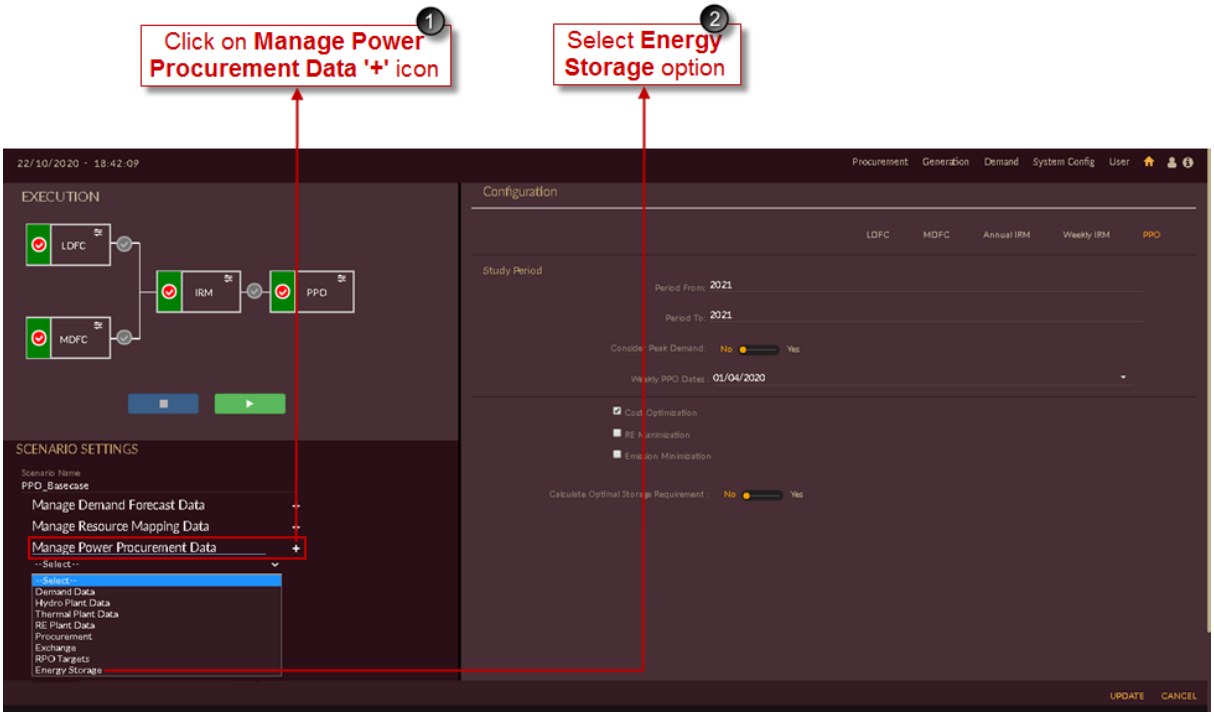


Figure 282. Manage Energy Storage Data

3. Click on **Configuration** icon of respective storage plant to configure it into PPO Basecase scenario. Here **Pumped Storage Independent** plant is selected in Figure 283.

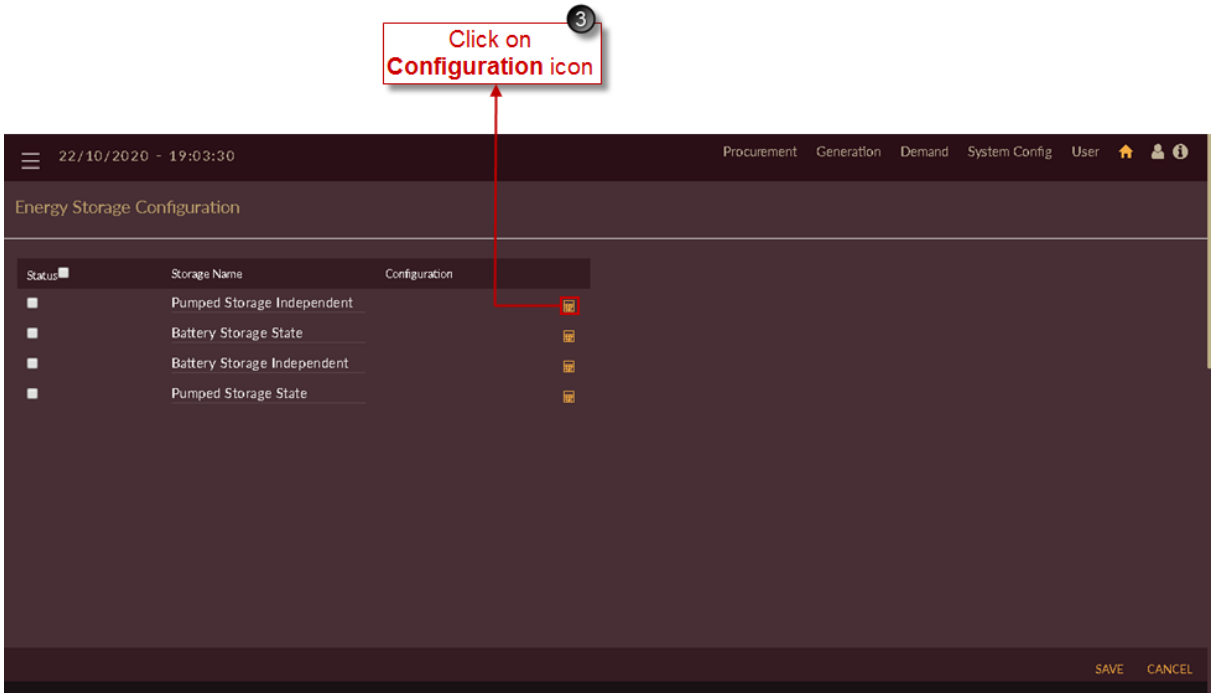


Figure 283. Configuring Storage Plant for PPO Scenario

Once you click on **Configuration** icon of respective storage plant, storage information of selected storage plant will appear as shown in Figure 284.

4. You can edit the storage plant details if required, the fields like;
    - **Storage Information** details like;
        - Maximum Generation in MW
        - Energy availability per day in MWh
        - Storage efficiency in %
        - Ramp Up and Ramp Down rates in MW/Min.
    - **Cost Details** like;
        - From Date and To Date
        - Fixed Cost in INR/MW and Variable Cost in INR/MWh.
    - Hourly **Generation Profile** details.

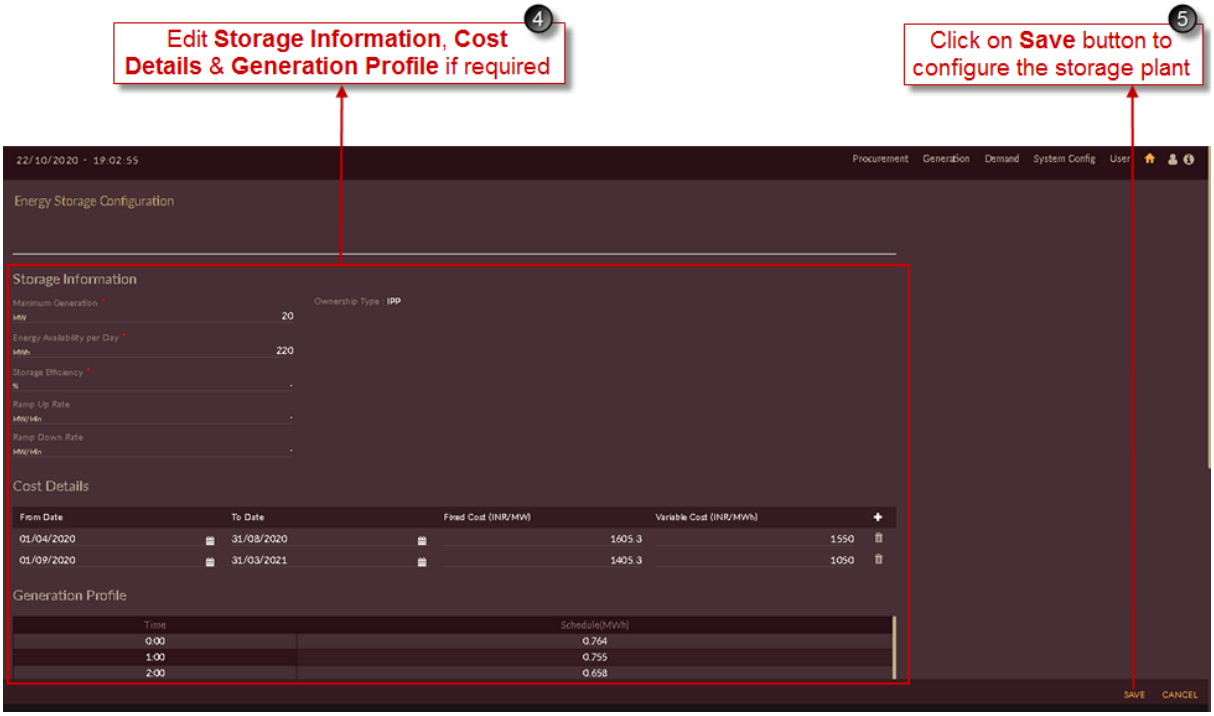
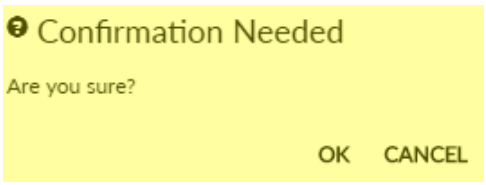


Figure 284. Saving Configured Storage Plant

5. Click on the **SAVE**  button to save and configure energy storage data into the PPO scenario.

   The **"Are you sure?"** confirmation message appears.



   Click on the **OK** icon to save the scenario. The "Saved Successfully" message appears.

6. Figure 285 shows configured sorage plant into the PPO Base case scenario. Blue tick indication ☑ appears for the storage plant which is configured or partcipating into the scenario for PPO studies.

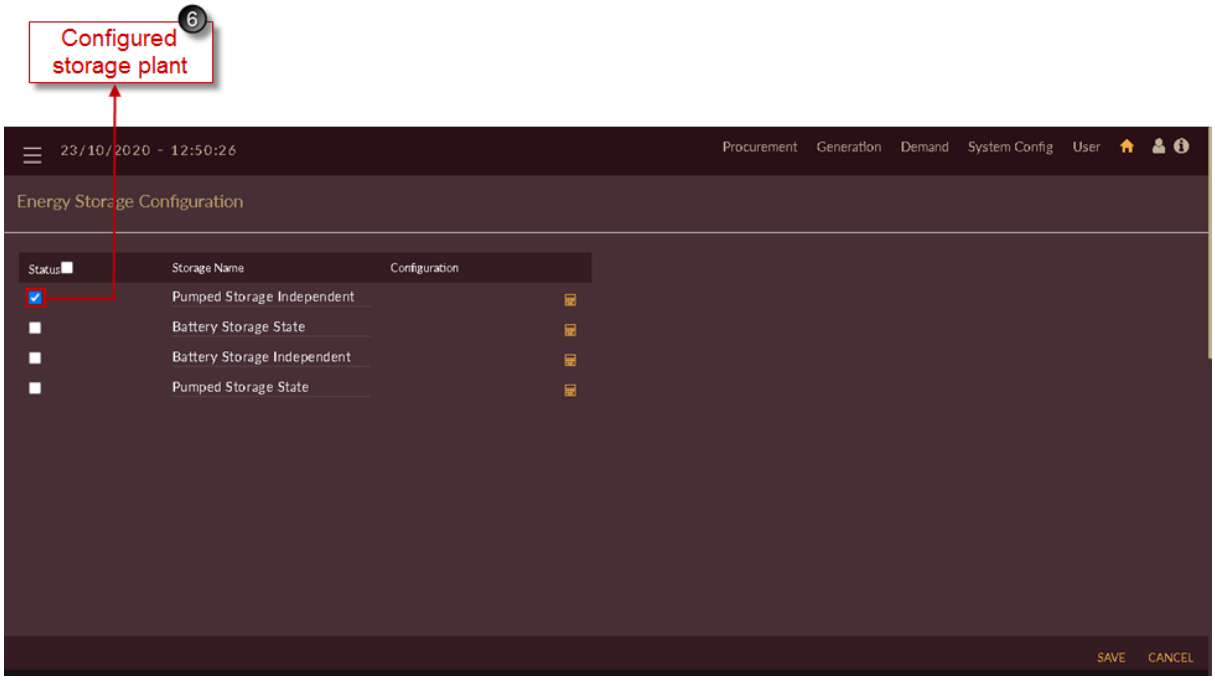


Figure 285. Successfully Configured Storage Plant

Repeat above steps for configuring other enrgy storage plants into the PPO Base case scenario for PPO studies.

Once all the Storage plants are configured into the PPO Base case scenario the final Energy Storage Configuration page will appear as shown in Figure 286.

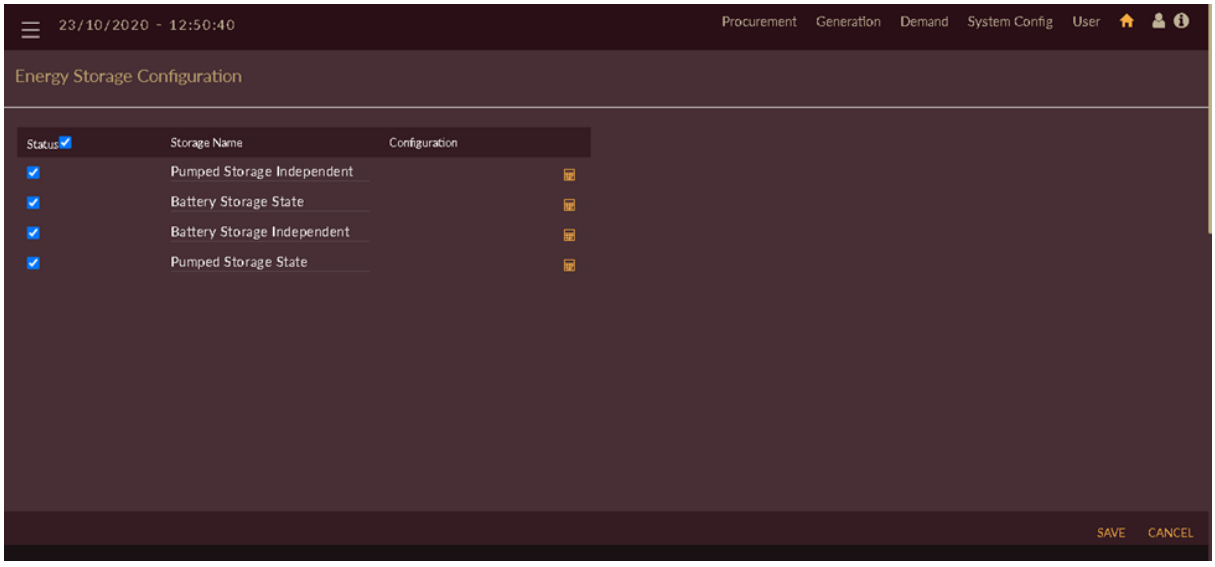


Figure 286. List of Successfully Configured Storage Plant

7. After managing all power procurement data like Demand Data, Hydro Plant Data, Thermal Plant Data, RE Plant Data, Procurement Data, Exchange Data, RPO Targets Data and Energy Storage Data into the PPO Base case scenario, you will see the page as shown in Figure 287.

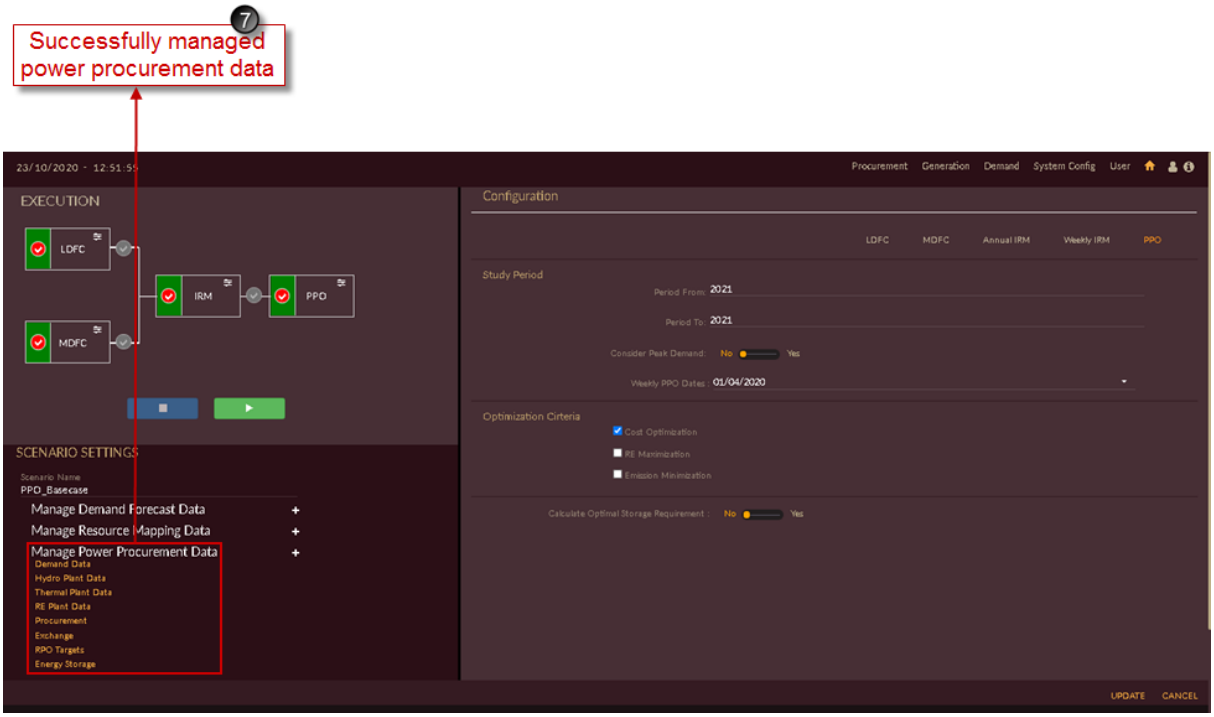


Figure 287. Finalized PPO Scenario

2.3.4.3 EXECUTE PPO SCENARIO

This section gives you the steps to execute the scenario created.

1. Go to scenario list page as shown in Figure 288 and click on **Edit Scenario** icon for the scenario which you need to execute. Here we are executing PPO Base case scenario.

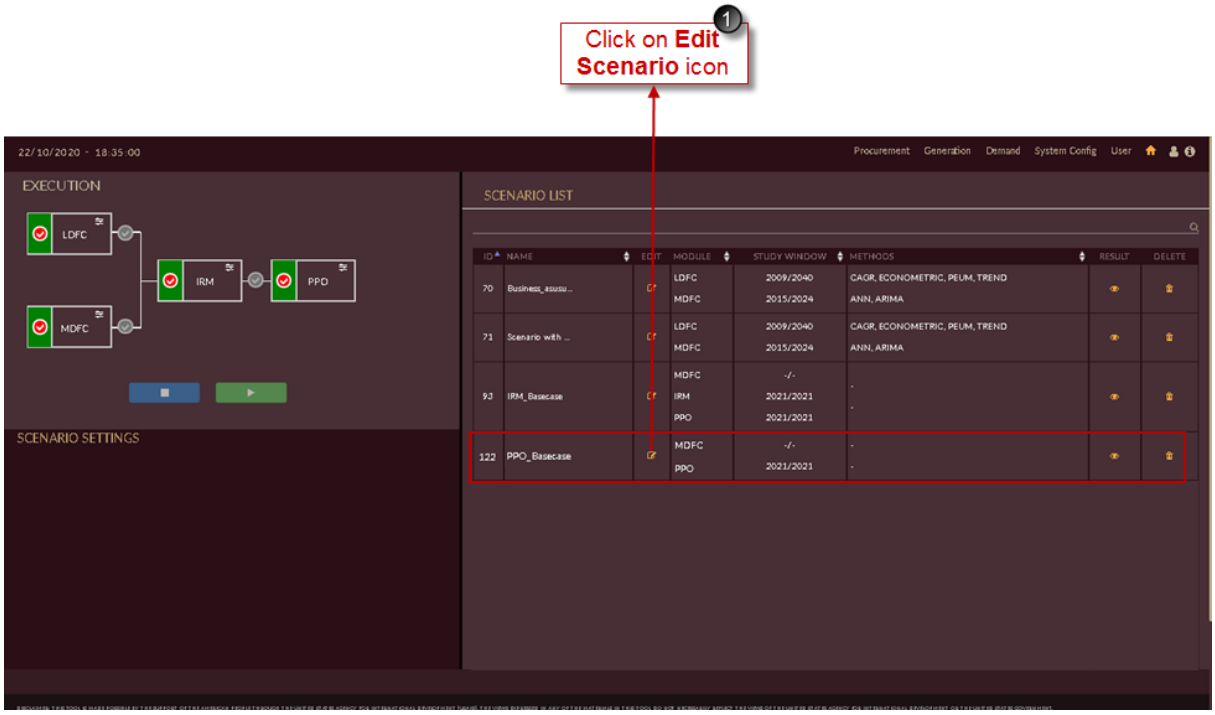


Figure 288. Select PPO Scenario to Execute

2. Select the method i.e, **PPO function** 

by clicking the red  tick mark of respective method.
3. Click on the Execute  icon on the left-side shown in Figure 289.
4. Orange line appears on the top of the software page indicating that scenario is getting executed.

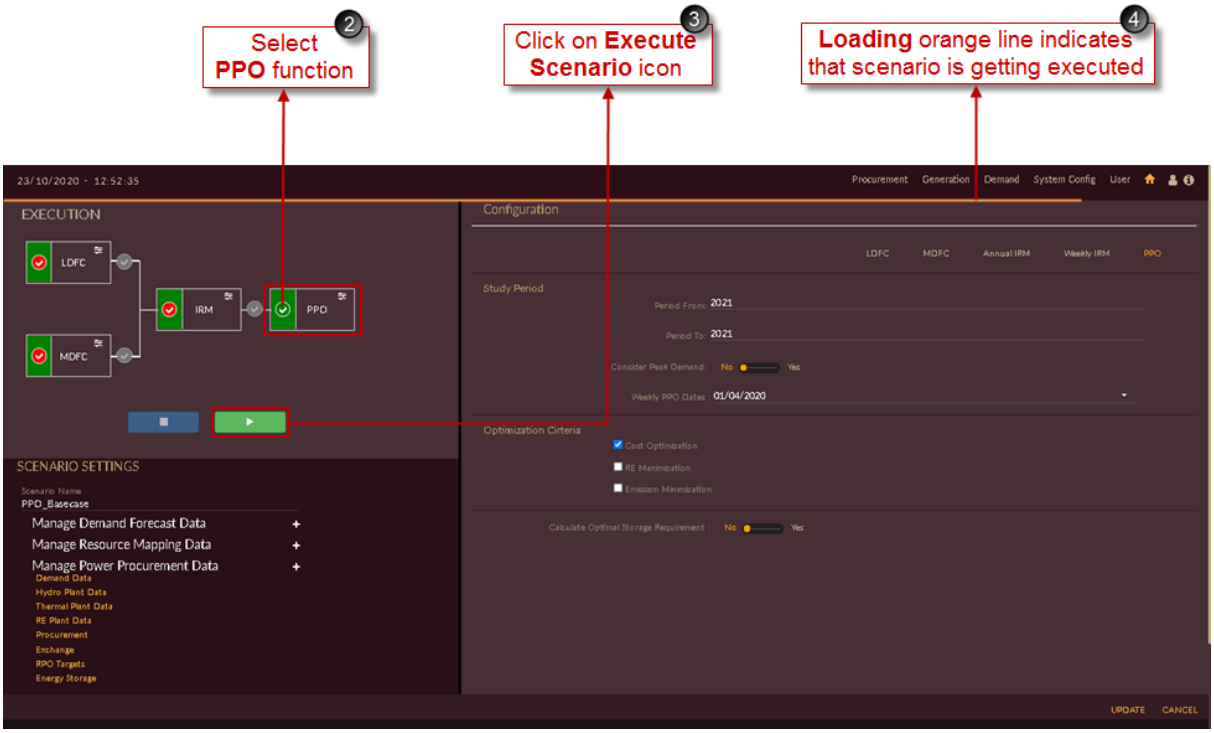
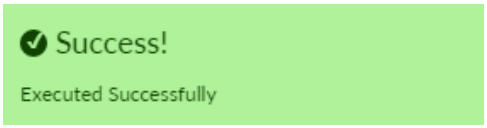


Figure 289. Execution of PPO

The "Executed Successfully" message appears.



The software page will navigate to results page as shown in Figure 290.

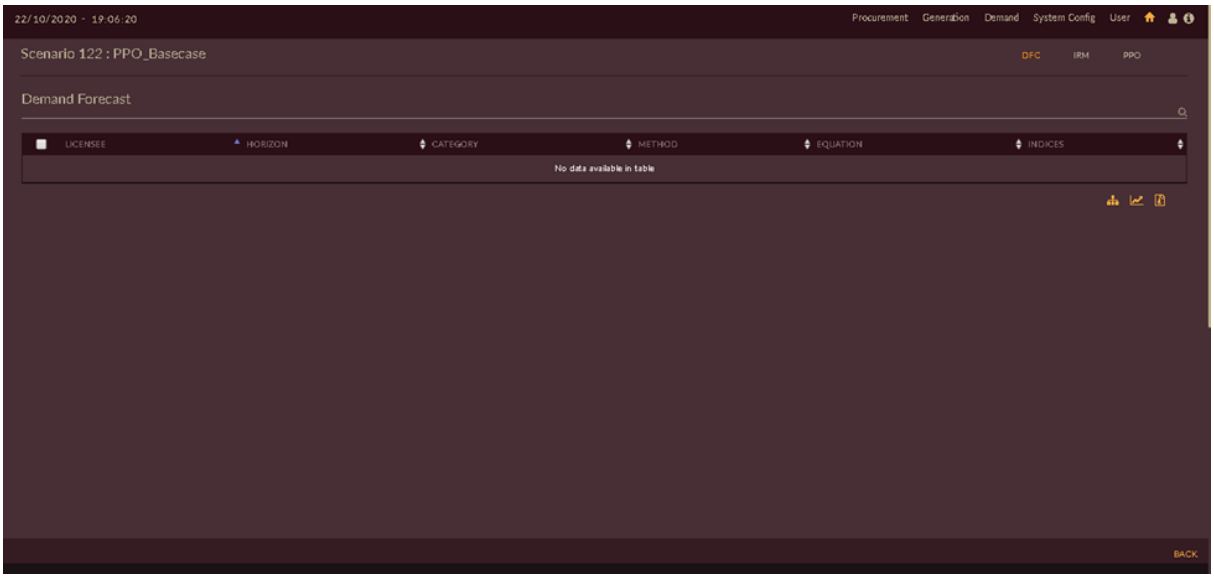


Figure 290. Result Page

2.3.4.4 DOWNLOAD/EXPORT/VIEW PPO SCENARIO RESULTS

This section gives the steps to view, export and download PPO Scenario Execution Results.

STEPS TO VIEW & EXPORT PPO RESULTS:

Login to the software. The **Dashboard/Home** page appears. The **Scenario List** appears on the right of the home page.

1. Click on the **View Result** icon on the scenario that you wish to view. In this example, we see the results of the scenario 122, PPO Base case.

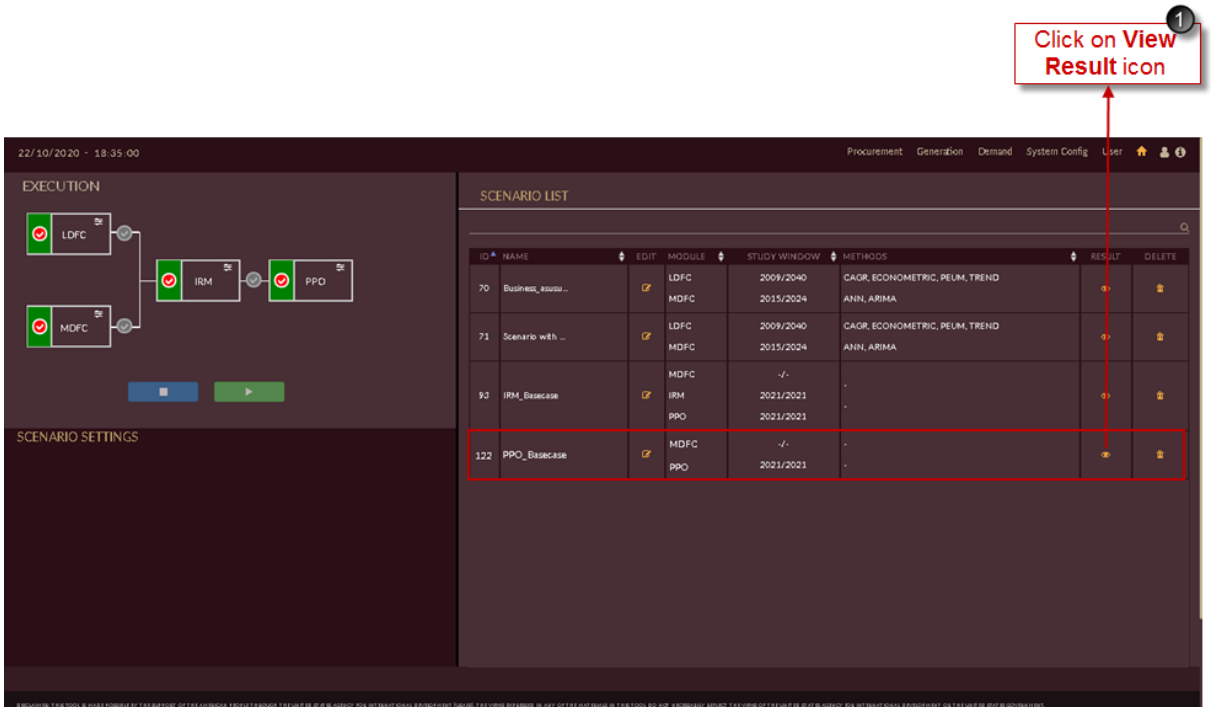


Figure 291. View PPO Scenario

Once you click **View Result** icon, the result page of selected scenario, PPO Base case will open as shown in Figure 292.

In result page by-default **DFC** DFC icon will be selected.

2. Click on **PPO** PPO tab, to view PPO results.

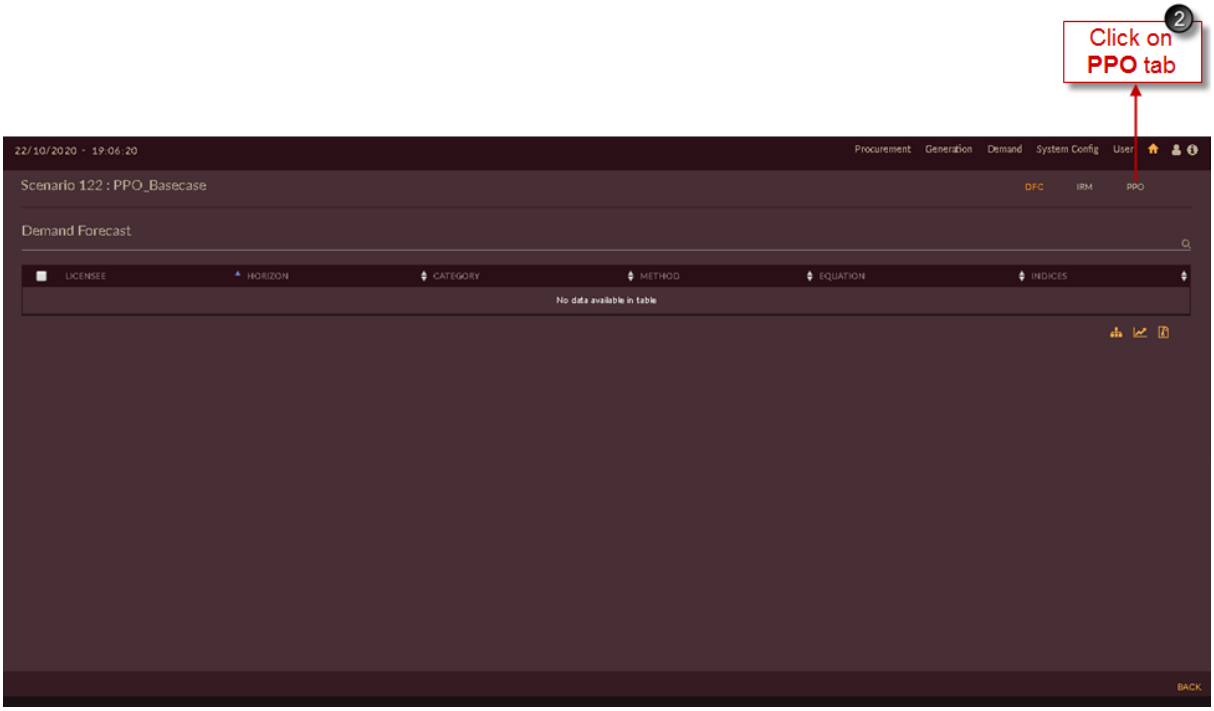


Figure 292. Result Page of PPO Scenario

Once you click **PPO** PPO icon, in the result page by-default results will appear in the form of graphical representation and slider will be on graphical option as shown in **Error! Reference source not found.**.


30/12/2020 - 19:41:44
Procurement
Generation
Demand
System Config
User
Scenario 38 : JBVNL Optimization
DFC
IRM
PPO
Power Procurement Optimization
Annual summary
Reserve
Energy Loss
Demand
Unmet
Storage
Exchange
Procurement
Hydro
Thermal
RE
Weekly Demand Generation Mapping
Week Number
Hydro
Chhukha Bhutan
Rangit NHPC
SHPS
Tala Bhutan
Tees
BarhS1_Contract
Karanpura_Contract
PTPS1_Cor
Week
Weekly Variable Cost Per Unit
Exchange
Hydro
long_contract
RE
Thermal
RPO Targets
2021
Actual
Target
Biomass
PV
WIND
Hourly Demand Generation Mapping
Hourly plant-level dispatch
Hourly Contract Dispatch
Resource Overview
PLANT CODE
UNIT CODE
THERMAL PLAN
TTPS
RungtaMines
INLAND
Farakka1
Kahalgaon1
INSERVICE

Figure 293. Results in Graphical Form

3. You can also view the graphical results in tabular form just by setting **Graph or Table**  data slider to Tabular option. The same data appears as table as shown in Figure 294.

Figure 294. Results in Tabular Form

STEPS TO DOWNLOAD PPO RESULTS:

This section gives you the steps to download results.

Repeat steps from 1 to 3 from **STEPS TO VIEW & EXPORT IRM RESULTS:**.

4. Click on the **Download PPO PDF REPORT** icon to download the PDF report file to see detailed PPO results along with input data. A screenshot of the PDF report PPO Base case is shown in Figure 295.

Figure 295. Power Procurement Report PPO Base Case PDF Report

5. Click on **Download Text Reports** icon to download CSV files to view detailed PPO results along with input data.

Figure 296. Downloading PDF and Text Reports

Once you click on **Download Text Reports** icon to download CSV files the ZIP folder gets downloaded as shown in Figure 297 which contains detailed PPO results in CSV formats.

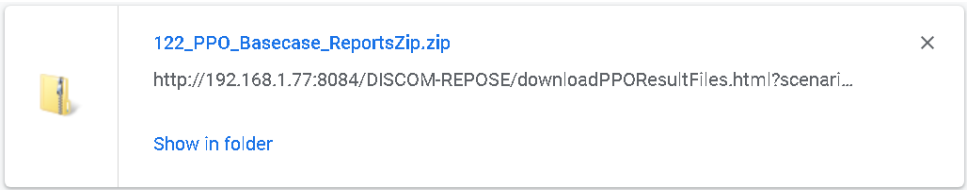


Figure 297. Downloaded Text Report in Zip File Format

6. Once detailed PPO studies are made you can permanently delete the scenario just by clicking **Delete Scenario** icon.

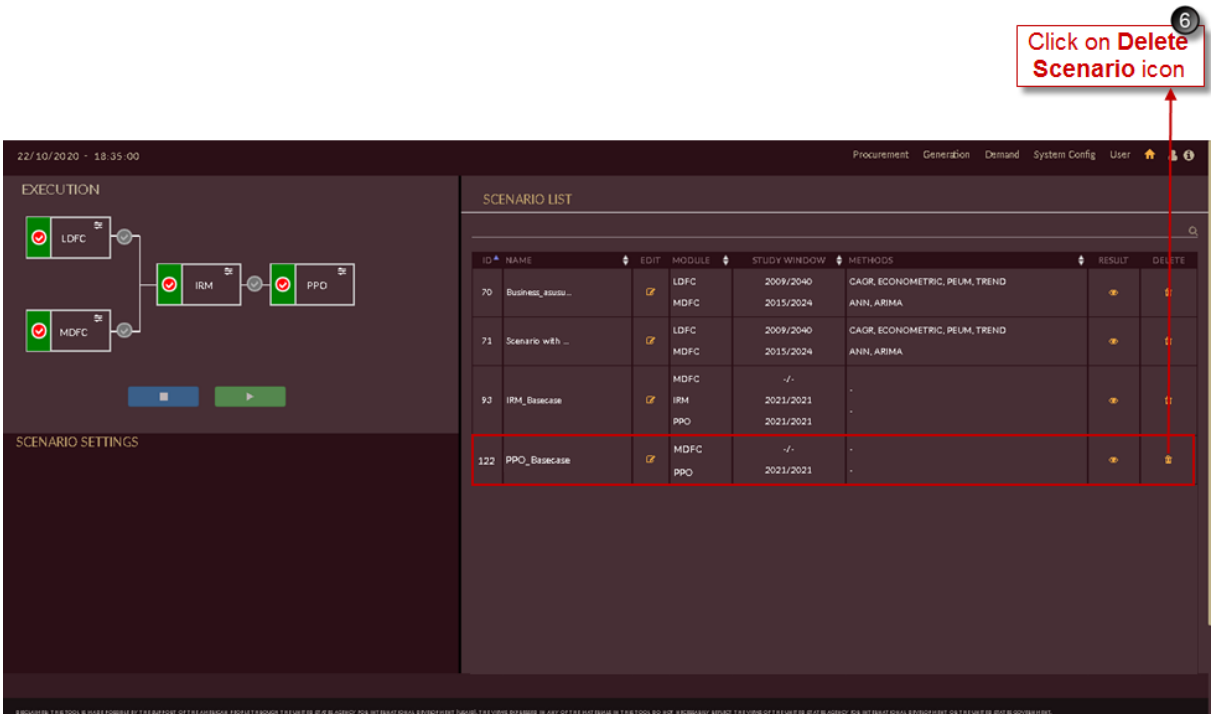


Figure 298. Delete PPO Scenario

2.3.4.5 VIEWING/DOWNLOADING CONSOLIDATED RESULTS

This section gives the steps to view, export and download PPO Scenario Consolidated Reports.

1. Click on the **PPO** button in the scenario results page.

2. Click on the Consolidated Reports  icon.

Figure 299. PPO Consolidated Reports

3. Click on the **Graph Type** drop-down to select the option for which you wish to view the graph.
4. Click on the **Plot** button to render the respective graph as shown in

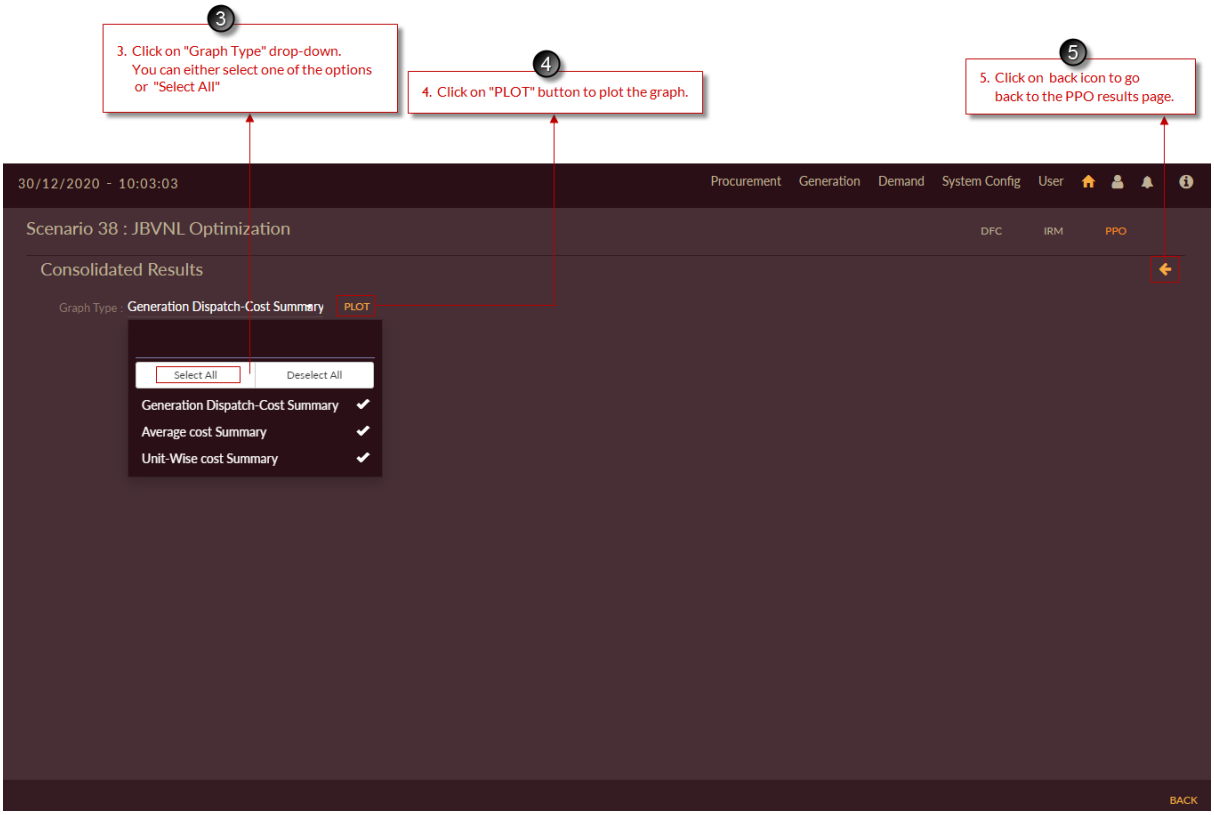


Figure 300. Plotting the Graphs for Generation Dispatch Cost Summary

5. Click on the back icon to go back to the previous screen.
6. Select the Contract Type.
7. Click on the Plant Type and select the plant.
8. Click on the Unit name.
9. Click on the Generation Dispatch cost year drop-down and select the year for which the graph is to be generated.
10. The graph gets plotted for the selected year as shown in Figure 301. Generation Dispatch Cost Graph - RE Plant

Figure 301. Generation Dispatch Cost Graph - RE Plant

11. Click on the Contract type as State Owned or Contract.
12. Select the Plant Type as Thermal Plant.
13. Select the Plant name.
14. Select the Unit name.
15. The graph gets plotted below as shown in

Figure 302. Generation Dispatch Cost Graph - Thermal

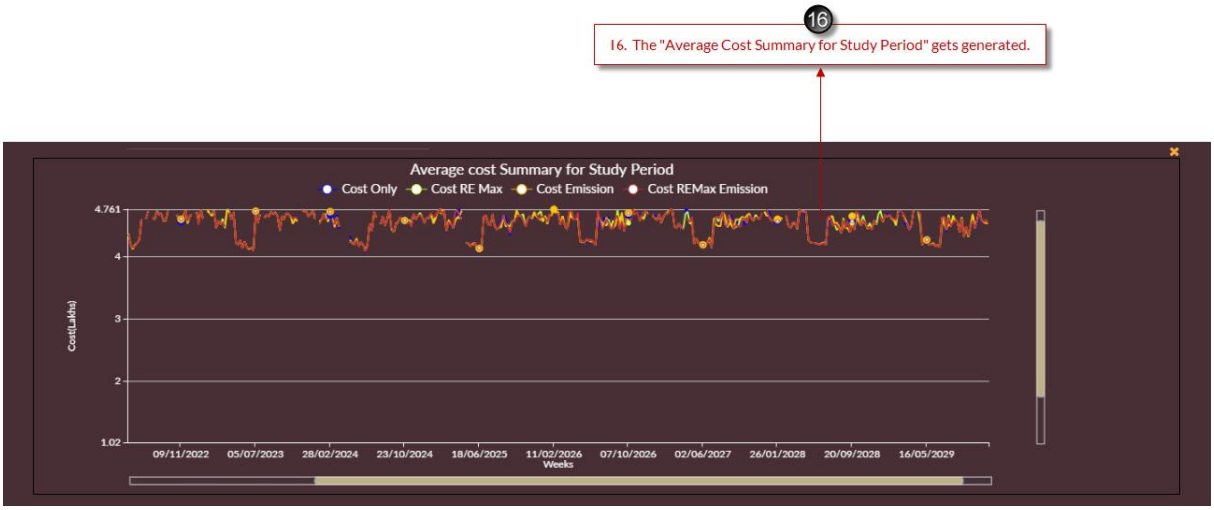


Figure 303. Average Cost Summary for Study Period Selected

2.3.4.6 VIEWINIG/DOWNLOADING RECOMMENDED REPORTS

This section gives you the steps to download the recommendation reports.

1. Access the **PPO** Results tab and click on the **Recommendations Reports** icon.

Figure 304. Recommendations Report Option in PPO Results Page

2. The Recommendations Report page appears. Select the Optimization Type from the drop-down menu and click on Generate button.

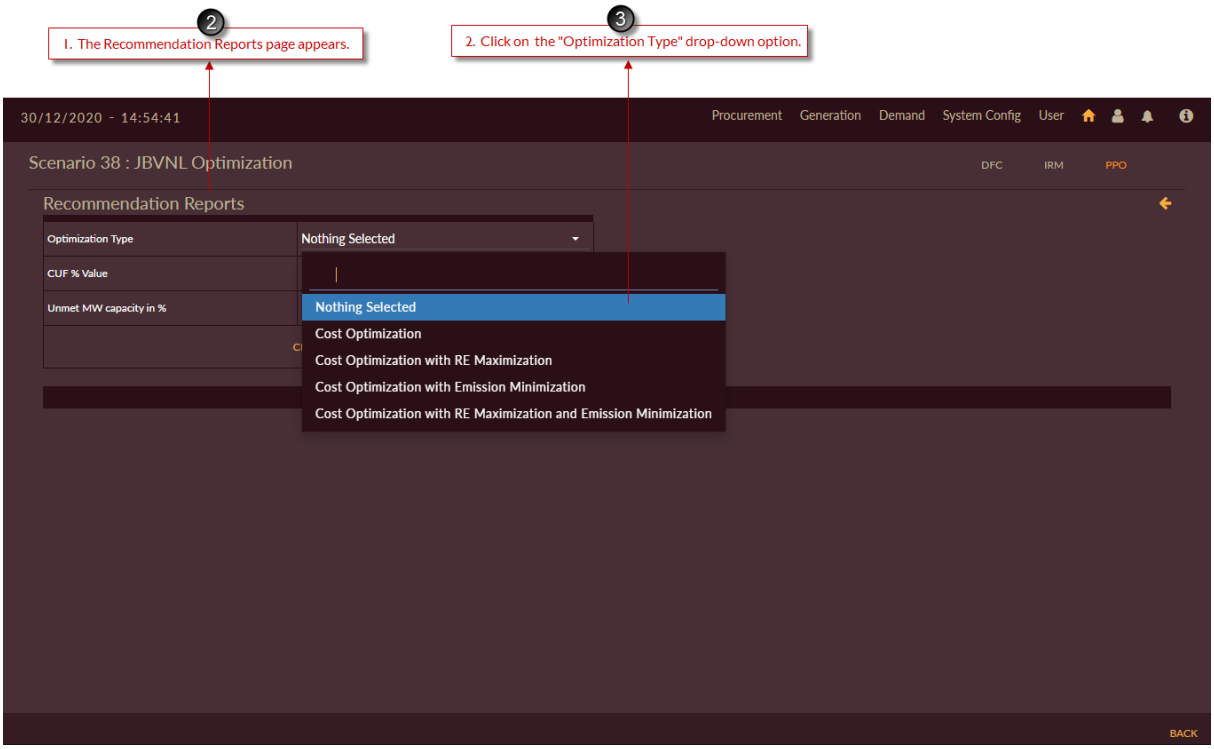


Figure 305. Recommendations Report Options

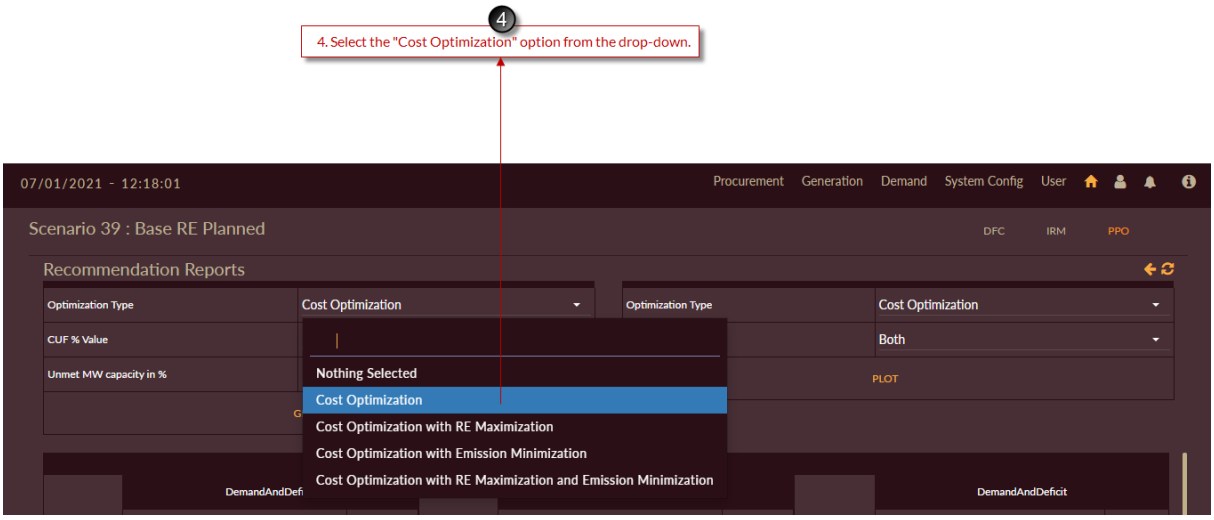


Figure 306. Optimization Type Selection

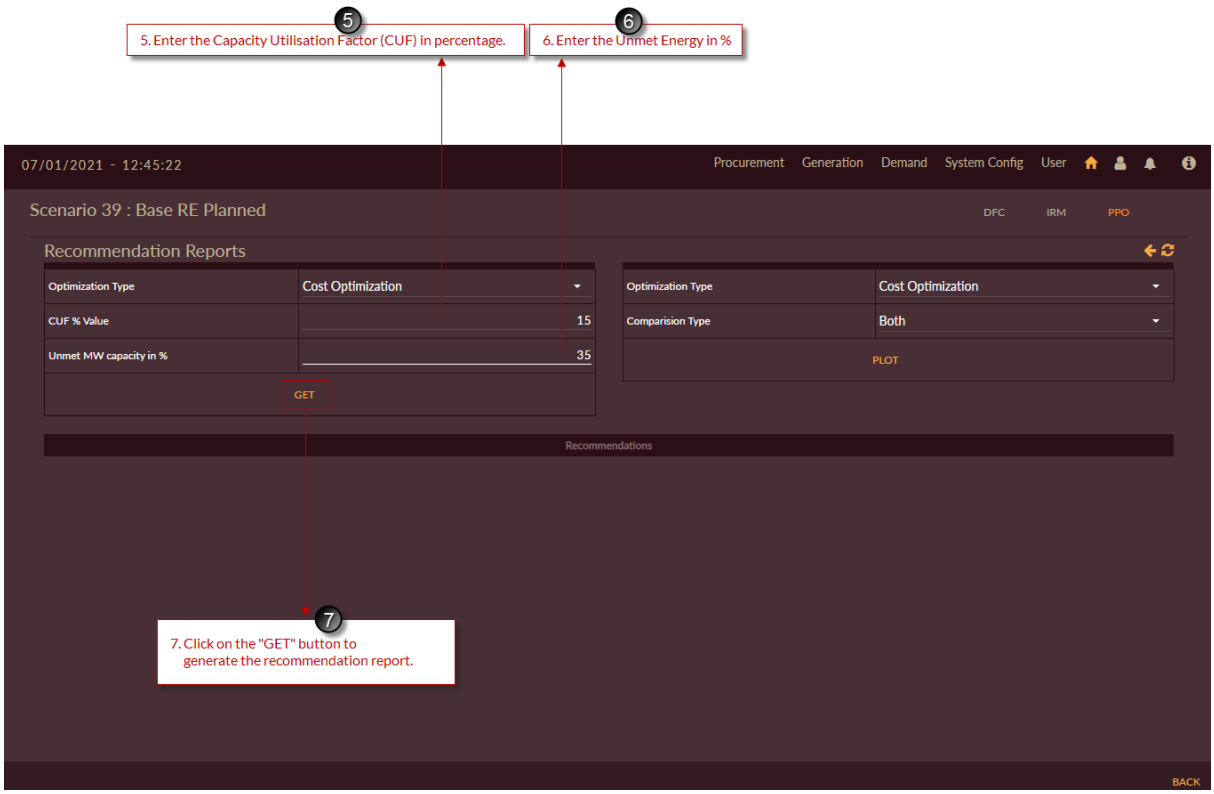


Figure 307. Generate Optimization Tables

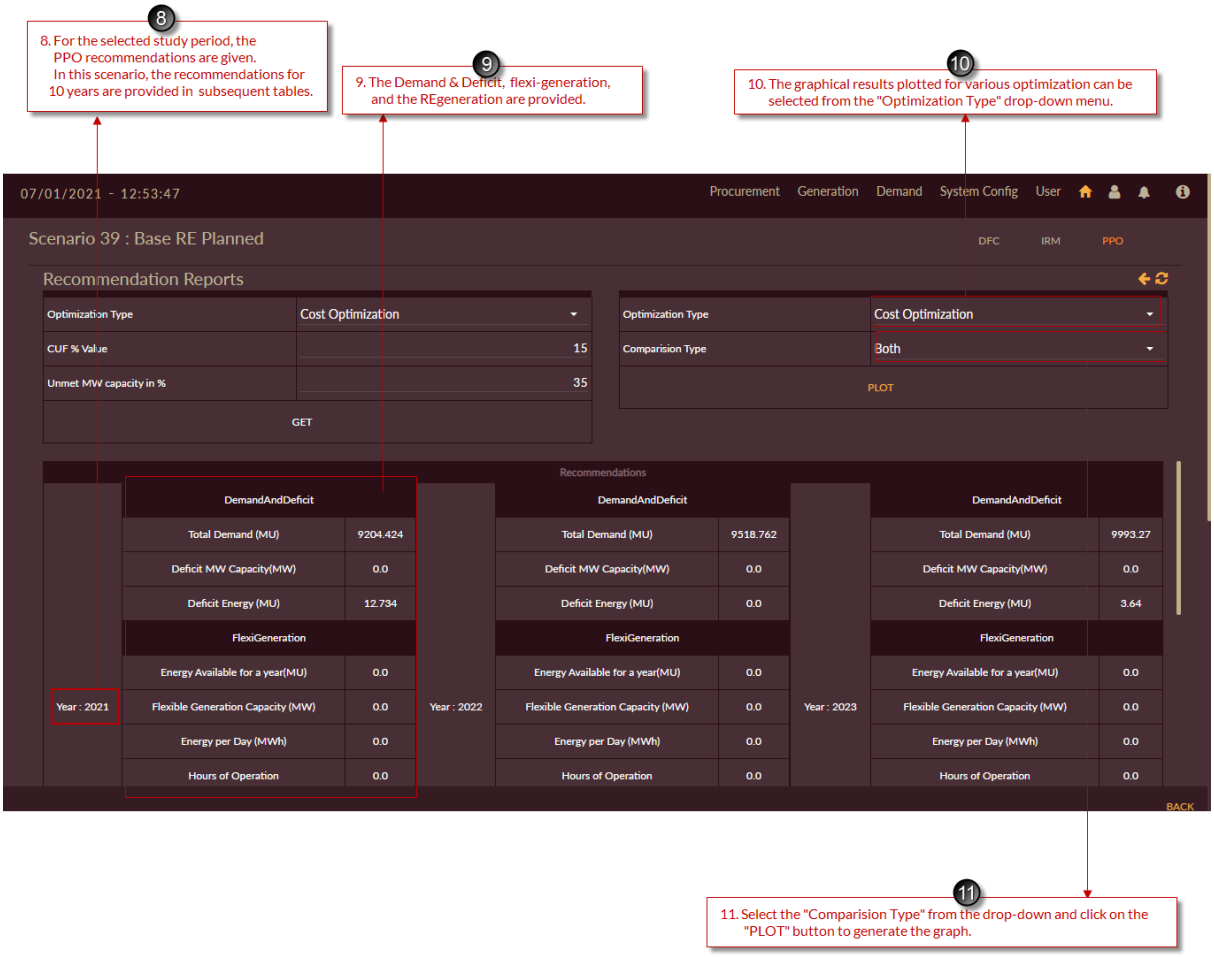


Figure 308. Select the Optimization Graphs

Figure 309. Demand Trend - Demand, Unmet Demand, Peak Demand, Peak Unmet

Figure 310. Demand Trend - Demand with Peak Demand and Peak Unmet

Figure 311. Demand Trend with Peak Unmet

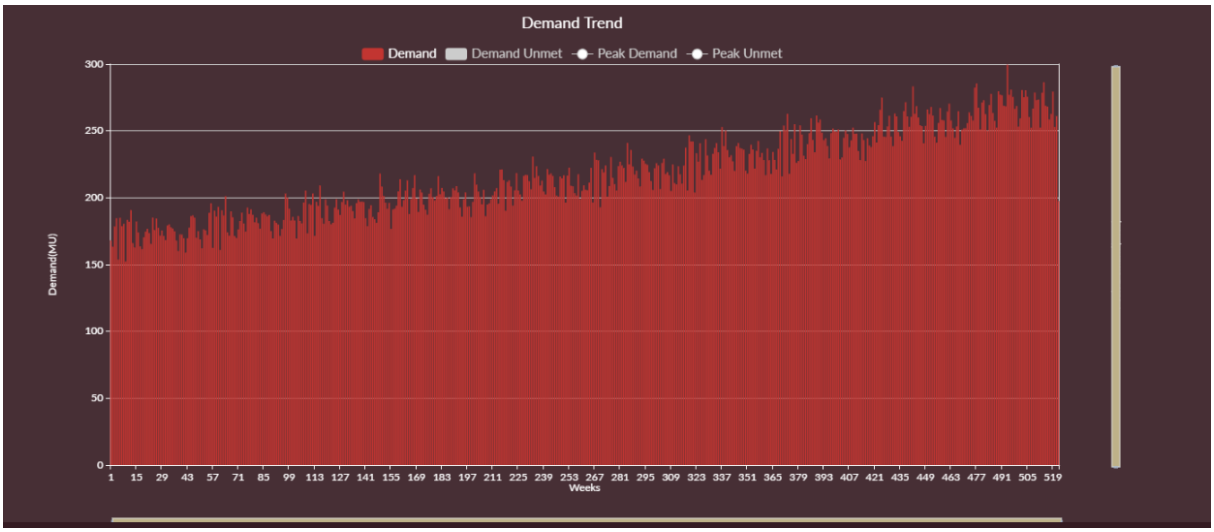


Figure 312. Demand

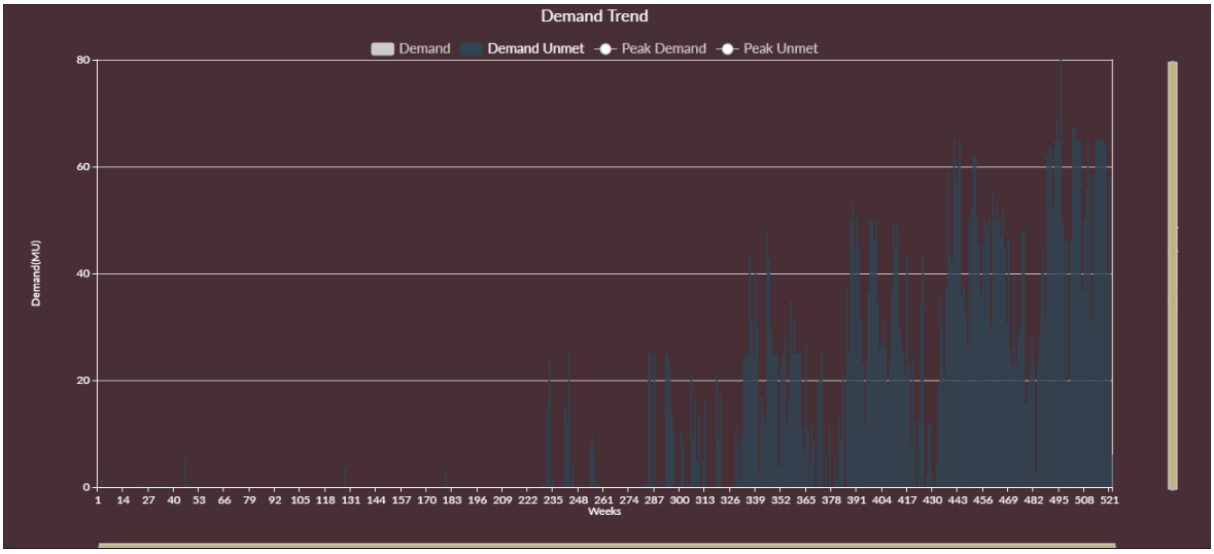


Figure 313. Demand Unmet

2.4 FREQUENTLY ASKED QUESTIONS

2.4.1 Demand Forecast

1. WHAT ARE THE VARIABLES PRE-CONFIGURED IN THE SOFTWARE?

The following variables are pre-configured:

Demand Data

Historical Energy Sales Data: The historical energy sales data is given as input to the application to forecast the future energy sales of the DISCOM. This variable acts as the dependent variable that participates in forecasting the future sales. Based on the forecasted energy sales for each category, the total DISCOM demand can be evaluated.

Weather Variations

TEMPERATURE: Temperature has the utmost influence on electrical demand among all weather-related factors. The parameters which have the impact on energy sales are also called as independent variables. When the temperature is cold or hot, there will be a large number of heating or cooling loads put into operation, which will result in a substantial change in power consumption needs in the residential and commercial sectors. Therefore, temperature, scaled at monthly horizon is an important factor in the medium-term load forecasting.

RAINFALL: The impact of wet years versus draught years on the demand, and further, the impact of years witnessing heavier/lower rainfall than usual can be estimated by including Rainfall (in mm) in the year/season/month as one of the independent variables. The impact of rainfall on energy sales can have either positive or negative depending on the geographical location of the DISCOM.

HUMIDITY: The yearly averages for humidity levels (in percentage) also play a key role in correlating the impact of weather variation on demand. However, this parameter has limited role on medium-term and long-term demand projections.

WATER TABLE: It is the ground water level measured in mgbl i.e., Meters Below Ground Level. The vast majority of groundwater supply sources require considerable energy for pumping. As the level of underground water recedes, the power required to draw the water through water-pumps and bore-wells increases, which will result in a substantial change in power consumption needs in the agriculture sector. Hence the water table is included as one of the independent variables to find the impact on DISCOM energy sales.

Demographic Variables

TOTAL POPULATION: Considering the rise in the growth of per capita consumption in a developing country, an increase in population will increase the demand seen by the utility. Domestic category energy sales mainly depend on the increase in population. Hence, population is included as an independent variable while calibrating the impact on DISCOM's energy sales.

Econometric Variables

GROSS DOMESTIC PRODUCT: The energy demand in a given area will increase at a rate that depends upon the population and economic growth of the people living in the area. This is reflected in the market value of final goods, measured by GDP. GDP of different sector gives an insight on the possible demand from the corresponding consumer categories. In addition, literature findings also emphasize the need for considering the Price of Electricity (Rs/kWh) as an important variable in addition to GDP to be able to effectively forecast the per capita consumption of electricity.

PER CAPITA INCOME: It is calculated based on the GDP value and the population forecasted. The per capita income represents the average income of an individual and this exhibits a positive

relationship with the consumption of electricity. As the income of an individual increases the consumption of electricity also increases, as the individual will opt for more electrical and electronic gadgets.

PRICE DEFLATOR: It is the deflation in the prices of the general commodities used in day-to-day life of the general public. This variable explains the effect of prices in the demand equation. This parameter has been calculated based on the ratio of GDP at current prices and GDP at constant prices.

GDP Manufacturing: The manufacturing sector is the largest consumer of industrial electricity. It runs power intensive processes that use a large amount of electricity. A rise in manufacturing increases the demand for electricity, especially for industrial use. Manufacturing is a key data point because it has a weight of more than three-fourths in the total demand experienced by the DISCOMs.

GDP Agriculture: Agriculture is described as the backbone for most of the developing countries like India. Agriculture uses energy directly as fuel or electricity to operate machinery and equipment, for lighting on the farm or mostly to pump water and indirectly in manufacturing fertilizers and chemicals produced to support farming

TAX HOLIDAY: A tax holiday is also implemented for businesses to encourage economic activity and foster growth. Used in the hopes of increasing the gross domestic product (GDP) in developing countries, tax holidays are a way in which governments attract foreign investors or foreign companies that establish base in the host country. Tax holidays are often put in place in particular industries to promote growth, develop, or diversify domestic industries. For specific categories like commercial, industrial, etc., several incentives are provided, which would impact the production and in-turn, the consumption by the category. For instance, the StartUp India Campaign by the Government of India allows startups to enjoy a three-year **TAX HOLIDAY** in a block of seven years. This encourages the startups to maximize their services/productions for the said period without having tax implications.

Which of the variables are suitable for each of the categories?

Typically, the suitability of variables is evaluated through data research. However, an indicative table is given in Table 8.

Table 8: Indicative Category – Variable Mapping List

SL. NO.	CATEGORY	VARAIBLES
1	Domestic	i. Population ii. Per Capita Income iii. GSDP
2	Commercial	i. GSDP ii. Per Capita Income iii. Price Deflator
3	Public lighting & water works	i. Population
4	Bulk Supply	i. GSDP
5	Industrial	i. GSDP Manufacturing ii. Price Deflator
6	General Purpose	i. Per Capita Income
7	Agriculture/Irrigation	i. GDP Agriculture

2. LIST THE SOURCES OF DATA FOR THE DIFFERENT VARIABLES USED IN FORECASTING THE DEMAND

The data may be found in sources indicated in Table 9.

Table 9: Indicative Data Source

DATA SET TYPE	DATA VARIABLES	SOURCE
Consumer Data	Consumer Categories	Distribution Licensee
Demand Data	Category-wise annual energy consumption	Distribution Licensee
	DISCOM-wise annual load profile	SLDC
	Load Factor	Distribution Licensee or computation from annual load profile data
	Per Capita Energy Consumption	Reports of surveys and statistical analysis carried out by designated entities
Weather Data	Seasons of the year	India Meteorological Department
	Annual/Seasonal Maximum Temperature	Public websites with weather data like accuweather
	Annual/Seasonal Rainfall	
	Annual/Seasonal Average Humidity	
	Water Table	Reports from relevant Central and State Boards
Demographic Variables	Population	Census of India or committees who carry out statistical analysis based on projection of population
	Number of connections	Distribution Licensee
Econometric Variables	Gross Domestic Product (overall and/or sector-wise)	Niti Aayog Reports, Economic surveys, policies and statistical analysis carried out by designated entities
	Per Capita Income	
	Price Deflator	
	4. GSDP Manufacturing	
	GDP Agriculture	
	Incentives like Tax Holidays	

3. Define Partial End -Use Method (PEUM) and What are the variables used in it?

Partial End-Use Method (PEUM) is a combination of time series analysis and end-use method. The time series method shall be used to project growth indicators, which shall then be used for forecasting electricity demand. The consumption of power is assumed to be a measure of the indigenous requirements. The future demand is not projected directly out of past demand data but from the power utilized in end products, which is measured through growth indicators. The indicative list of growth indicators for broad categories is tabulated in Table 10.

Table 10: Growth Indicators for each Category

SL. NO.	BROAD CATEGORY	GROWTH INDICATORS
1	Consumer Categories	iv. Number of Electricity Consumers (typically mid-year) v. Energy Consumption per Consumer (kWh)
2	Public Lighting & Public Water Works	ii. Connected Load (kW) iii. Average energy consumption per kW of connected electric load (kWh/kW)
3	Irrigation	ii. Number of Pump-sets / Tube-wells iii. Average capacity of pump-sets / tube-wells iv. Hours of operation of pump-sets / tube-wells
4	Industries	Direct projection of energy consumption based on past trend
5	Railway Traction	Scaling the existing consumption based on 'track electrification programme'

Table 10: Growth Indicators for each Category		
6	Bulk Supply	Based on data of specific consumers (research establishments, institutions, hospitals, power projects, etc.) made available from various sources or by trend analysis.

2.4.2 Power Purchase Optimization

1. What are CONTRACTS?

The Power purchase agreements between a utility and power producer are termed as contracts. The energy procured from the seller by the Utility over different period of times is mutually agreed and fixed.

2. What are the different types of contracts that a utility can have?

A utility may have either a short-term contract termed as "Exchange" which can be purchased to meet hourly demand predicted by the utility or a medium-term or long-term contract called "Procurement" that shall be used by the utility to meet the demand.

3. Can the contracts with constraints be modeled in discom-repose?

Yes. The **OPERATING LIMITS** of each individual unit participating in the power procurement contract will be honored while modeling in such a way that for the committed contracts, the total hourly production across contracts from each unit will have a lower bound that is set to minimum generation and an upper bound set to maximum generation

4. Can I see the total energy procured via a contract annually?

Yes. It will be a user-defined value. The respective utility can fix this value while honoring the contract in the software.

5. Does the contract come with fixed cost?

No. A contract has both fixed and variable cost for the time period the contract is active. It can be easily configured under Procurement Module in the software.

6. How is the Open access contract treated in the software?

The Open Access contracts made directly by consumers have been accommodated in the Demand Forecasting Module as a driver. The short-term and long-term Open Access directly contracted by the Utilities will be configured in this PPO module.

2.5 TROUBLESHOOTING

2.5.1 Hardware Issues

Q: Facing application performance issue

A: Server memory may be less. Ensure the following minimum requirements are met:

- RAM – 8 GB
- Hard Disk – 250 GB
- Network/Wi-Fi interface should be minimum 1 Gbps.
- Windows Pro or Windows Server Edition

2.5.2 Software Issues

Q. Discom-Repose is not getting invoked as expected?

A: The proper invocation of the Discom-Repose requires the successful installation and working of the following software products. Check if the following software dependencies are fixed.

1. **Microsoft Visual C++ Redistributable 64 bit**: Check whether Microsoft Visual C++ Redistributable 64 bit is installed successfully or not.

   Follow these steps to check if Microsoft Visual C++ Redistributable is installed on your machine:

   1. Go to **Start>Control Panel >Programs and Features**
   2. Search for Microsoft Visual C++ Redistributable software.
   3. If you see the software listed in the programs, then it indicates that the software is installed on your machine.
   4. If the software is not listed then download 2015 version and install or seek the support of the DISCOM-REPOSE administrator to install.

      https://www.microsoft.com/en-in/download/details.aspx?id=48145

2. **Python Packages:** The Python packages with the following versions essential for running Discom-Repose may not be installed or may not be properly installed. If installed ensure if the correct version of packages are installed on your machine. The packages with the version are listed below:

   - Tensorflow2.0
   - Keras 2.3.0
   - Matplotlib 3.3.2
   - Datetime 4.3
   - Pandas 1.1.2
   - Numpy 1.19.2
   - psycopg2 2.7
   - statsmodels 0.12.0
   - sklearn 0.23
   - mlxtend 0.17.3
   - ortools 7.8.7959

Follow these steps to ensure if the packages are installed on your machine. **Note:** You have to install all these packages using the PIP command. Check the installation guide for more detailed steps.

1. Go to **Start>Run>Command>Enter**.
2. In the command prompt type "pip show "package name".

   Ex- pip show pandas

3. **"powerlfc" Application: Check if** "powerlfc" application is installed and ensure if it is activated.

Follow the steps to find the path of the installed files.

1. Navigate to **folder > Service > application.properties**
2. There we can find the powerlfc path.

Q. Getting "This site can't be reached" error message in browser when tried to open application with valid URL?

A: Either the Tomcat server may be down or the ports using which the application connects is blocked or not configured properly in the client property file while installing the application.

1. **Tomcat Server Down:** The Apache Tomcat 8 server may be down. Check if server is up and running, if not make the server active and running. If you still face difficulties please contact Discom-Repose administrator.
2. **PORTS are not configured:** In the client property file, the ports should be configured in the right manner for the software to function efficiently.

Follow the steps to verify if the ports are configured correctly.

1. Navigate to folder > Service > application.properties
2. Navigate to folder - C:\Program Files\Apache Software Foundation\Tomcat 8.0\webapps\DISCOM-REPOSE\WEB-INF\classes\properties\database.proerties
3. Navigate to folder - C:\Program Files\Apache Software Foundation\Tomcat 8.0\webapps\DISCOM-REPOSE\WEB-INF\classes\client\client.proerties
4. If all these steps fail, contact the Discom-Repose administrator for further help.

Note: The location in which you may find the folder may be different from the illustration.

3. **PORT is blocked:** Sometimes the PORT may be blocked for unknown reasons. In such cases, contact the Discom Repose Administrator.

2.5.3 Installing DISCOM-REPOSE Software WAR Files

Q. Users complain that after the deployment of the new build, they still find the old build.

A: Check the steps below:

1. Check if the latest build is present on the server with build details. Locate the build details file by navigating to the folder:

   Start>Mycomputer>C:\Program Files\Apache Software Foundation\Tomcat 8.0\webapps\DISCOM-REPOSE\Build-details.txt

2. Navigate to Tomcat 8 folder and check the "catalina.out" in the logs directory of Tomcat 8. Check if the "*. WAR" filename is deployed or not.

3. If both are checked and the issue still persists, then stop the Tomcat service and clear the content of the temp directory under the work/Catalina/localhost using the

   Reference command:

   Follow these commands to stop and resume the service.

   1. To stop the service – ctrl+c
   2. To start the service – Navigate to folder C:\Program Files\Apache Software Foundation\Tomcat 8.0\bin
   3. Right click on Tomcat8x and run as administrator.

2.5.4 Login Issues

Q. I am unable to Login to DISCOM-REPOSE application.

A: Check for any of the following reasons.

1. **User ID is not created** – contact DISCOM-REPOSE administrator to create a valid id.
2. **Password entered may be wrong** –The passwords are case sensitive. Check if Caps Lock is on. If you have forgotten the correct password, use Forgot Password option or contact DISCOM-REPOSE administrator to reset your password and re-login with the new password.
3. **Role is not assigned** – At least one role must be assigned to each of the software user. Contact DISCOM-REPOSE administrator to check if a role is assigned and get a role assigned for the user.
4. **Schema details may be wrong** – The right schema should be configured for successful login of the users. Hence verify if the right schema is configured in the "database.properties" file. Follow the steps to locate the file.

   1. File path - Navigate to folder - C:\Program Files\Apache Software Foundation\Tomcat 8.0\webapps\DISCOM-REPOSE\WEB-INF\classes\properties\database.proerties

Q. I am unable to access DISCOM-REPOSE URL.

A: Check for the following possibilities to resolve the issue.

1. **Check the URL**: URL is case sensitive. Check if you have entered the URL properly. For correct URL, contact DISCOM-REPOSE administrator.
2. **Connectivity Issue**: Check the connectivity of the system. Internet/intranet connection should be working to be able to access the URL.
3. **Server Availability Issue** – DISCOM-REPOSE server may be down, contact DISCOM-REPOSE administrator to check the server availability.

2.5.5 Management & Administration

Q. How do I activate my account?

A: In order to be able to access DISCOM-REPOSE, you should have valid login credentials. Contact PRDC or the utility administrator.

What is the email address to be used for the same?

Q. I am unable to modify data (Variable/Category etc.).

A. Modifying any data in DISCOM-REPOSE requires the user to have MODIFY permission for the respective module. For the permission, contact DISCOM-REPOSE administrator.

Q. I am unable to view all the tabs.

A: The tabs and the buttons that can be seen by a user depend on the permissions assigned to the user. If you are not seeing few of the tabs mean that you don't have the permission to view those tabs. Contact DISCOM-REPOSE administrator.

2.5.6 Module 1: Demand Forecasting

2.5.6.1 INPUT PARAMETERS

Q. I am unable to create Input Parameters.

A: Do the following to rectify the issue.

1. Creating any data in DISCOM-REPOSE requires the user to have CREATE permission for the respective module. Check if your account has the permission to create the input parameters. To get the permission, contact DISCOM-REPOSE administrator.
2. Ensure appropriate mapping of parameters are done in the application: The order of creation of parameters is the following: variables→ categories→ licensees.

A Licensee is mapped to categories of consumers whereas each of the categories is in-turn mapped with independent and dependent variables. Ensure that for any parameter that you select for creating a scenario, appropriate categories and variables are configured and mapped.

Q. I am unable to configure variable data in decimals.

A: The value of the "Variable" may be set to "Count". Reset the value to "Decimal".

Q. I am unable to fetch data of bigger size.

A. Verify weather "set maxHttpHeaderSize" is set to 65536 under connector tag or not in server.xml file. If not please update and save then restart the server or contact DISCOM-REPOSE administrator.

Follow the steps to make changes.

1. Navigate to "C:\Program Files\Apache Software Foundation\Tomcat 8.0\conf\server.xml"
2. Stop the server using – ctlr+c
3. Server Start - Navigate to folder C:\Program Files\Apache Software Foundation\Tomcat 8.0\bin
4. Right click on Tomcat8x and run as administrator.

2.5.6.2 BUILDING Scenarios

EDIT SCENARIO

Q. I am unable to edit variables data in License Projection page.

A. 1. Historical data cannot be edited.

2. State variables data cannot be modified in license projection data page.

Q. I am unable to see any variables in PEUM page.

A. Any variable created is ideally mapped to a category. In this case, maybe no variables are mapped to the categories under the PEUM tab.

EXECUTE SCENARIO

Q. I am unable to Execute Demand Forecasting Scenario.

1. Base/Raw data may not be configured and saved properly in configuration pages, (Ex: Variable historical and future data, Drivers data, Driver data, T&D losses data etc.)
2. After creating a scenario, License and State projection data may not be configured and saved. As License and State projection data are the mandatory data for demand forecasting scenario execution.
3. Java spring boot Service may be down, contact DISCOM-REPOSE administrator.
4. Generally, a folder for saving the execution files is created and this folder path should be configured in database.properties and client.properties file to ensure all the files are stored in this location.

   The files are located in the following path:

   1. Database.proerties File path - C:\Program Files\Apache Software Foundation\Tomcat 8.0\webapps\DISCOM-REPOSE\WEB-INF\classes\properties\database.proerties
   2. Client.proerties File Path - C:\Program Files\Apache Software Foundation\Tomcat 8.0\webapps\DISCOM-REPOSE\WEB-INF\classes\client\client.proerties
   3. Navigate to both these files and check if the folder name provided for storing the execution files is mentioned appropriately.
5. Python files may not be saved and files path is not mentioned in application.properties file. To resolve this, do the following:

   Navigate to folder > Service > application.properties

DOWNLOAD/EXPORT/VIEW SCENARIO RESULTS

Q. I am unable to download PDF document.

A. Try the following steps to download the document.

1. May be the pop-up blocker is enabled in the browser which is blocking the download. Enable the pop-up and retry.
2. The required image files are not added in directory or directory path may be wrong. Create a folder and update its path in property files or contact DISCOM-REPOSE administrator.
3. Probability analysis may not be executed properly. Even though it is not mandatory for PDF report, due to some junk file it causes issue. Please execute Probability analysis again and save data.

2.5.7 Module 2: Integrated Resource Mapping

2.5.7.1 INPUT PARAMETERS

Q. I am unable to create input parameters?

A. Try all the steps given below to resolve.

1. Creating any data in DISCOM-REPOSE requires the user to have CREATE permission for the respective module. For the permission, contact DISCOM-REPOSE administrator.
2. Dependencies are maintained in configuration of Input parameters. In order to create a PLANT all required libraries need to configure.
3. In order to create portfolio, all plants need to be created.

2.5.7.2 BUILDING SCENARIOS

EDIT SCENARIO

Q. I am unable to view demand forecasted in pre-executed scenario.

A. Load profile data need to download from pre executed scenario for years configured in IRM scenario.

EXECUTE SCENARIO

Q. I am unable to Execute IRM Scenario.

A. Try the steps given to resolve.

1. Base/Raw data may not be configured and saved properly in configuration pages (Ex: Hydro profile data, RE profile data & Demand data etc.)
2. After creating a scenario, Hydro, Thermal, RE & Demand data may not be configured and saved.
3. Java spring boot Service may be down, contact DISCOM-REPOSE administrator.
4. Folder need to be created in directory for execution files storing and folder path need to be configured in database.properties and client.propertiesfile.
    1. Database.proerties File path - C:\Program Files\Apache Software Foundation\Tomcat 8.0\webapps\DISCOM-REPOSE\WEB-INF\classes\properties\database.proerties
    2. Client.proerties File Path - C:\Program Files\Apache Software Foundation\Tomcat 8.0\webapps\DISCOM-REPOSE\WEB-INF\classes\client\client.proerties
5. Engine path is not mentioned in application.property file.
6. Navigate to folder > Service > application.properties

DOWNLOAD/EXPORT/VIEW SCENARIO RESULTS

Q. I am unable to view graphs/data in result screen even after successful execution?

1. May be py.db property file is not configured with valid database and schema details.

    Navigate to folder > IRM_Engine > pydb.properties

2. May be output parser is missing from the directory, contact DISCOM-REPOSE administrator.

    Output parser file path
    Navigate to folder > IRM_Engine > ro_output_parser

Q. I am unable to download PDF/text document?

1. May be browser is blocking the pop up, please enable the pop up.
2. Required image files are not added in directory or directory path may be wrong. Create a folder and update its path in property files or contact DISCOM-REPOSE administrator.
    1. File path - database.proerties File path - C:\Program Files\Apache Software Foundation\Tomcat 8.0\webapps\DISCOM-REPOSE\WEB-INF\classes\properties\database.proerties
3. Execution should be successful.

Q. I am unable to download and export load profile templates?

The size of the memory configured for Apache tomcat server cache/pool memory may be less. Reconfigure the memory with required memory size and save the settings. Or else contact the Discom Repose administrator.

B. HARDWARE REQUIREMENTS

1. HARDWARE REQUIREMENTS

This section includes the system requirements table that lists out all the system requirements.

Table 11 DISCOM-REPOSE System Requirements Information			
1	RAM	16GB	32 GB RAM
2	CORE	QUAD-CORE	QUAD-CORE
3	OS	WINDOWS SERVER 2008	WINDOWS SERVER 2012 R2 standard/2016/2019
4	DATABASE	----------	POSTGRESQL V.10

2. UNBOXING SOFTWARE – INSTALLATION & DEPLOYMENT

2.1.1 Software Requirements

The software requirements of DISCOM-REPOSE are discussed in this section. These are mandatory and should be installed prior to the installation of DISOM – REPOSE software for its successful installation and usage.

2.1.1.1 INSTALLING JAVA JDK 8.0

1. Download the Java SE Runtime Environment 8 (exe) for Windows operating system using the following link.

   https://www.oracle.com/technetwork/java/javase/downloads/jre8-downloads-2133155.html

   Note: Accept the license agreement term and remember to choose a compatible version 32/64 bit for your machine.

2. Check for downloaded file and double-click on the .exe file to initiate the installation.

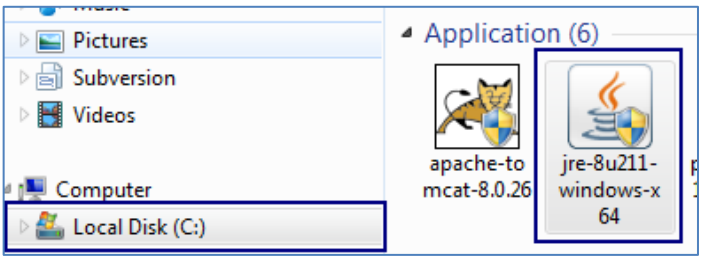


Figure 314. Download JAVA JDK

3. The Wizard to guide the Installation process appears. Click on **Install** to continue.

   Note: If you wish to continue the installation with the default folder, continue from

Step 4**The Java Setup - Progress** page appears.

Figure 315. Java Installation Begins

Follow these steps to **Change the Destination Folder**.

If you wish to change the destination folder, follow the steps below.

a. To change the destination folder, click on **Change destination folder** check-box.

b. Click on **Install** button. The **Change destination** folder page appears.

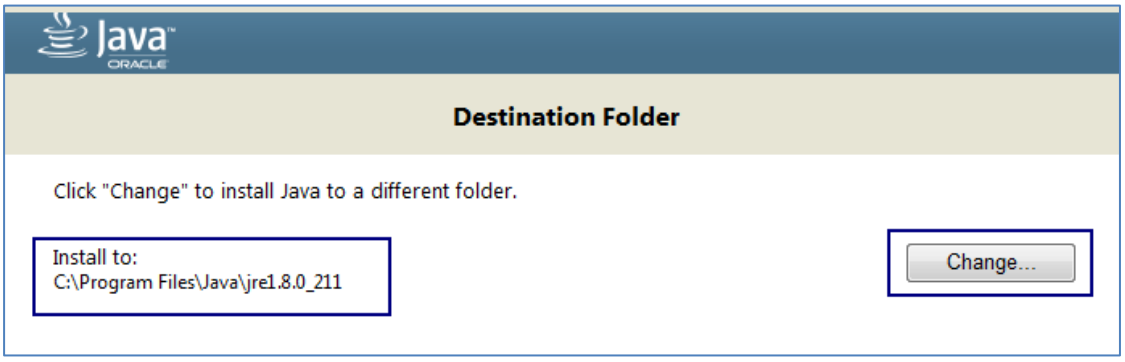
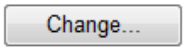


Figure 316. Change Location to Install Java in a Different Folder

c. The **Browse For Folder** pop-up appears. Click on 

button to change the folder.

Note: If an alternative folder exists, you could select that folder and click **OK** button. Otherwise, select the drive and click on **Make New Folder** button and create a folder.

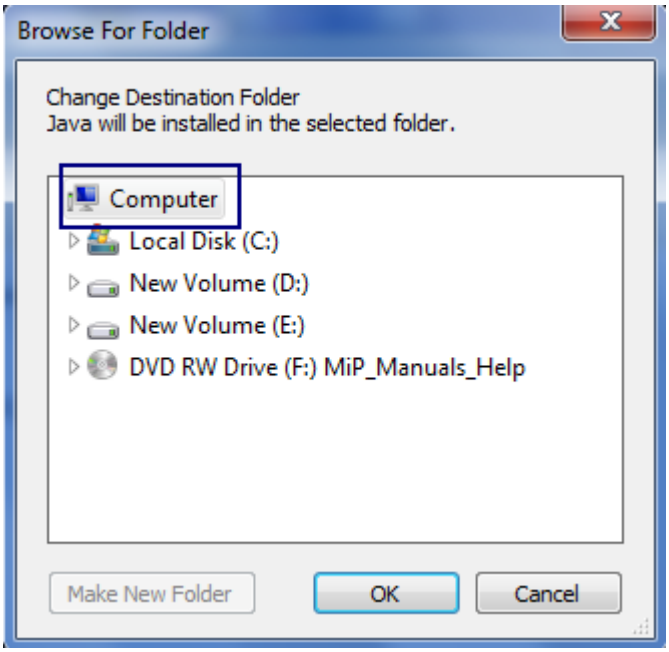


Figure 317. Browse For Folder

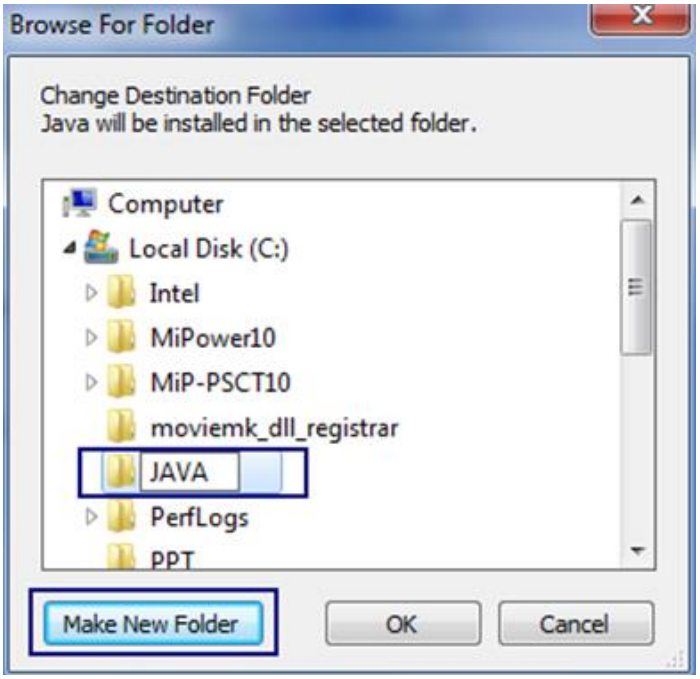


Figure 318. Make New Folder

d. Click on **OK**. The **Java Setup Destination Folder** reflects the alternative folder.

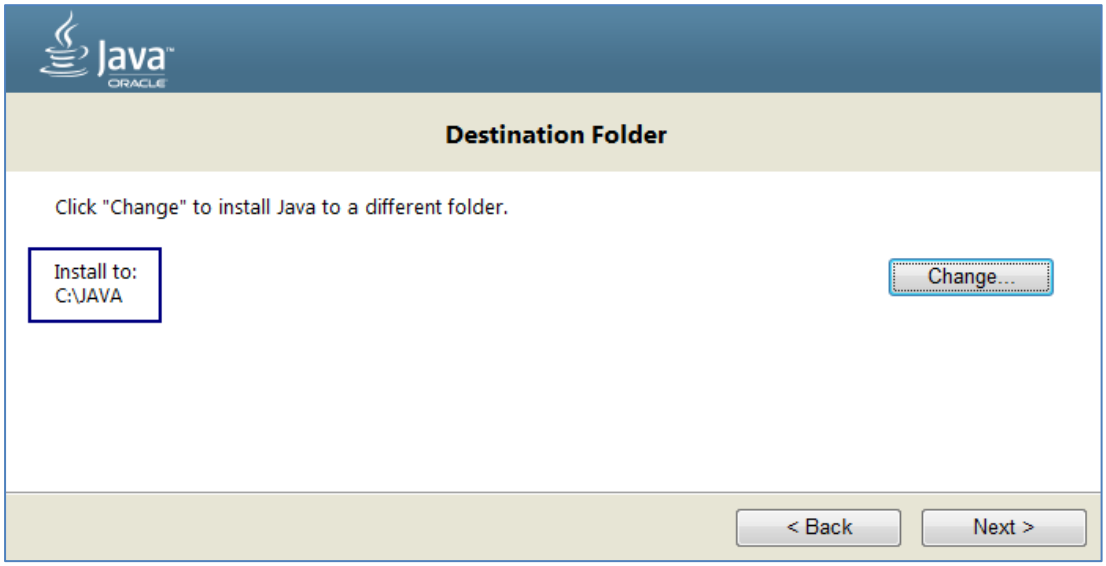


Figure 319. Java Installation Folder Changed

e. Click on **Next** button.

4. **The Java Setup - Progress** page appears.

Figure 320. Installing Java Page

5. The **Java Setup - Complete** page appears with a success message You have successfully installed Java.

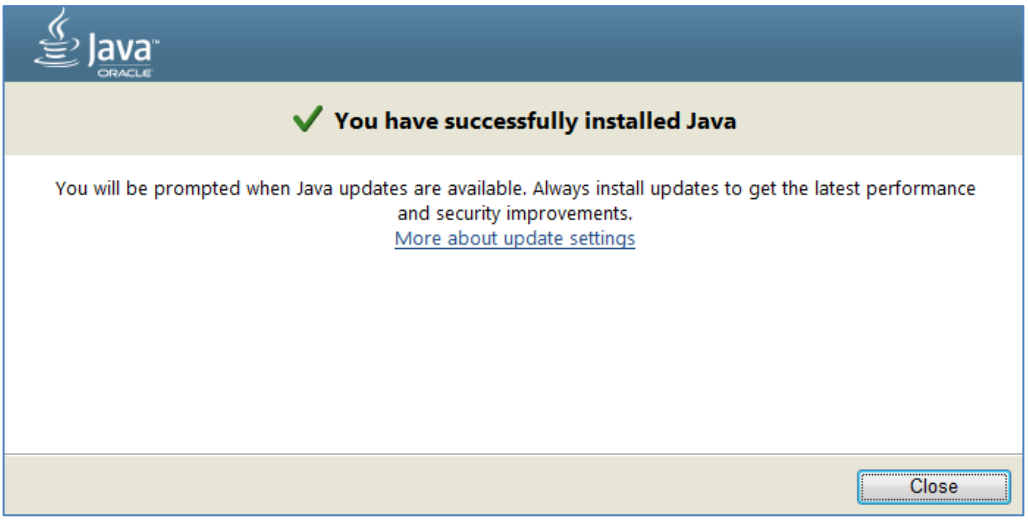


Figure 321. Java Installation Successful Page

2.1.1.2 INSTALLING TOMCAT V 8.0.X

This section gives you the steps to install TOMCAT V 8.0.x (64 bits).

1. Download the TOMCAT V 8.0.26 (exe) for Windows operating system using the following link.
   https://archive.apache.org/dist/tomcat/tomcat-8/v8.0.26/bin/apache-tomcat-8.0.26.exe
2. Check the downloads for the file and double-click on the exe file. The **Apache Tomcat Setup** page appears.

Figure 322. Apache Tomcat Setup

3. Click on **Next** button. The **License Agreement** page appears.

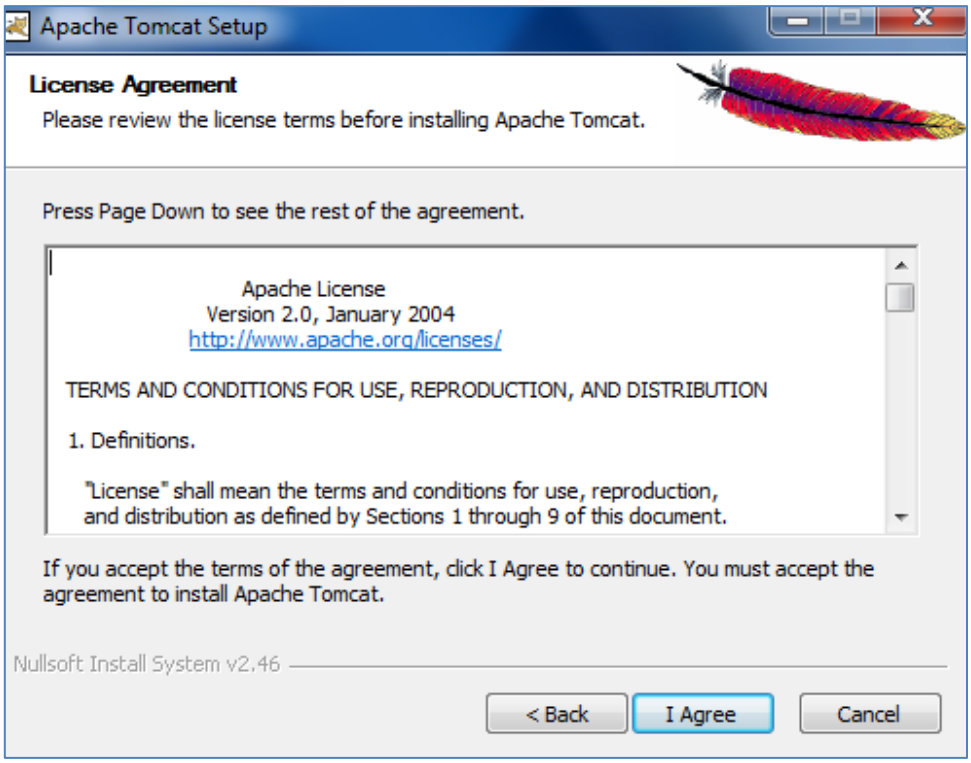


Figure 323. License Agreement

4. Click on **I Agree** button.

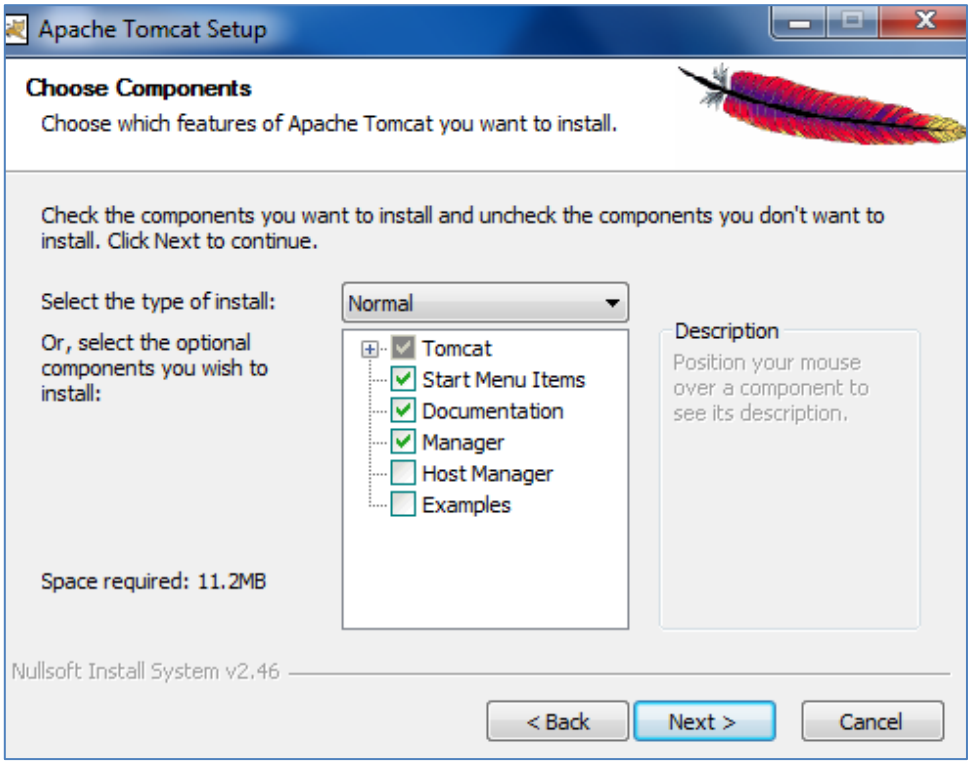


Figure 324. Choose Components Page

5. Select the necessary components by checking the check-boxes or leave it with the default as per your requirements and click on **Next** button.

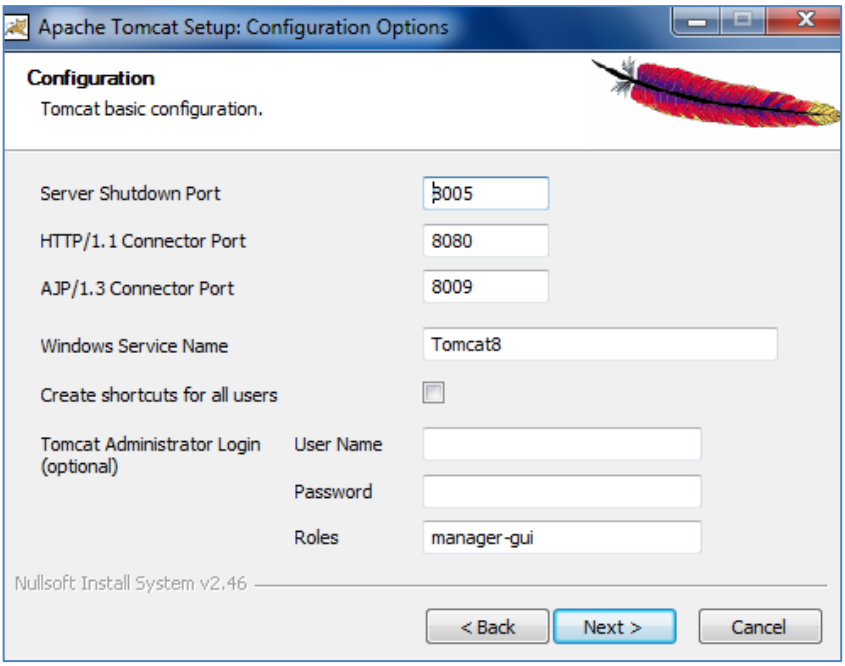


Figure 325. Configuration Settings

6. Click on **Next** button. The **Java Virtual Machine** Path Selection page appears.

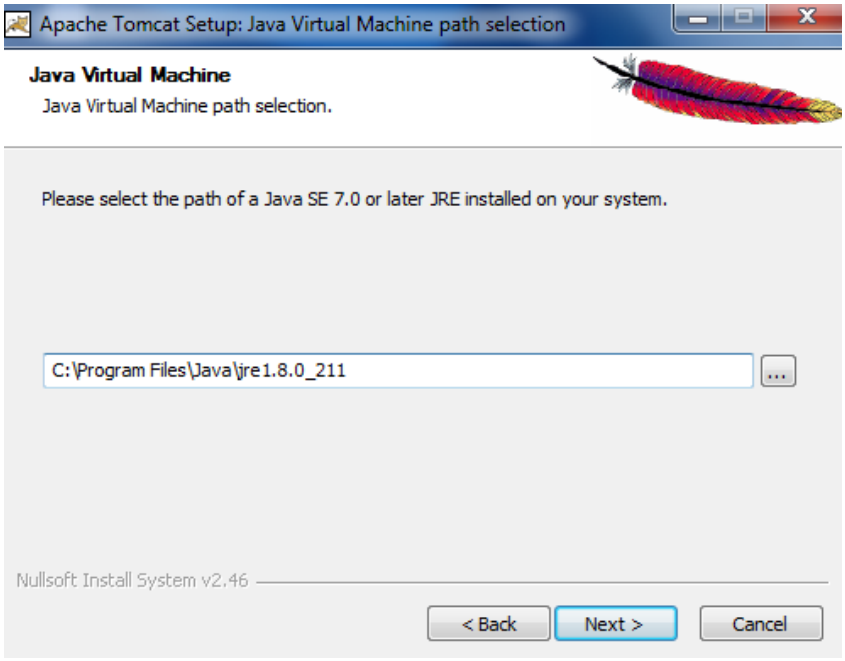


Figure 326. Java Virtual Machine Page

7. Click on **Next** button. The **Choose Install Location** page appears.

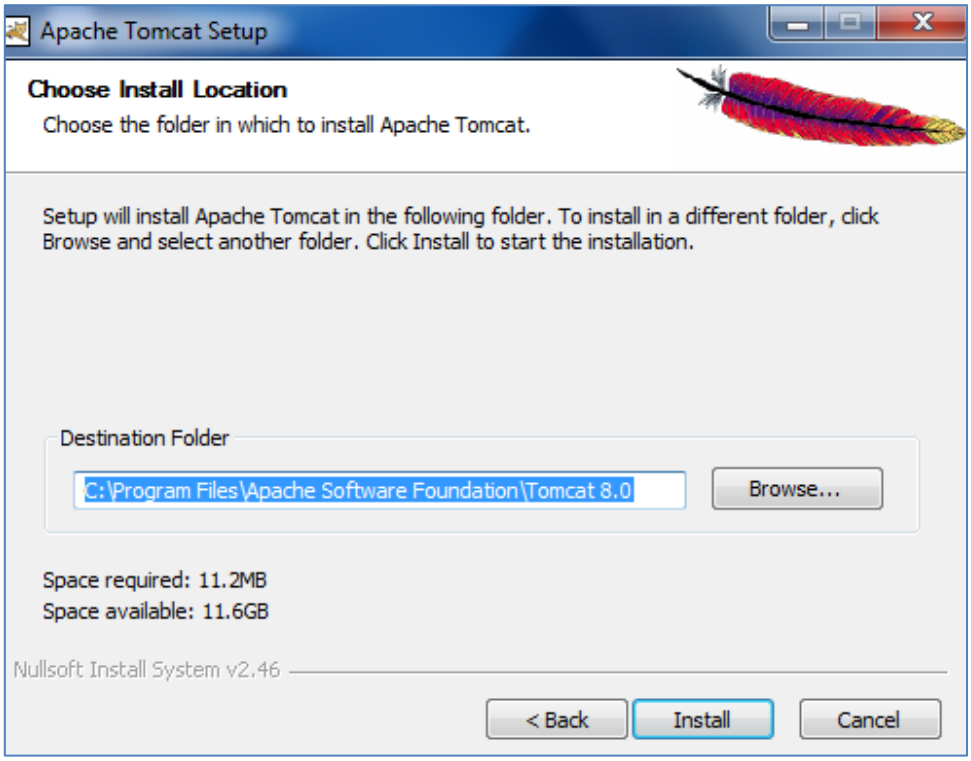


Figure 327. Choose Install Location

8. Click on **Install** to begin the installation process.

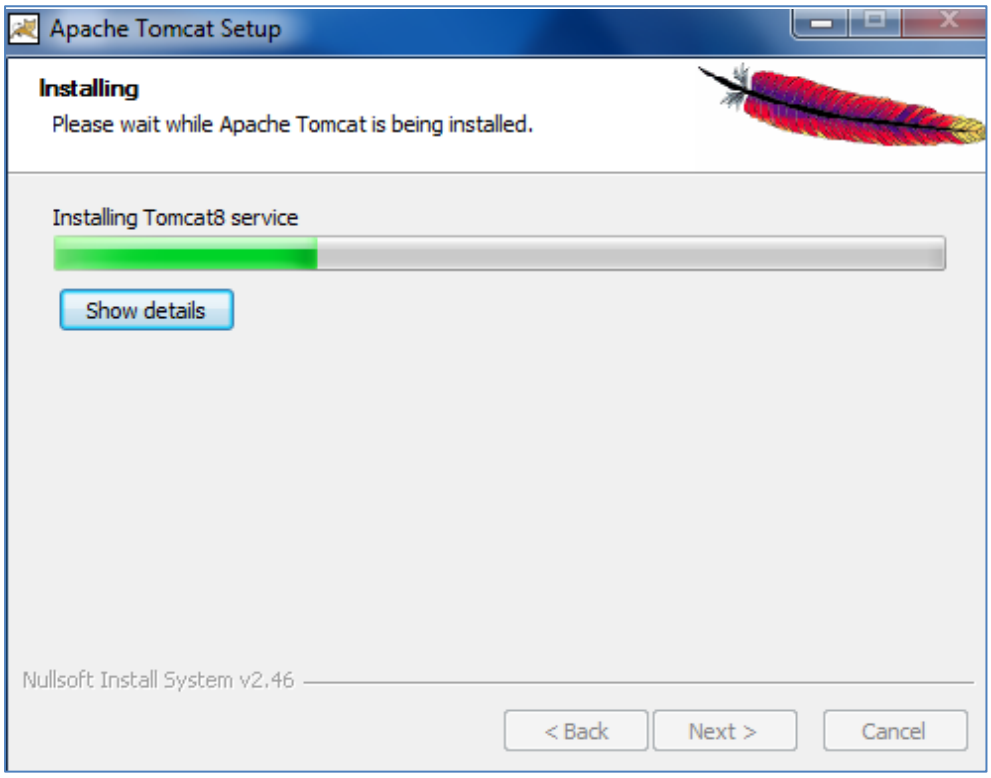


Figure 328. Installing

Note: You can change the destination folder using the **Browse** button to select another location.

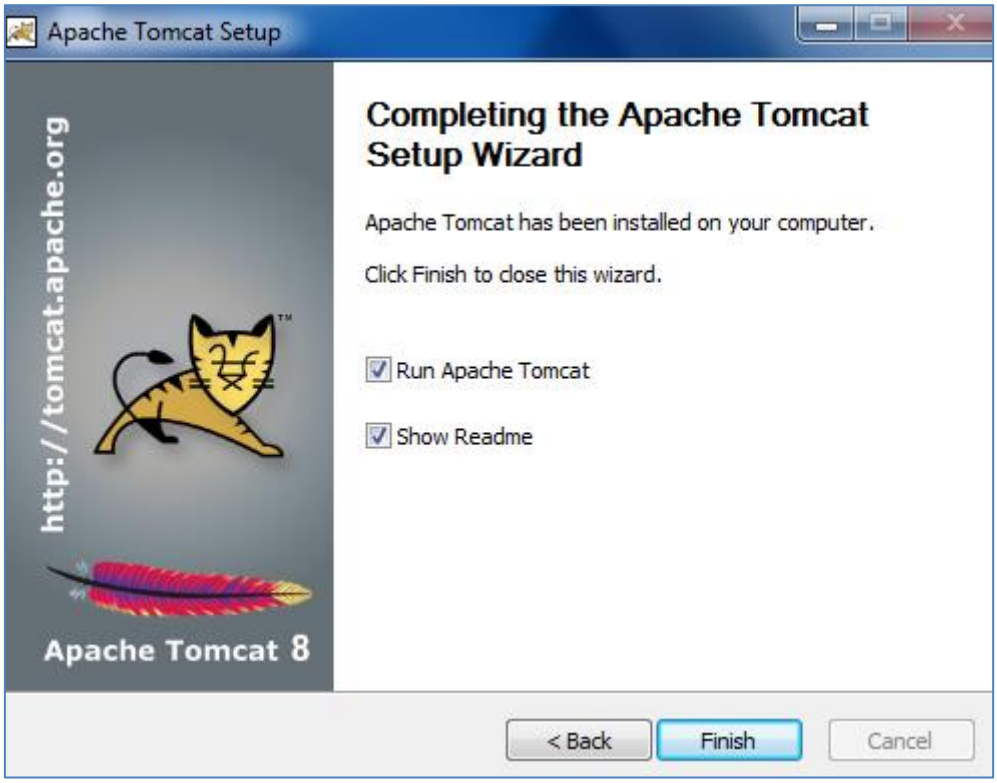


Figure 329. Setup Completed Page

9. The **Completing Setup** page appears. Click on **Finish** button to complete the task.

2.1.1.3 INSTALLING PYTHON V 3.7.2 CONFIGURATION

This INSTALLING PYTHON V3.7.3 section gives the steps to install Python V 3.7.3 for Windows 7 and above versions.

Check the Windows processor version if its 32 or 64 bits before installing python. Choose the right version of Python based on the bit-system on your machine. Ideally, the 3.7.3 VERSION (62 BIT) IS INSTALLED IN THIS SCENARIO.

Follow the steps to install Python.

1. Go to www.python.org.

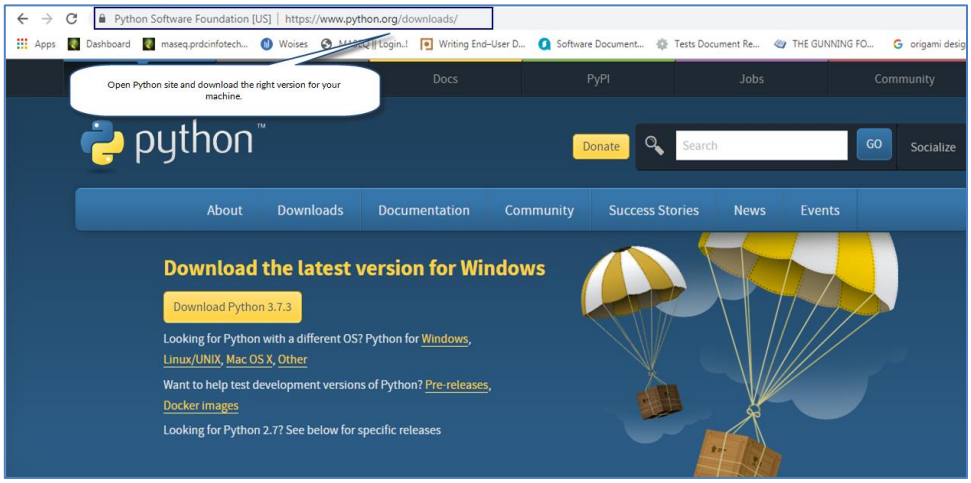


Figure 330. Python Website

2. Click on **Downloads** tab.

Figure 331. Download Tab

3. Click on the **Python 3.7.3** button under Download for Windows.

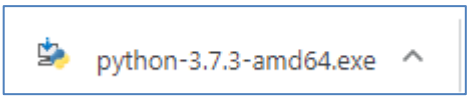


Figure 332. Downloading python-3.7.2.exe

4. Open the location where the file has downloaded.

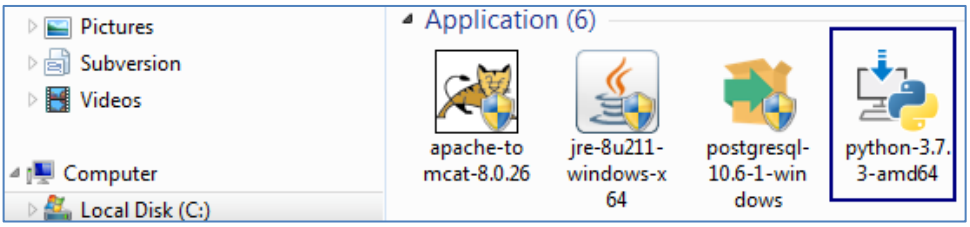


Figure 333. Location of the Downloaded File

5. Double-click on the folder. The **Open File-Security Warning** Dialog appears.

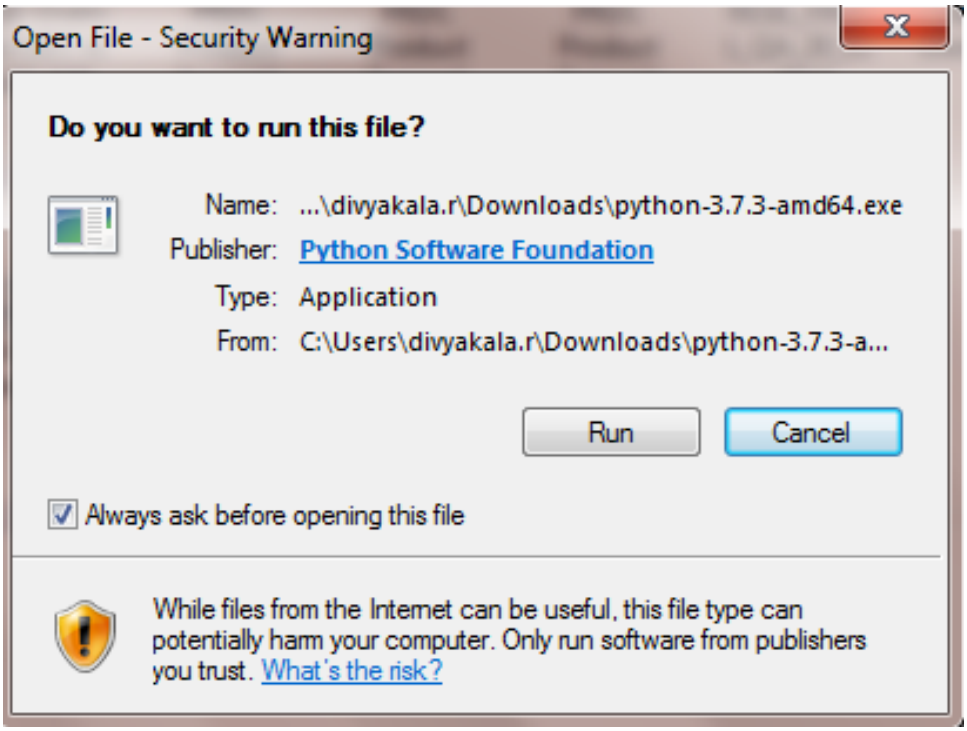


Figure 334. Run Dialog

6. Click on **Run**. The **Install Python 3.7.3 (64-bit)** dialog appears.

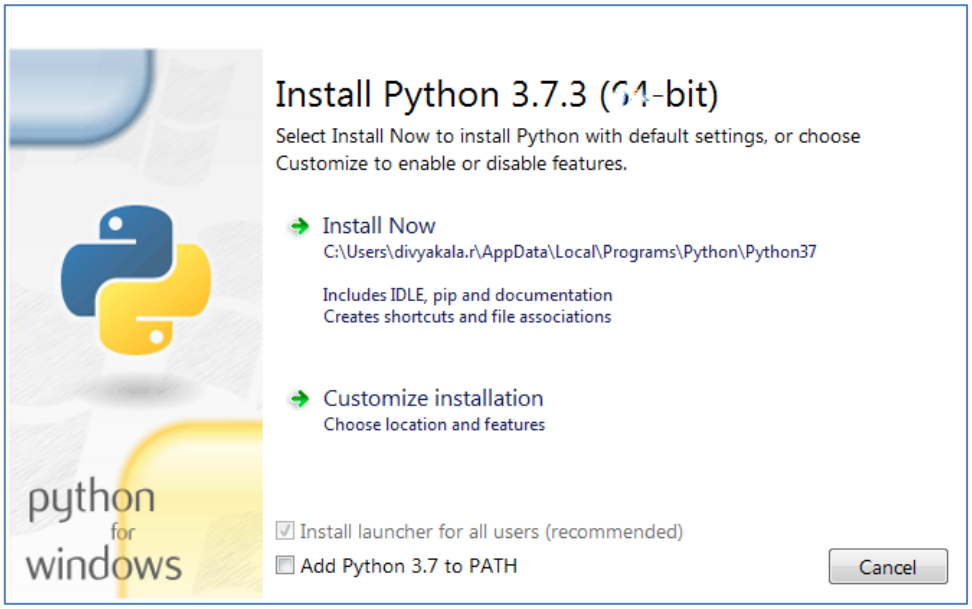


Figure 335. Python Setup Dialog-A

7. Select **Customize installation** option.

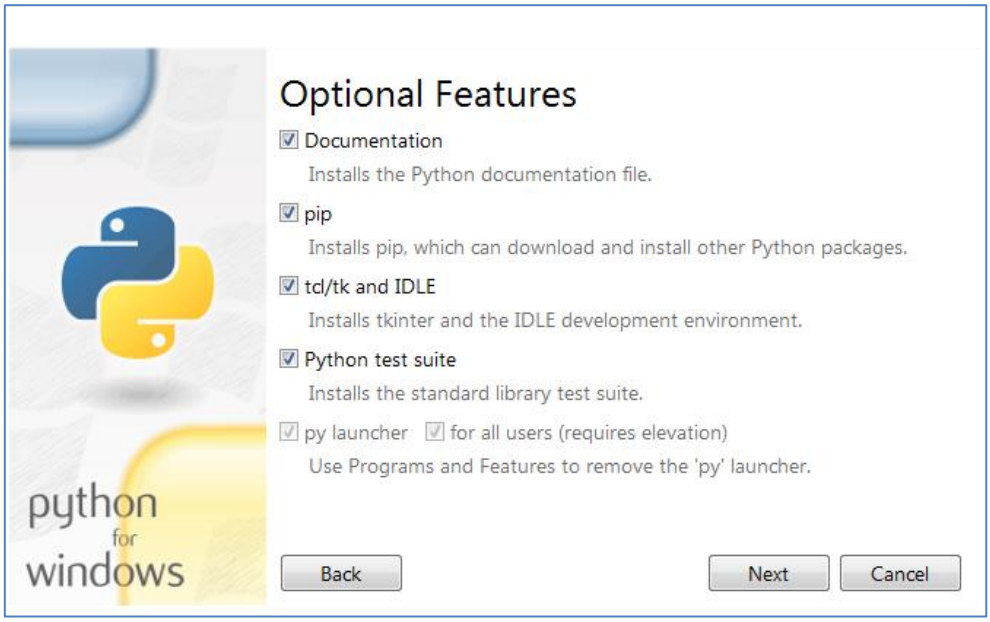


Figure 336. Python Setup Dialog-B

8. Click on **Next** button. The **Python Setup-Advanced Options** dialog appears.

Prerequisite

Before selecting the customized location, ensure you create a folder "**Python"** in a location of your choice. In this illustration, the Python folder is created in the following location.

`C:\Python`

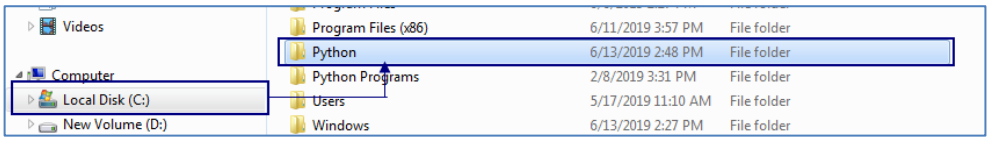


Figure 337. Create a Python Folder in C Drive

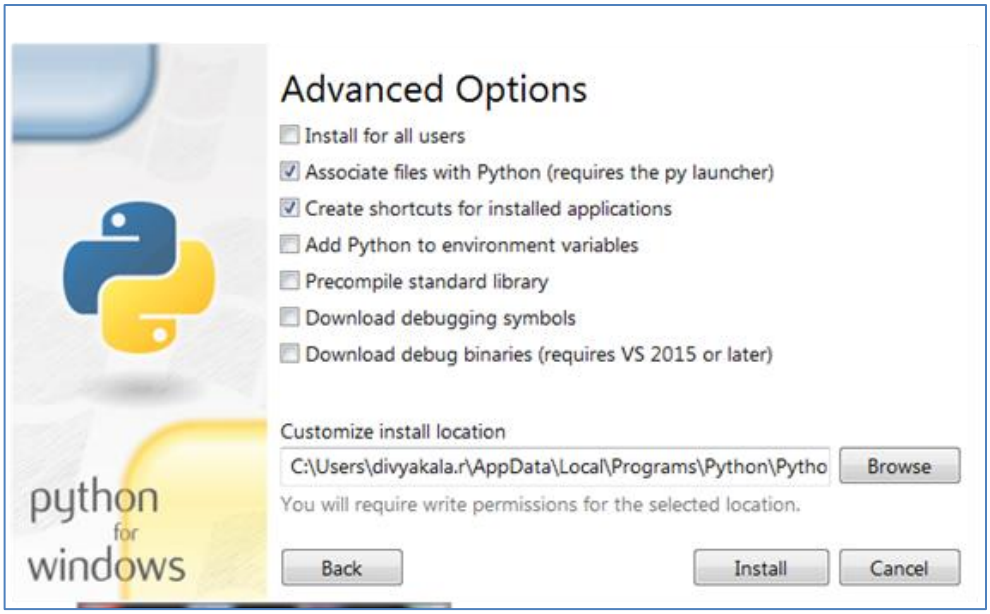


Figure 338. Advanced Options- Customize Install Location

9. Click on **Browse** button to select the Python folder in the following path: `C:\Python`

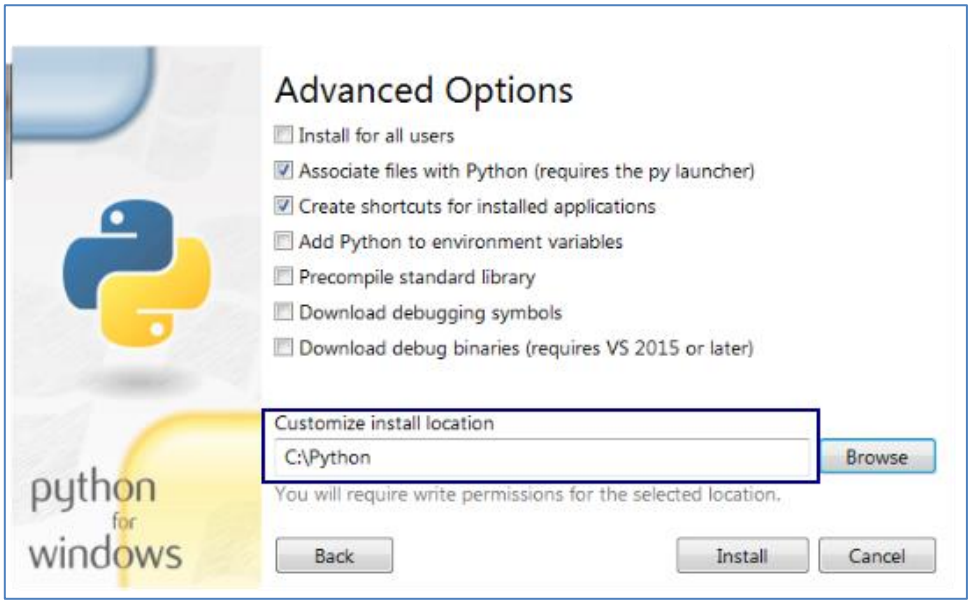


Figure 339. Select Python Folder

10. Click on **Install** button. The Setup Progress dialog appears.

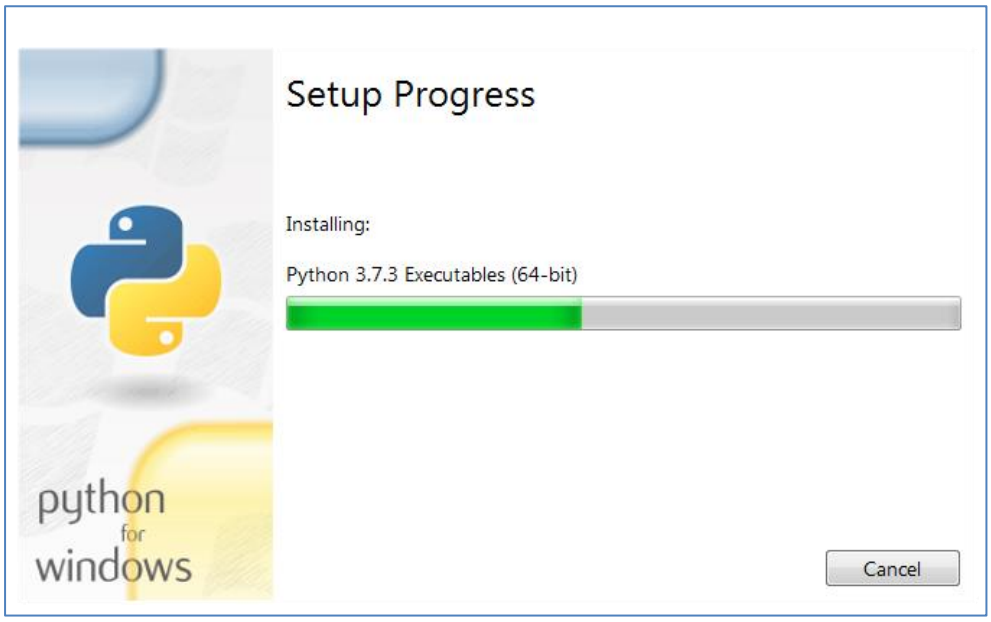


Figure 340. Setup Progress

11. Upon completion of installation the **Setup Successful** dialog appears.

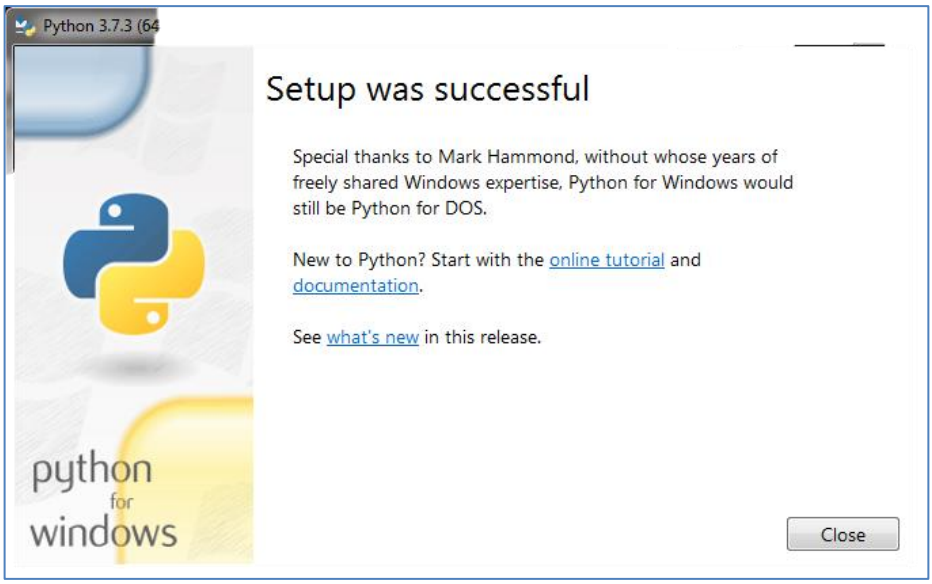


Figure 341. Setup Successful

12. Post installation the **Python 3.7 (32-bit)** application option appears in the Windows start menu.

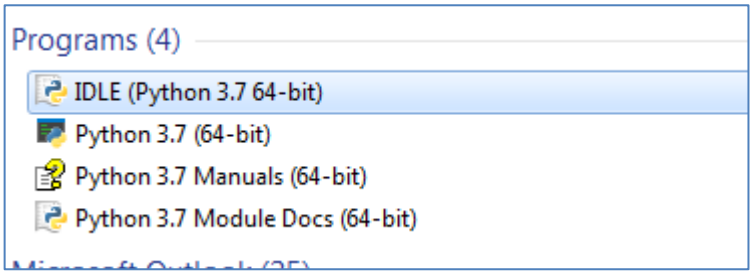


Figure 342. Python in the Windows - Start Menu

13. Go to **My computer**> **Right-click** > **Properties**>**Advanced System Settings**.

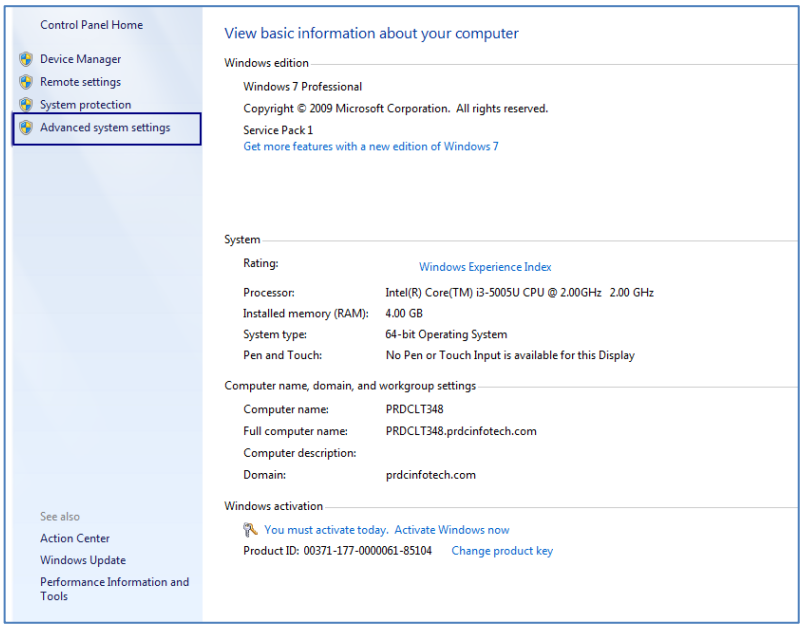
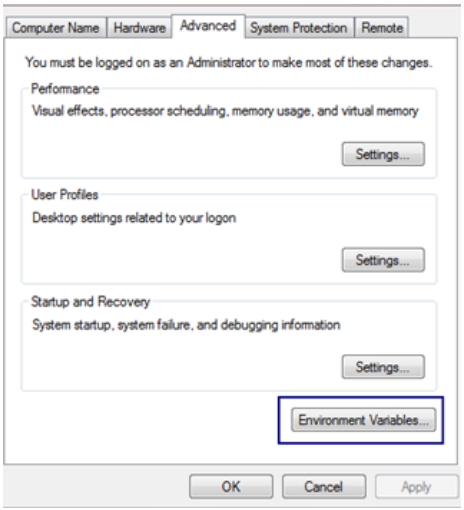


Figure 343. Windows Advanced Settings

14. The **Advanced** tab appears.



15. Click on the **Environment Variables** button. The Environment Variables dialog appears.
16. Click on **New** button. Enter the New User variable. Copy the path in which the **Python** directory is created as shown in the figure below. Click on **OK**.

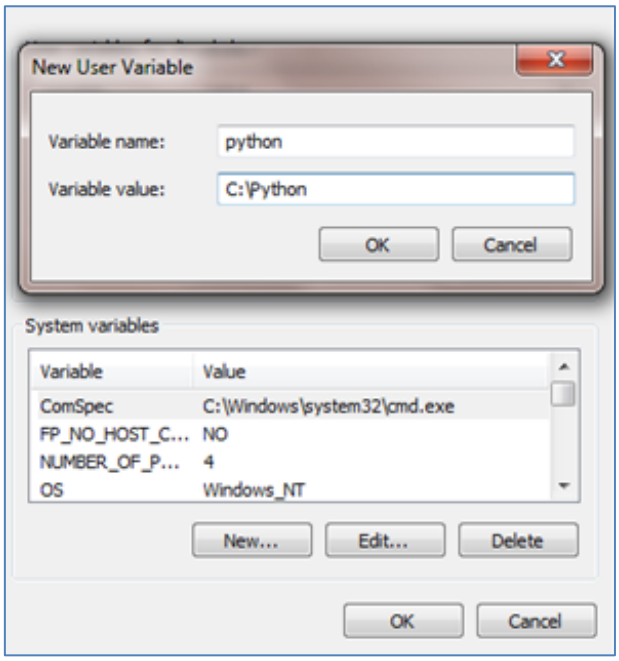


Figure 344. Python Folder

17. Click on **New** button. Enter the New User variable. Copy the path in which the **Python Scripts** directory is created as shown in the figure below. Click on **OK**.

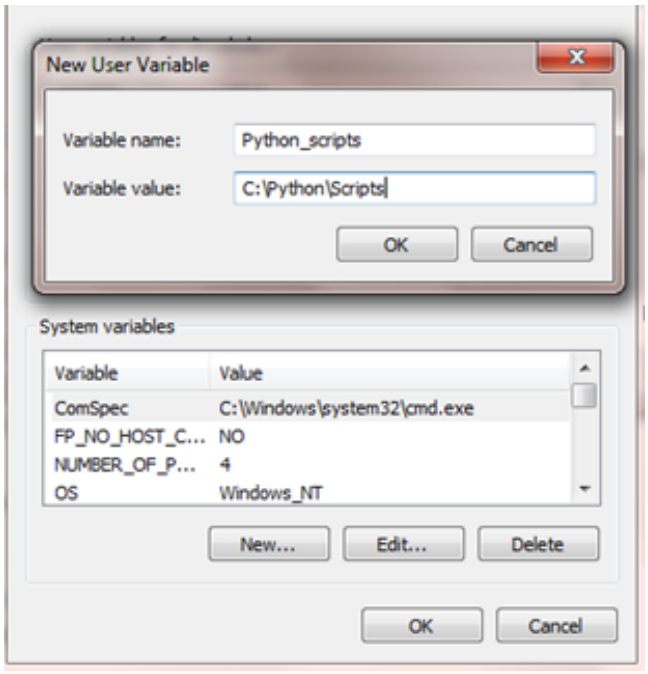


Figure 345. New User Variable

18. In the system variables section, select the **Path** option and click on **Edit** button.

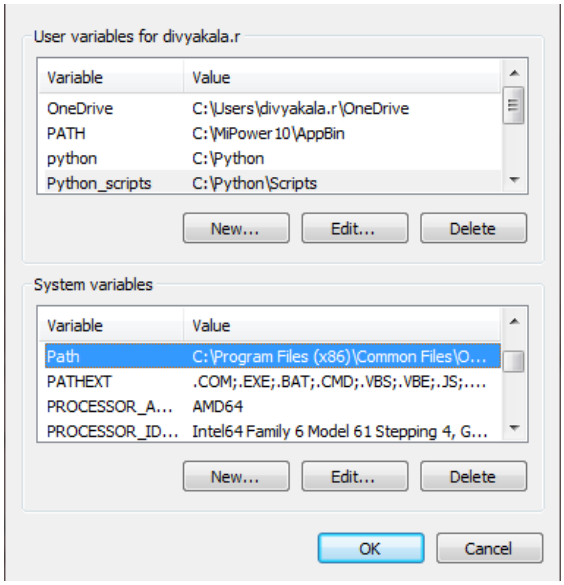


Figure 346. Edit Environment Variables

19. The Edit System Variable dialog appears.

Set the following environment variables as shown below.

1. Copy and paste the path of the **Python folder** and the **Python Scripts** folder separated by a semicolon as shown below and append it with the existing path.

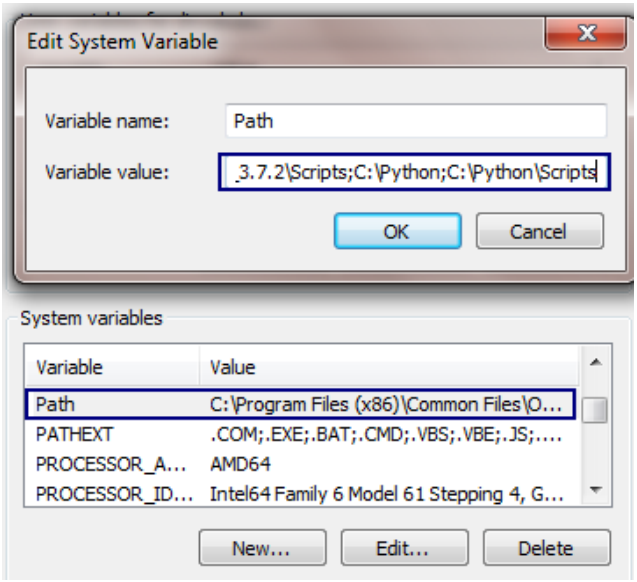


Figure 347. Edit System Variable Dialog

2. Click on **OK** button. Thus, the environment variables are set successfully.

2.1.1.4 SETTING UP THE IMAGE PACKAGES

1. Go to **Windows**> **Start** > Command **Prompt** (**cmd**). At the prompt, type **python.** The information about python installed appears. This ensures if installation of python is successful or not.

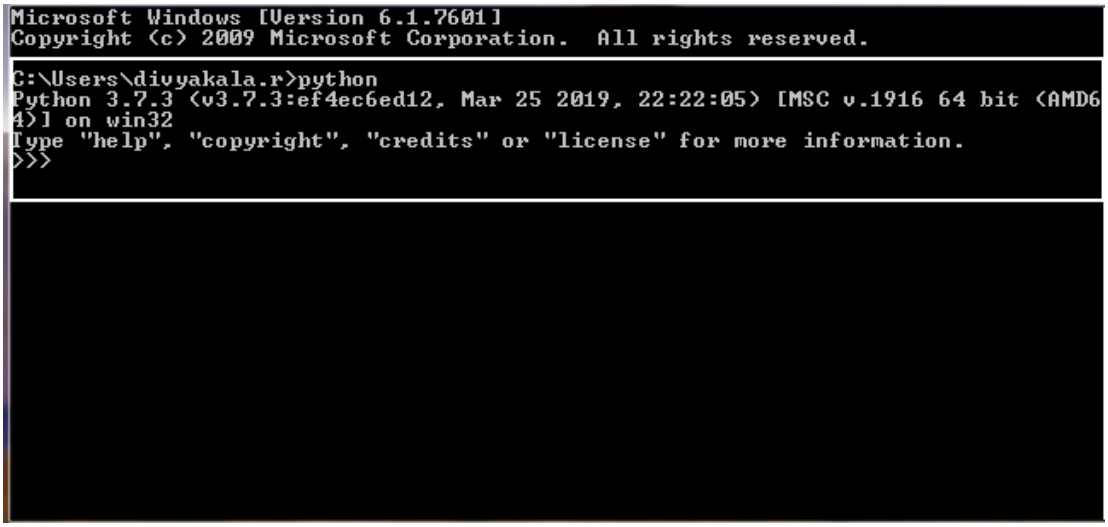


Figure 348. Python - Installation check

2. Install the image package using the following command.

C:\Users\divyakala.r\pip install image

3. The image package gets installed as shown in the figure below.

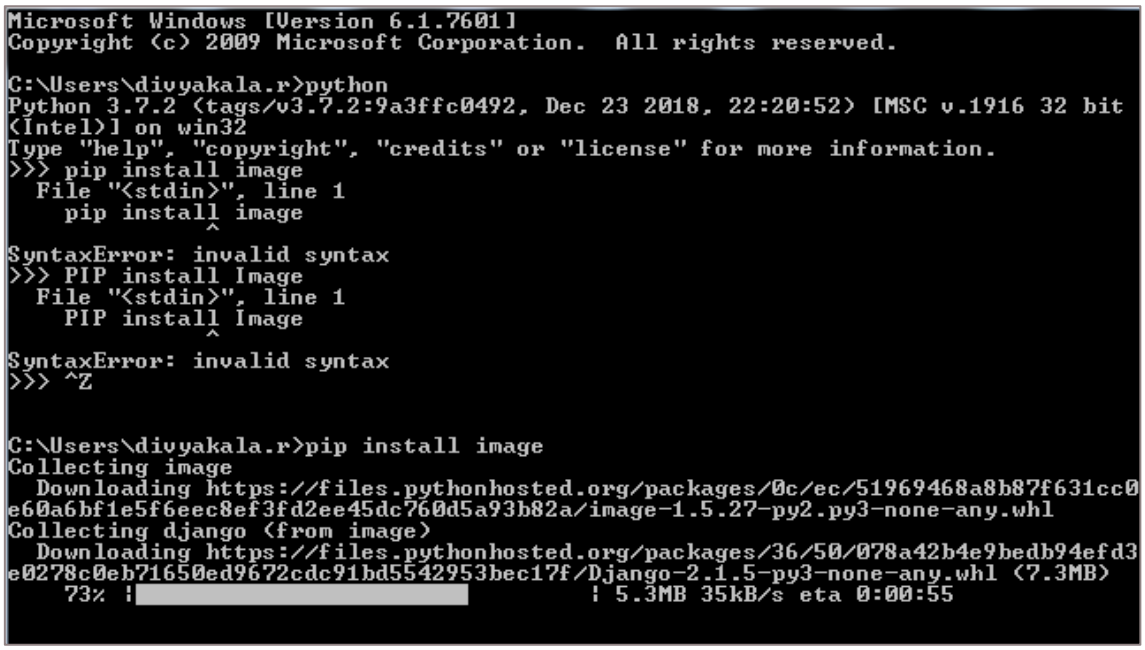


Figure 349. Image Package Installation

C:\Users\divyakala.r\pip install numpy

4. Install the numpy package using the following command.
5. The numpy package gets installed as shown in the figure below.

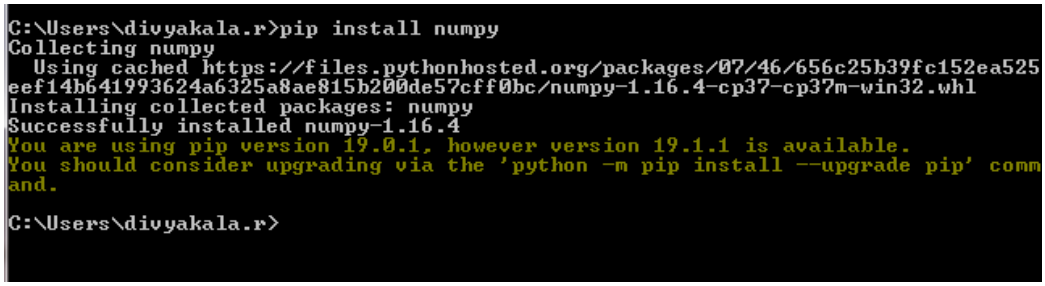


Figure 350. Numpy Package Installation

6. Install the MATPLOTLIB package using the following command.

C:\Users\divyakala.r\pip install matplotlib

7. The MATPLOTLIB gets installed as shown in the figure below.

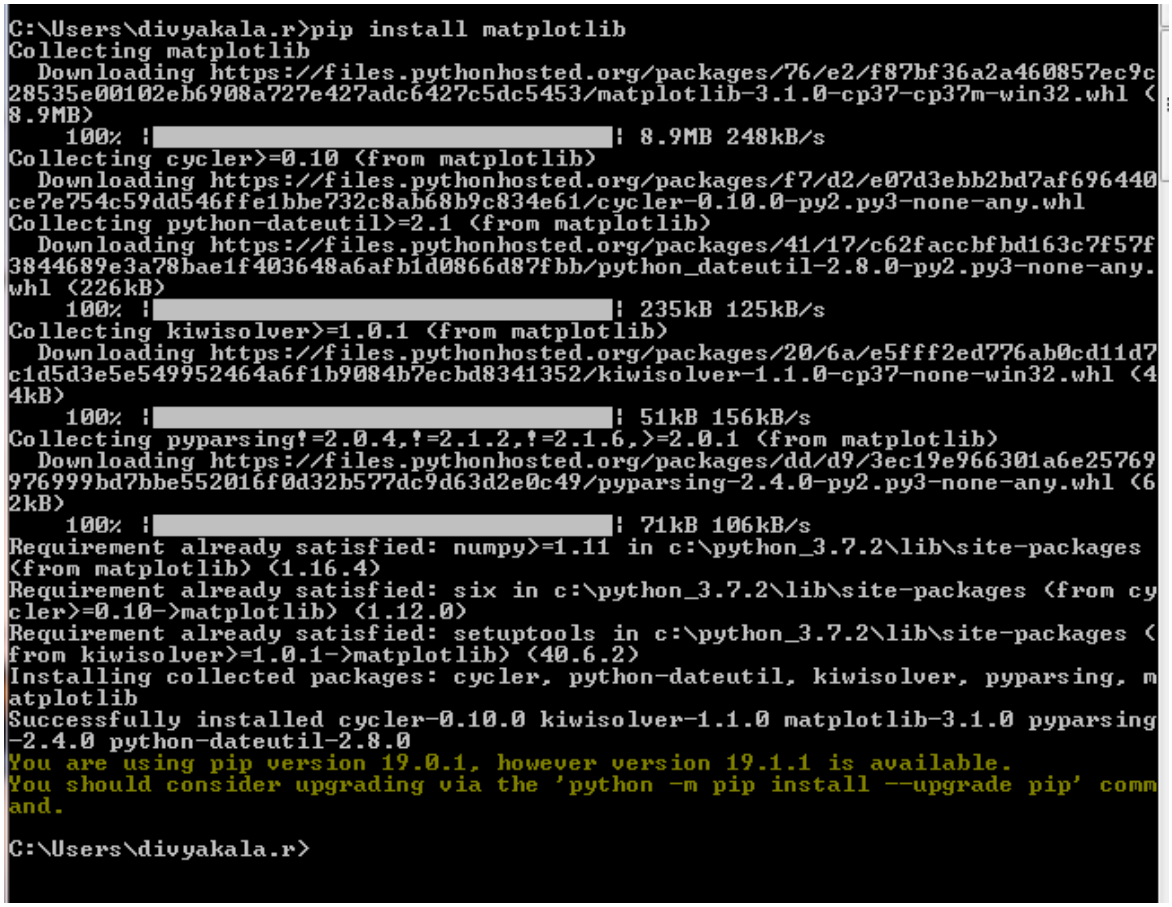


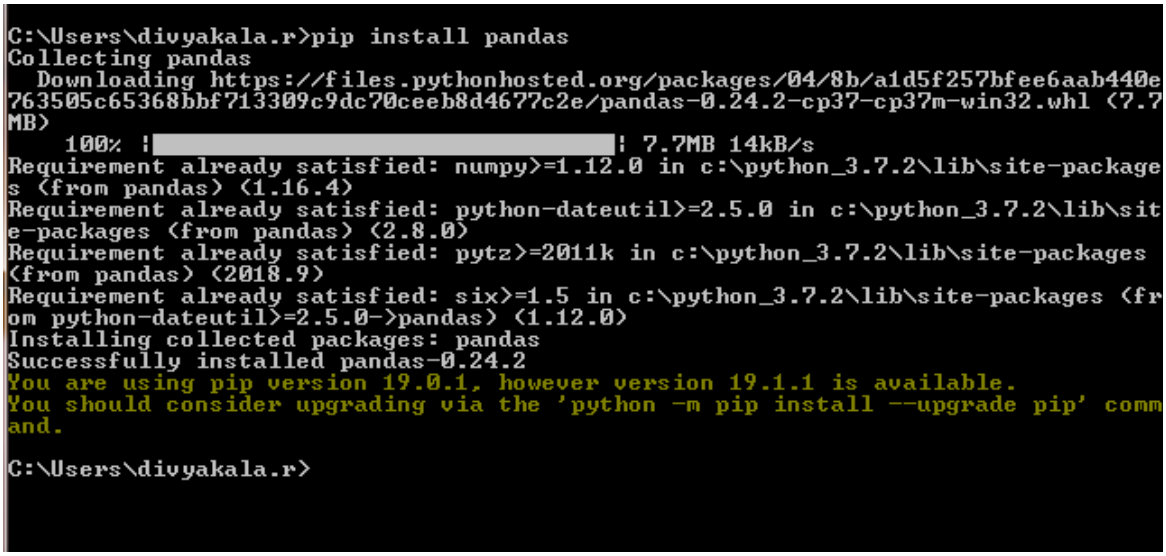
Figure 351. Matplotlib Package Installation

8. Install the PANDAS package using the following command.

C:\Users\divyakala.r\pip install pandas

9. The PANDAS gets installed as shown in the figure below.

Figure 352. Pandas Package Installation



10. Install the SKLEARN package using the following command.

C:\Users\divyakala.r\pip install sklearn

11. The sklearn package gets installed as shown in the figure below.

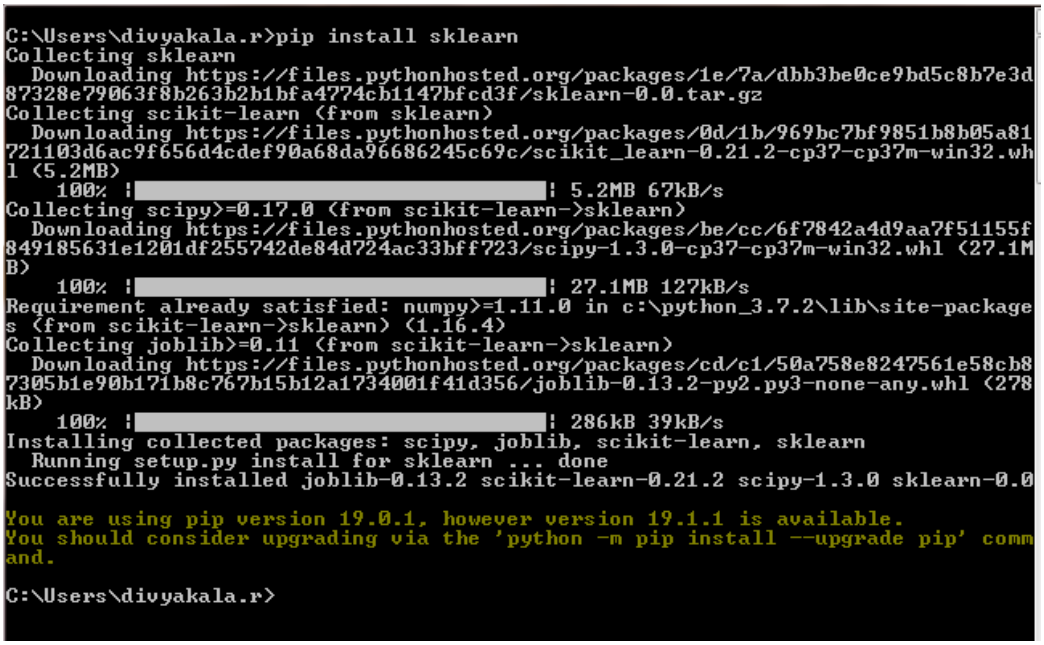


Figure 353. Sklearn Package Installation

12. Install the karas package using the following command.

C:\Users\divyakala.r\pip install karas

13. The karas package gets installed as shown in the figure below.

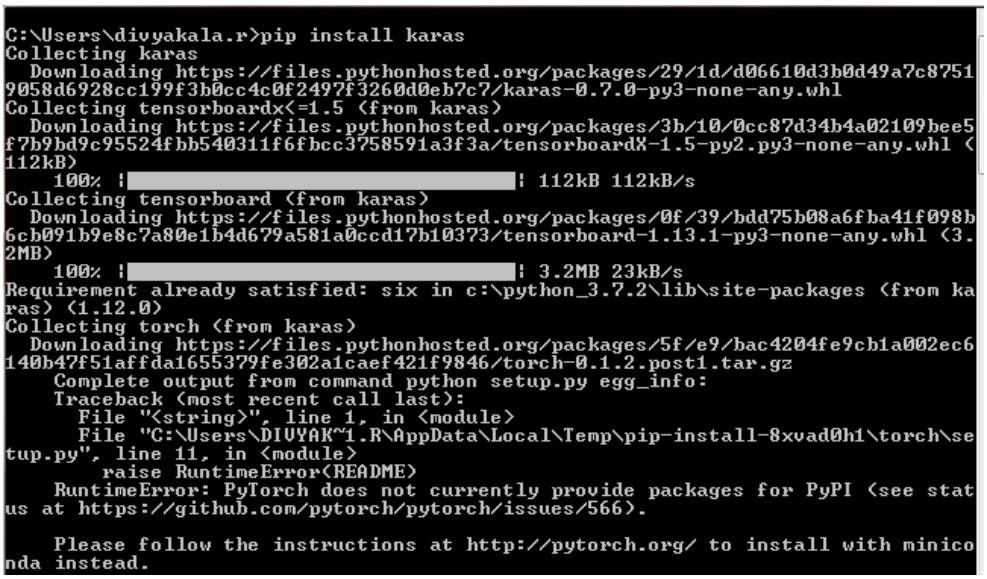


Figure 354. Karas Package Installation

14. Install the statsmodels package using the following command.

C:\Users\divyakala.r\pip install statsmodels

15. The statsmodels package gets installed as shown in the figure below.

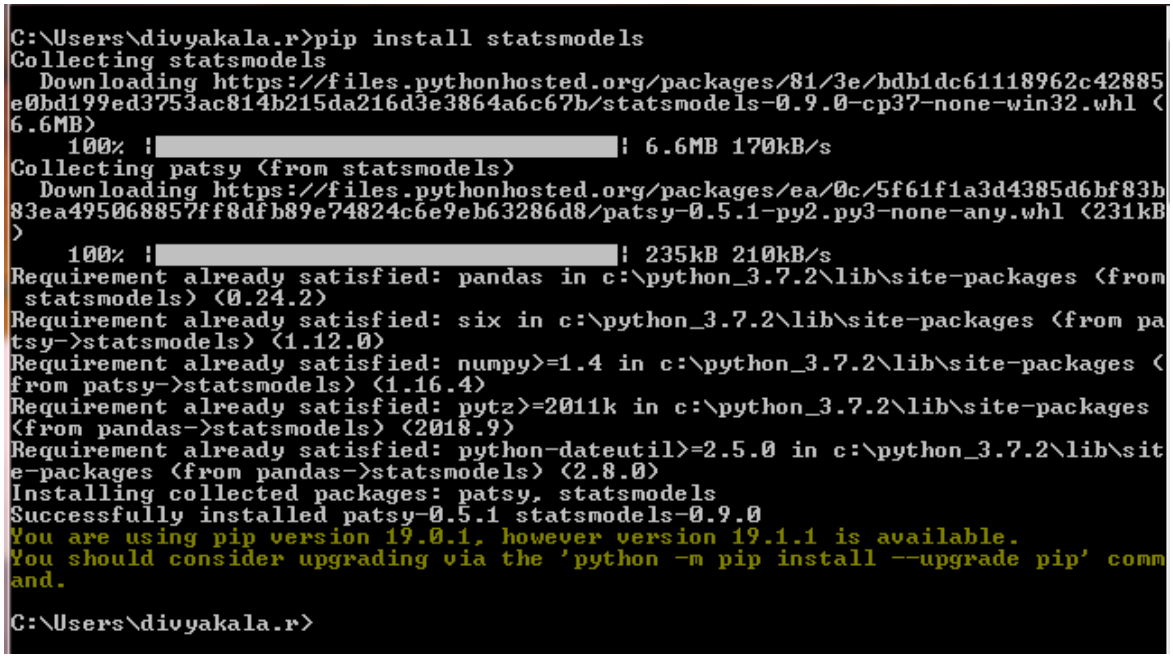


Figure 355. Statsmodels Package Installation

16. Install the mlxtend package using the following command.

C:\Users\divyakala.r\pip install mlxtend

17. The mlxtend package gets installed as shown in the figure below.

Figure 356. Mlxtend Package Installation

18. Install the TensorFlow package using the following command.

C:\Users\divyakala.r\pip install TensorFlow

19. The TensorFlow package gets installed as shown in the figure.

Figure 357. TensorFlow Package Installation

20. Install the ORTOOLS package using the following command.

C:\Users\divyakala.r\pip install ortools

21. The "OR Tools" package gets installed on the machine.

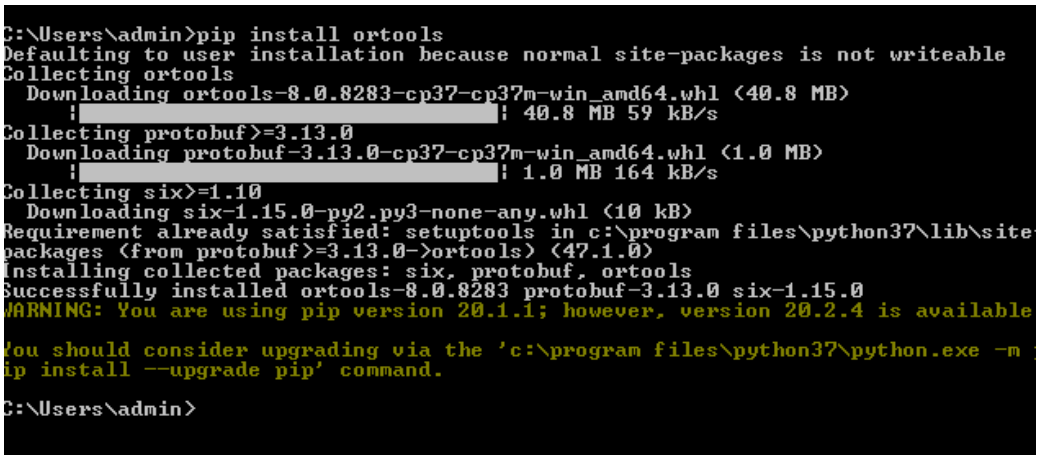


Figure 358. OR Tools Package Installation

22. Install the ORTOOLS package using the following command.

C:\Users\divyakala.r\pip install xlsxwriter

23. The “xlsxwriter” package gets installed.

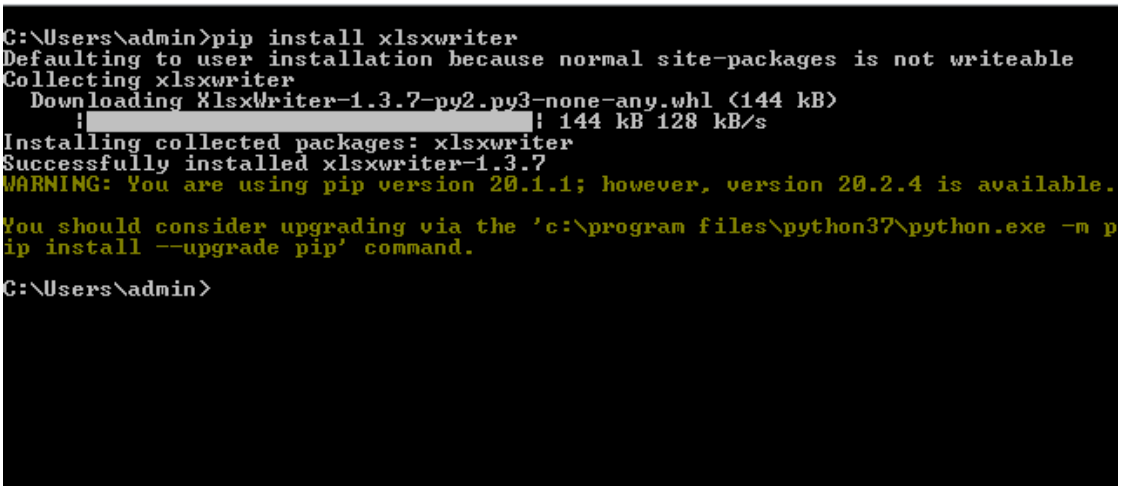


Figure 359. "xlsxwriter" Package Installation

24. Thus all the essential python packages are installed successfully.

Note: To check if all the packages are installed properly, run this command and verify the list of packages installed.

1. *Run → cmd → pip list*

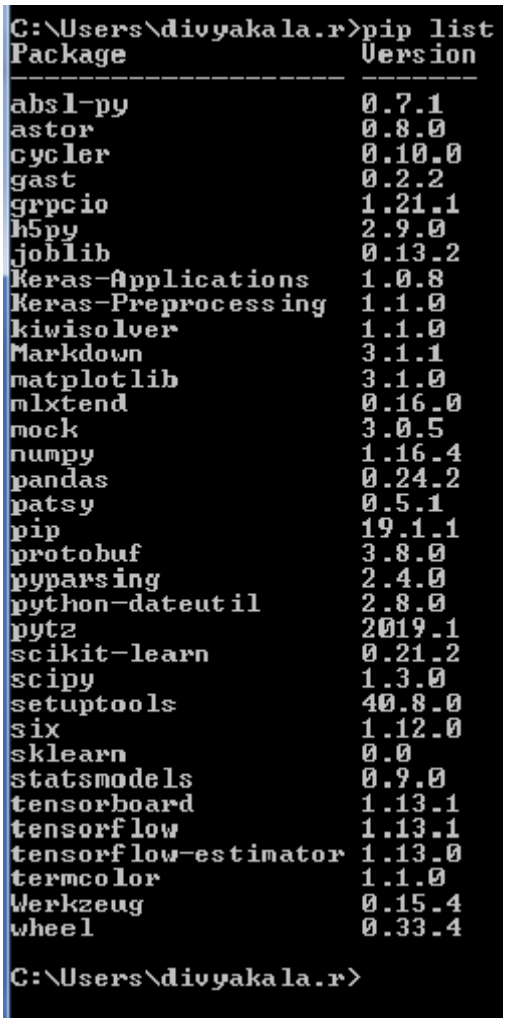


Figure 360. Lists all Libraries

Alternatively, run the following command

Import <package name>

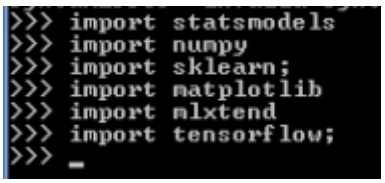


Figure 361. Check List of Libraries

2.1.1.5 POSTGRESQL V.10 SERVER CONFIGURATION

The steps to be followed for installing POSTGRESQL V.10 SERVER are provided in this section.

Ensure operating system Windows 32/64 bit is installed on the server.

Follow the steps to install PostgreSQL Server.

1. Download the PostgreSQL Server version 10.5-2 and above for Windows 32/64 bit.

   https://www.enterprisedb.com/thank-you-downloading-postgresql?anid=1256623 (32 bit)

   https://www.enterprisedb.com/thank-you-downloading-postgresql?anid=1256624 (64 bit)

2. Login into the Windows server check PostgreSQL setup file is available.

3. Double click on the PostgreSQL 10.6-1 setup file. Following screen will appear to install Microsoft Visual C++ 2013 Redistributable.

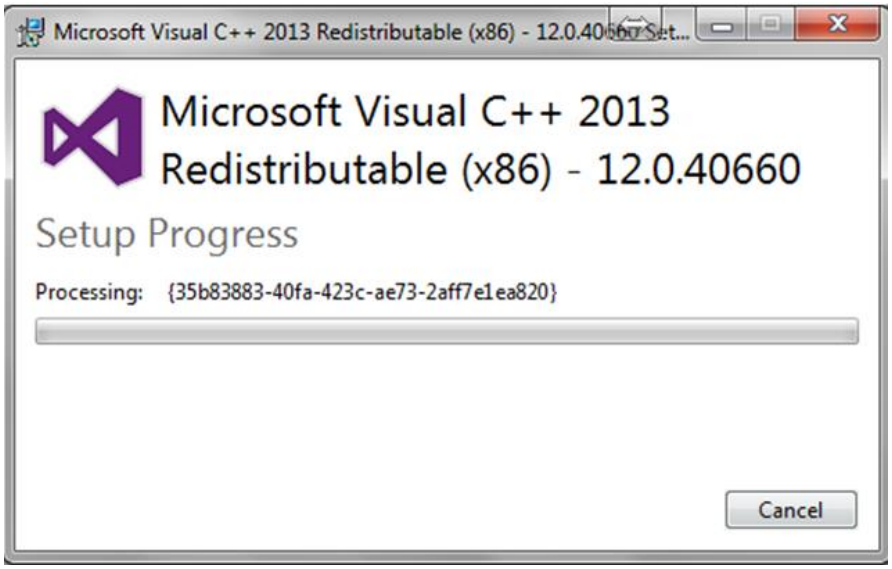


Figure 362. PostgreSQL Server Setup Progress Page

4. The first page of the Setup wizard appears. Click on **Next** button on this screen.

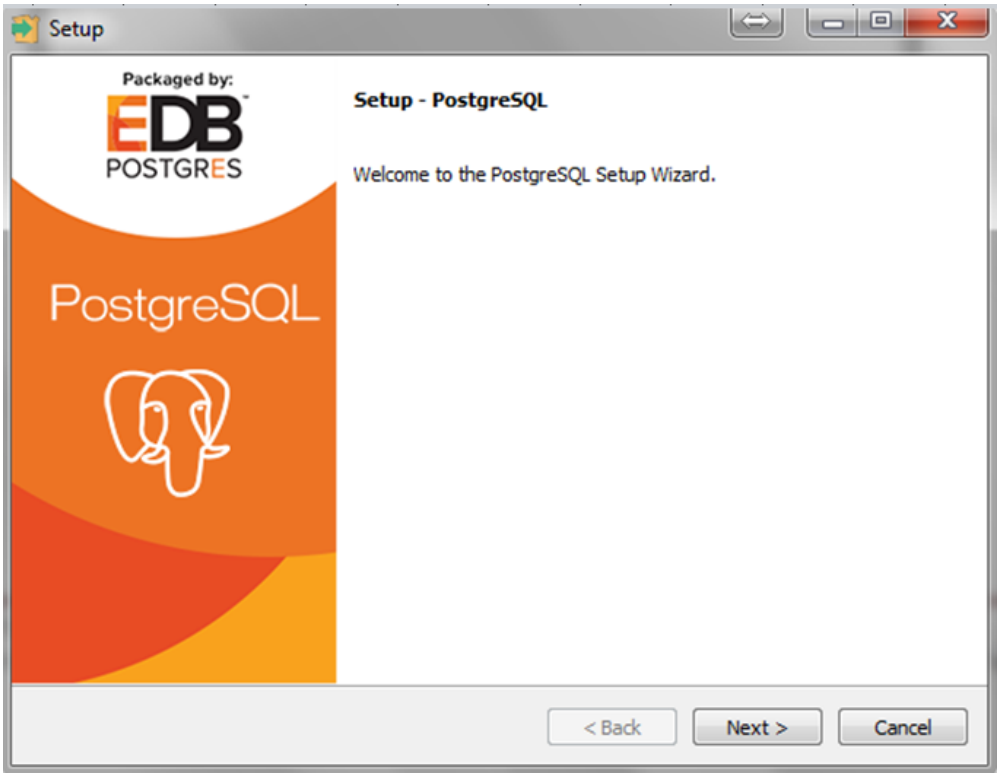


Figure 363. Setup –PostgreSQL Page

5. The **"Installation Directory"** page appears. Enter a different directory location or accept the default, and then click **Next** button.

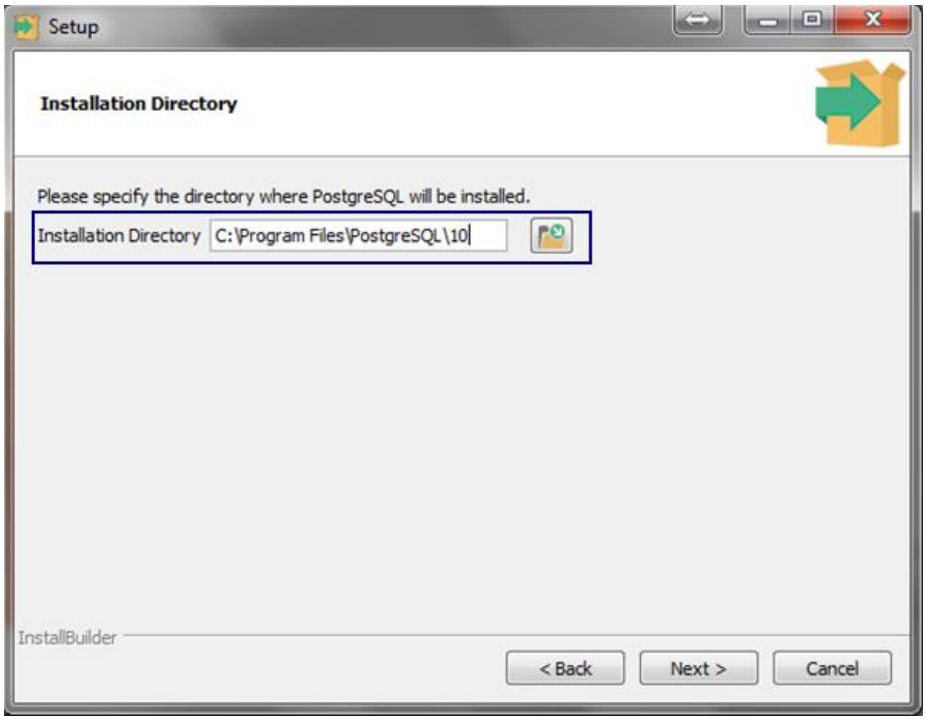


Figure 364. Installation Directory Page

6. The **Select Components** page appears.

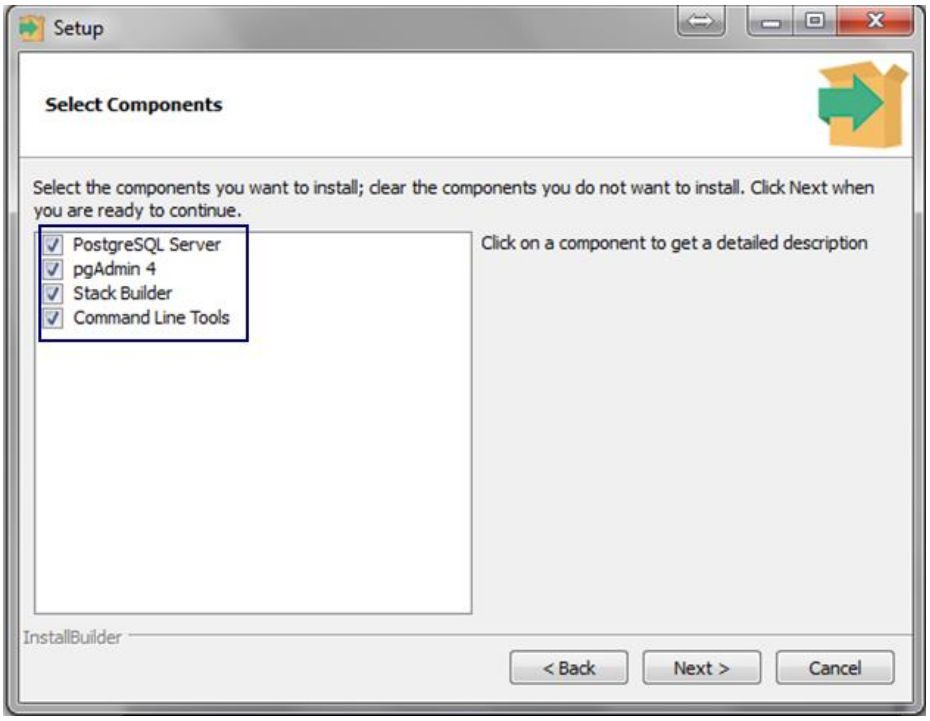


Figure 365. Select Components Page

7. Uncheck the **Stack Builder** option **and** click on **Next** button.

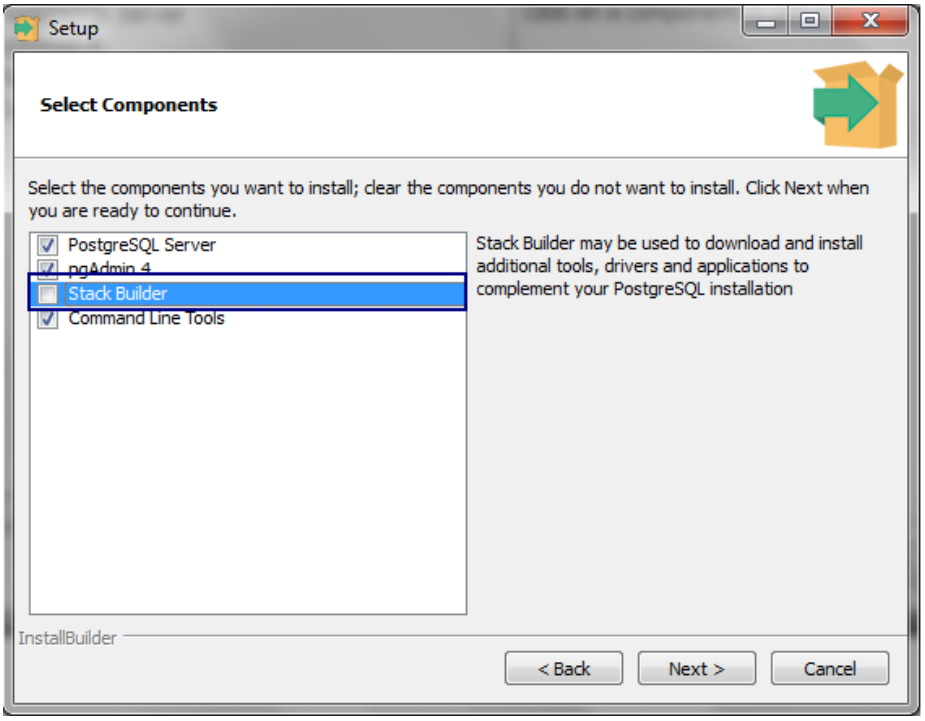


Figure 366. Remove Stack Builder Page

8. The **Data Directory** page will appear. Enter a different directory or accept the default, and then click **Next** button.

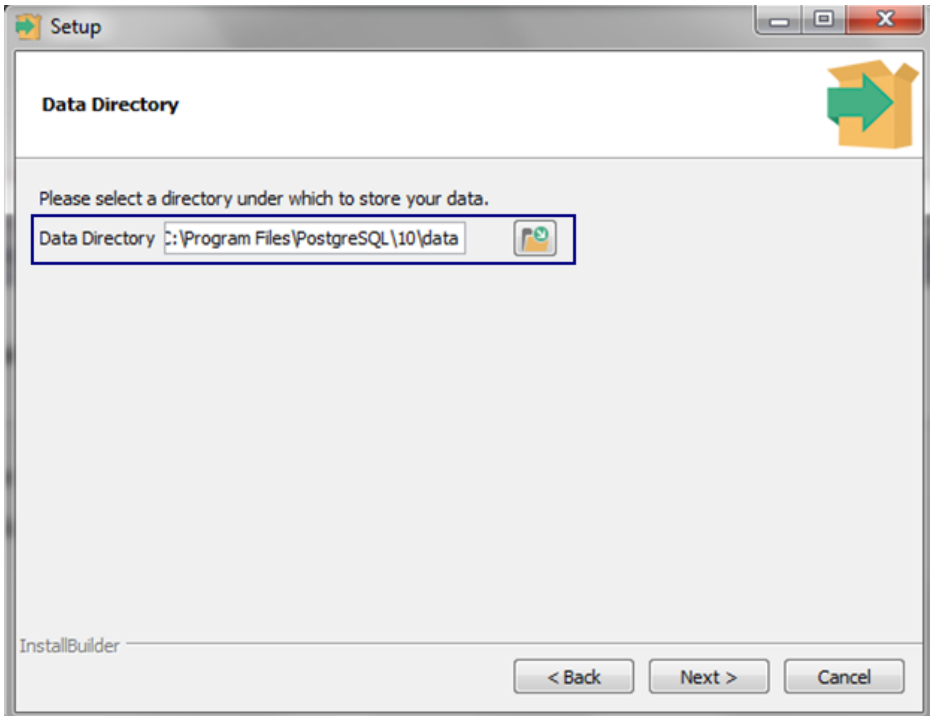


Figure 367. Data Directory Page

9. The **Password** page appears. Enter the password and press **Next** button.

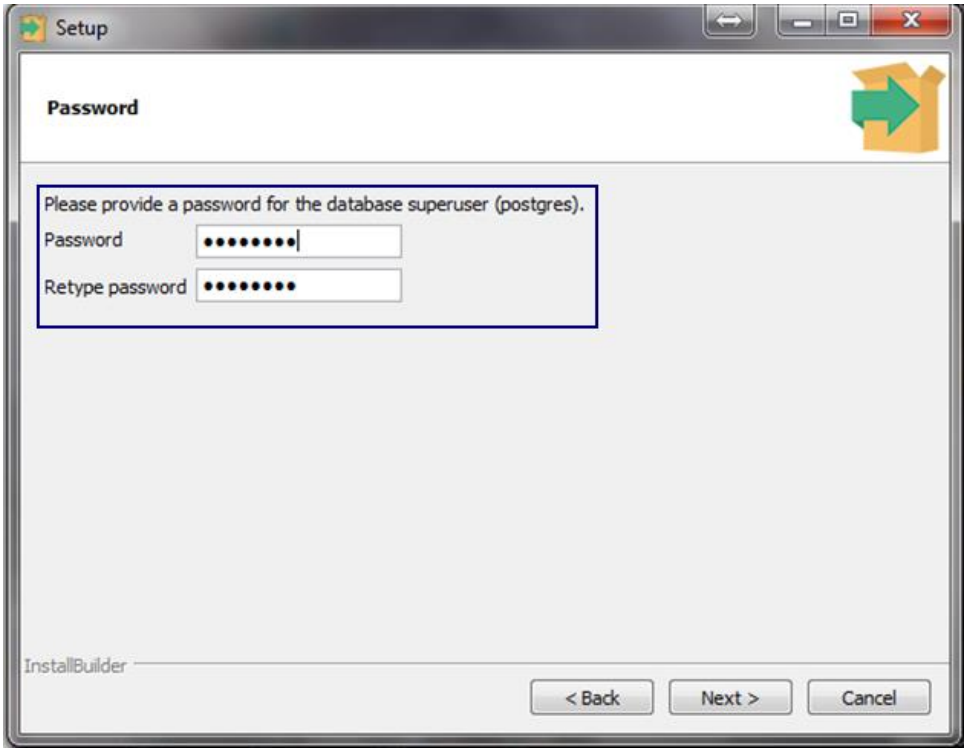


Figure 368. Password Page

10. The **Port** setup page appears. Enter the port or accept the default port (5432) and click **Next** button.

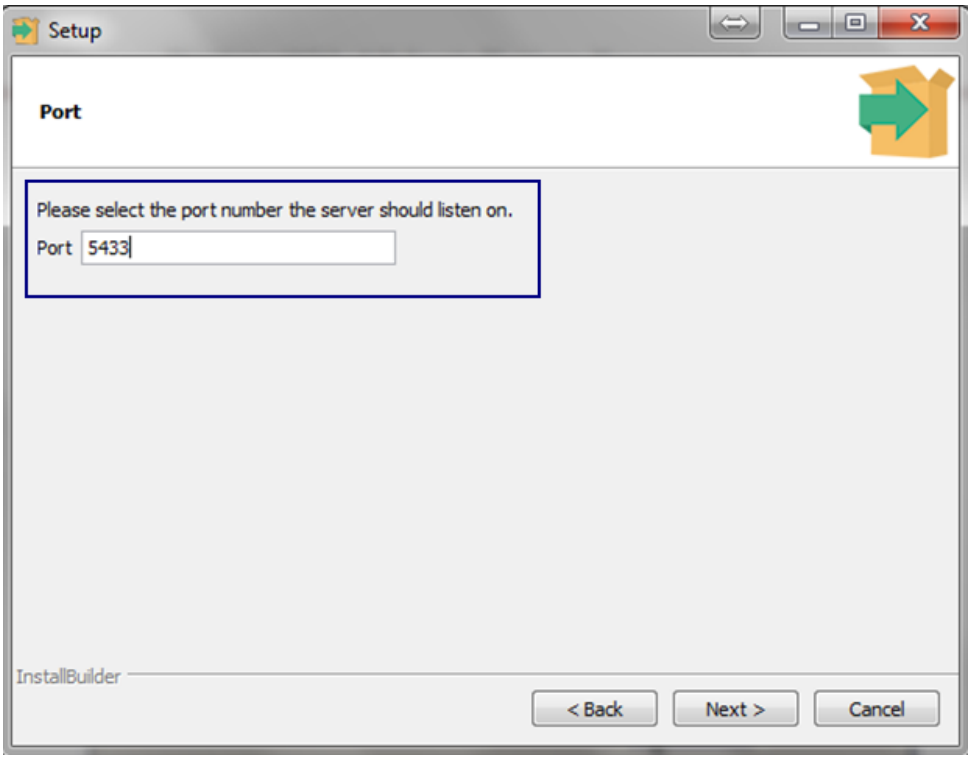


Figure 369. Setup the Port Page

11. The **Advanced Options** page appears. Select the required locale or accept the defaults and click on **Next** button on this page.

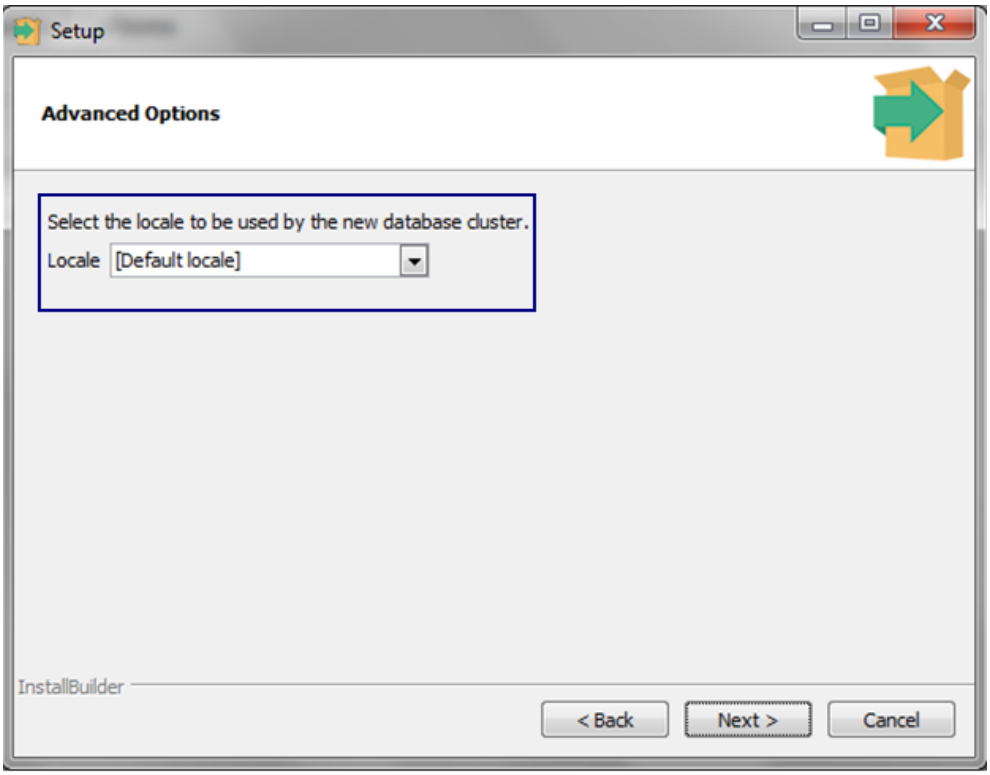


Figure 370. Advanced Options Page

12. The Pre Installation Summary page appears. Click on **Next** button.

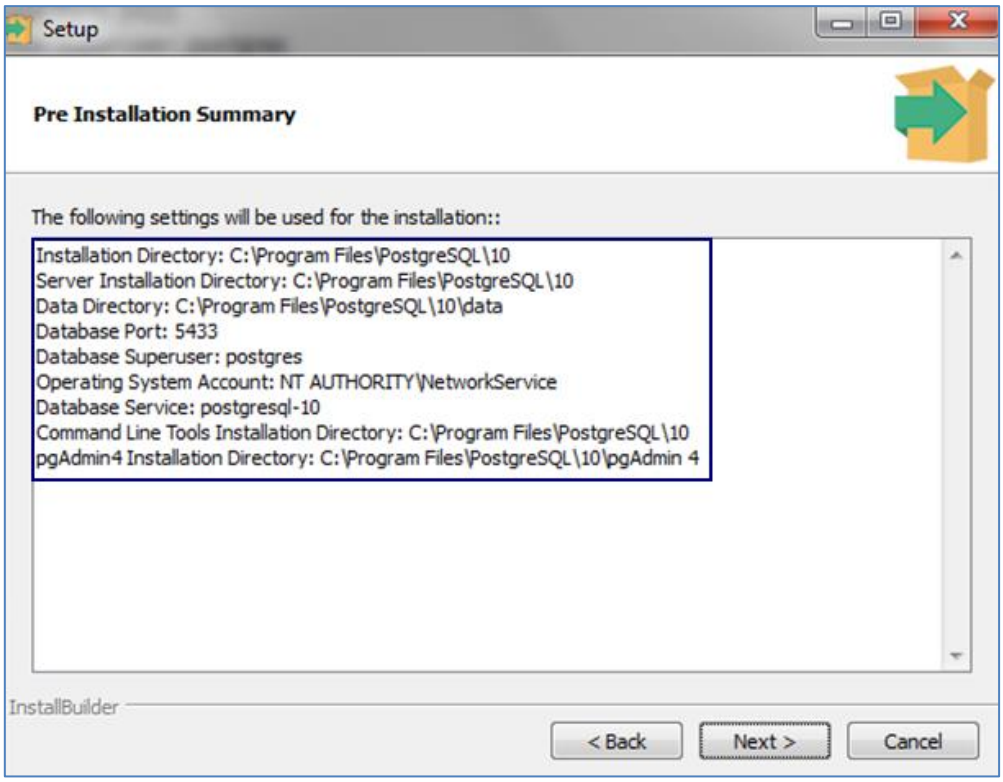


Figure 371. Pre Installation Summary Page

13. The **Ready to Install** page appears. Click on **Next** button to continue.

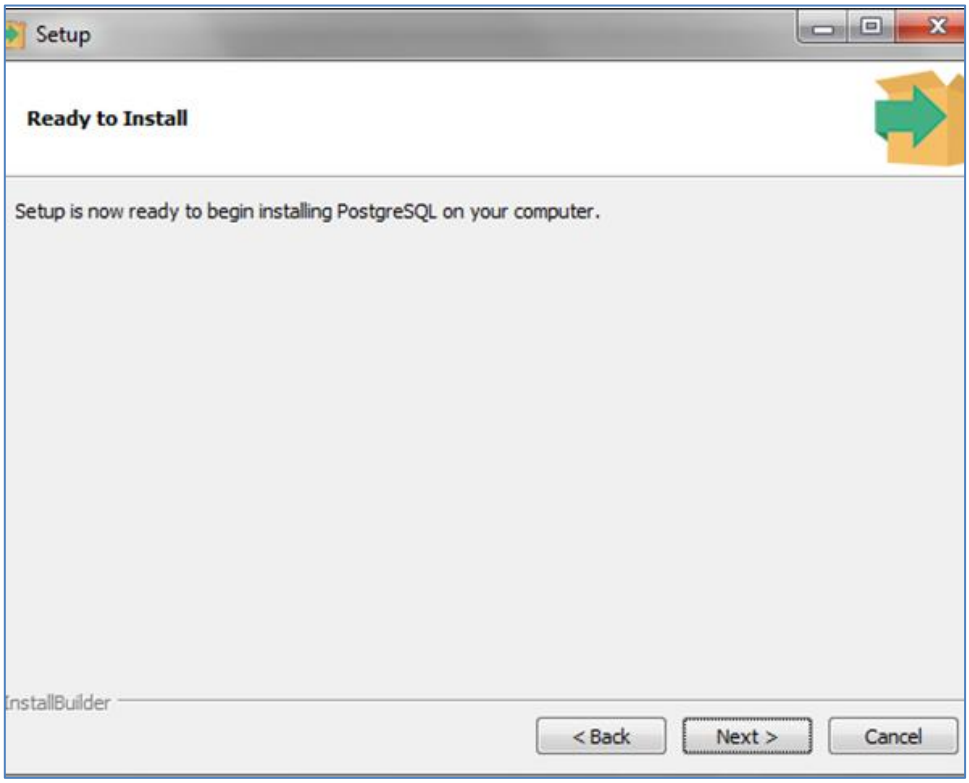


Figure 372. Ready to Install Page

14. The Installing page appears showing the progress of installation.

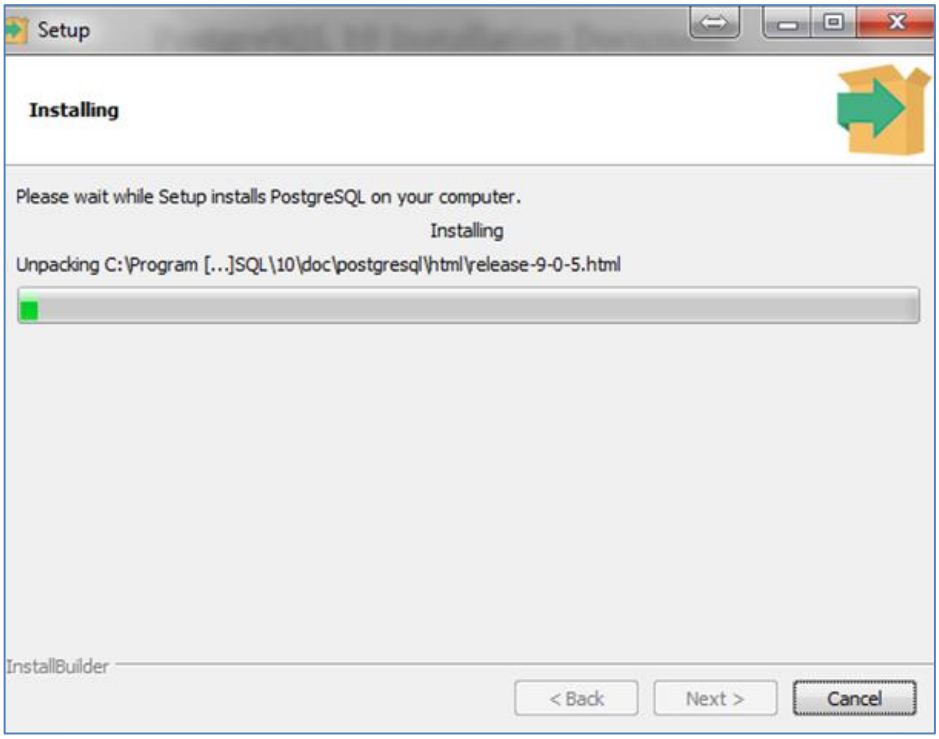


Figure 373. Installation in Progress Page

15. After installation is completed, **"Completing the PostgreSQL Setup Wizard"** page appears. Uncheck the Stack Builder check box and click **on Finish** button. Installation gets completed successfully.

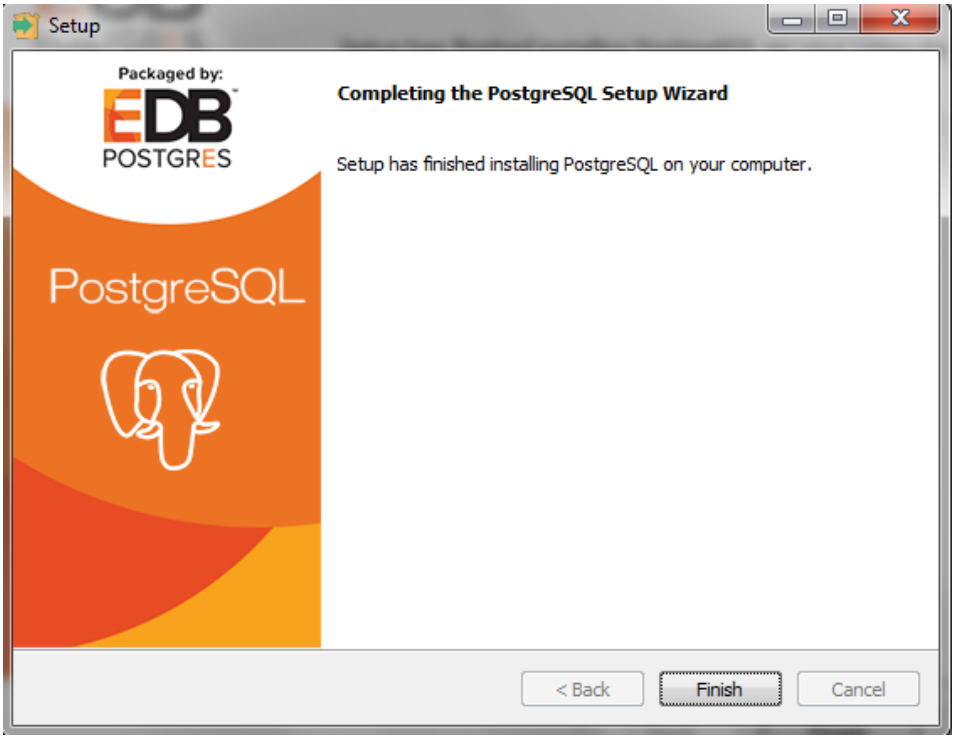


Figure 374. Installation Completed

2.1.1.6 CREATING DISCOM-REPOSE DATABASE

This section gives you the steps to create the database for DISCOM -REPOSE application.

Ensure PostgreSQL Server V.10 is installed.

CREATING TABLESPACE (OPTIONAL)

1. Click **All Programs → PostgreSQL 10 → pgAdmin 4.**

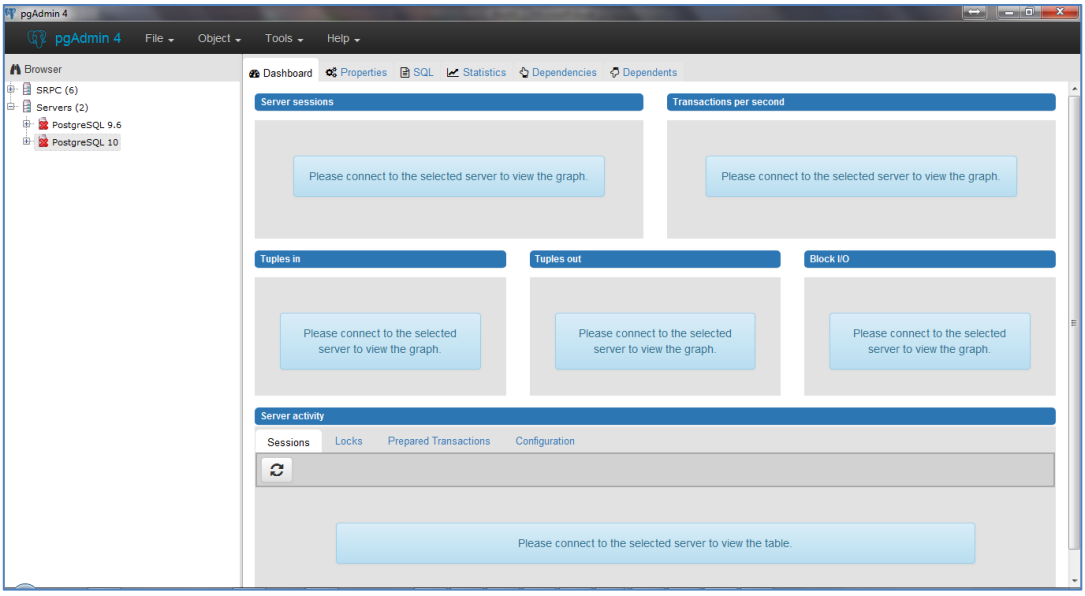


Figure 375. PostgreSQL Server V.10

2. Double-click on PostgreSQL 10. The **Connect to Server** pop-up to enter password (given while installing) appears. Enter the **Password**.

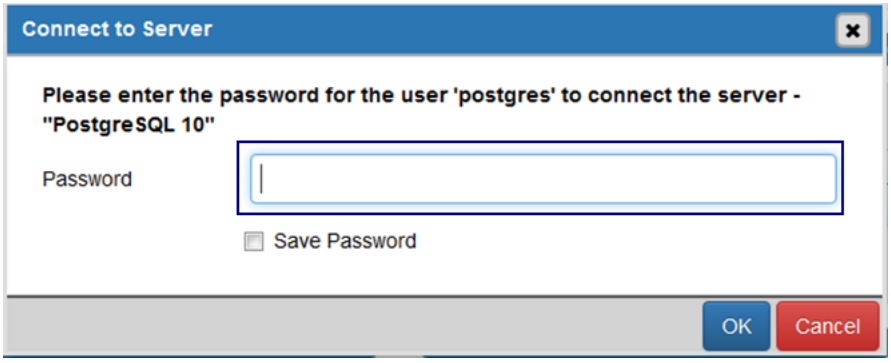


Figure 376. Connect to Server with a Password

3. Follow these steps to create the **Tablespace**.

    1. Right-click **Tablespace** (2) → **Create** → **Tablespace**…

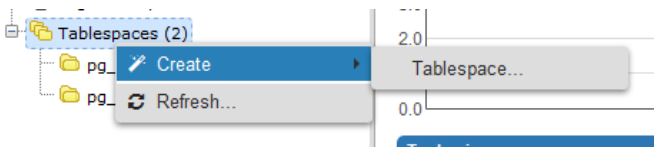


Figure 377. Create Tablespace

2. The **Create – Tablespace** window appears. Enter Tablespace name in **General** tab.

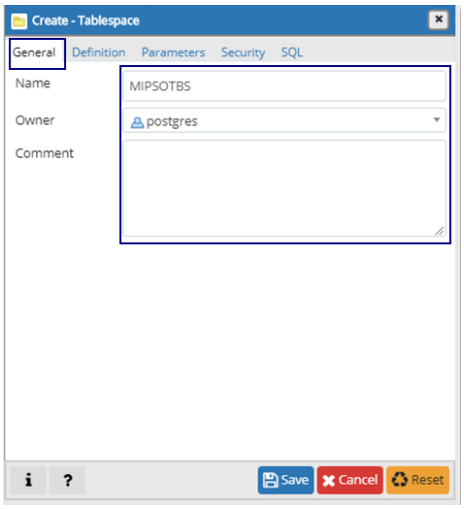


Figure 378. Create Tablespace – General Tab Details

3. In the **Definition** tab enter location of the tablespace in the file system. Click on the Save button to complete the creation.

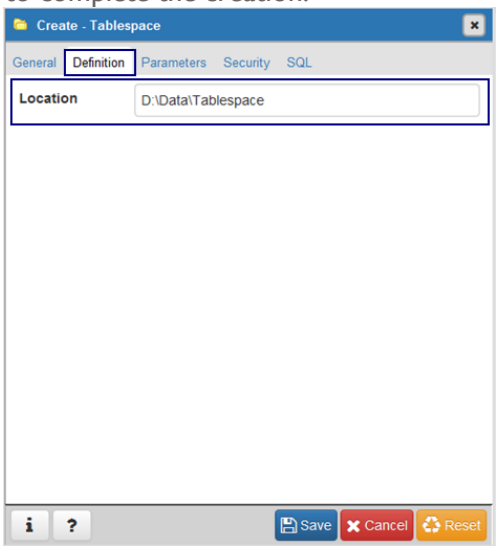


Figure 379. Tablespace Creation- Definition Tab Details

CREATING DATABASE

This section gives the steps to create database.

1. In pgAdmin 4, double-click **PostgreSQL 10**. Enter password and then right-click on **Databases** and click on create then on Database…

Figure 380. Create Database

2. The **Create – Database** page appears. Enter **Database** name in **General** tab.

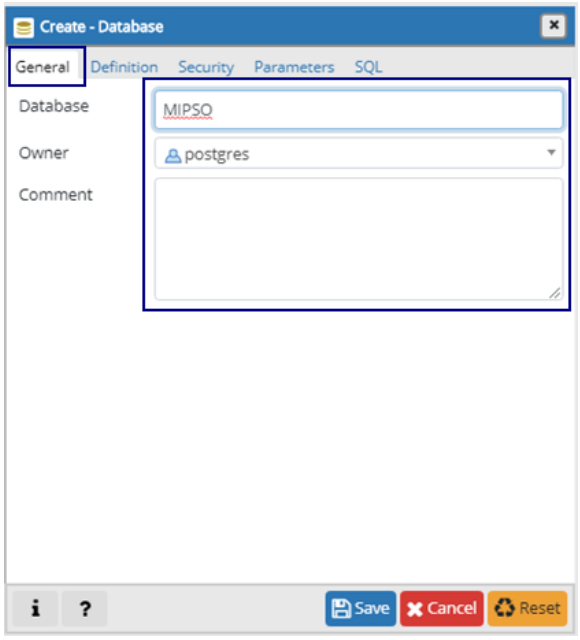


Figure 381. Create Database - General Tab Details

3. In **Definition** tab enter **Encoding**, **Template**, **Tablespace**, **Collation**, **Character Type**, and **Connection Limit**. Click **Save** button to create the Database.

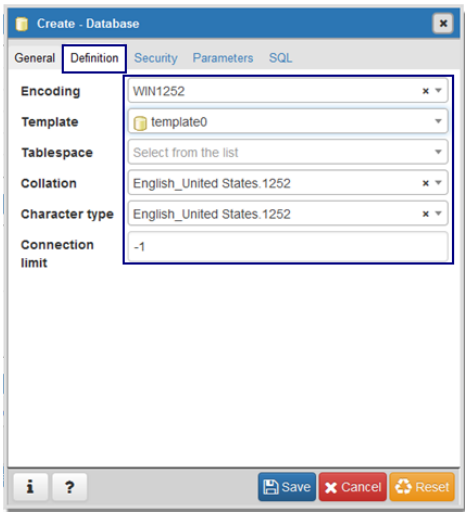


Figure 382. Create Database - Definition Tab Details

4. Now click on the newly created database. Database successfully created.
5. The new **Database** page appears.

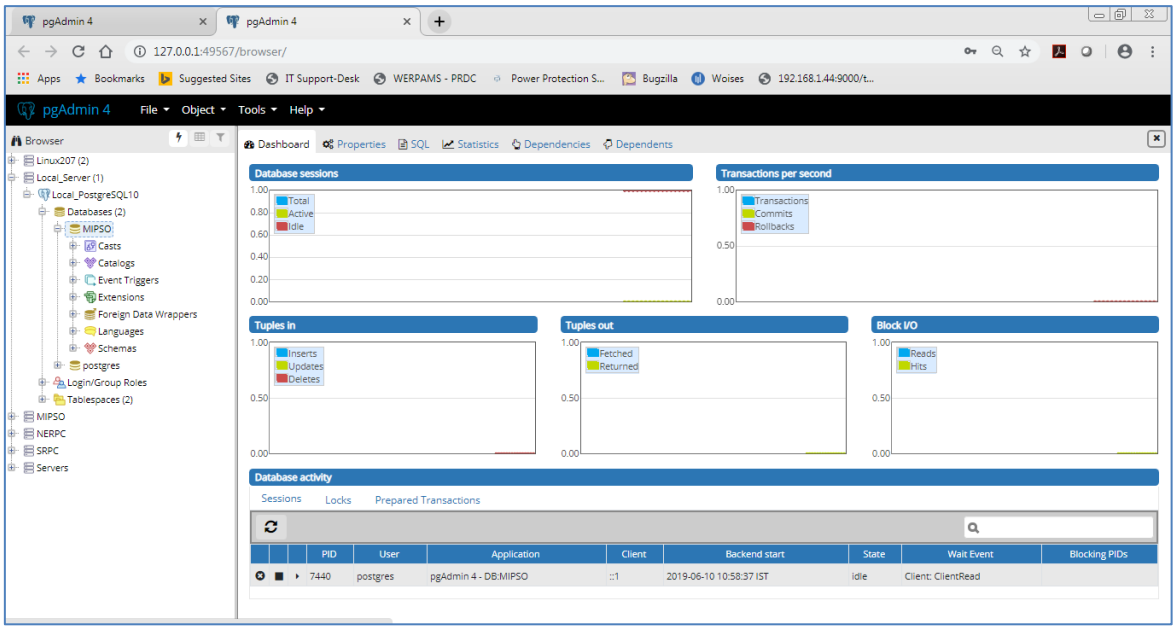


Figure 383. DISOM-REPOSE Database

CREATING USER

This section gives the steps to create a new user.

Ensure that user is able to connect by PostgreSQL admin users “postgres”.
Follow the steps to create a user.

1. Right click on **Login/Group Roles** (6), then select **Create**, now select **Login/Group Role**…

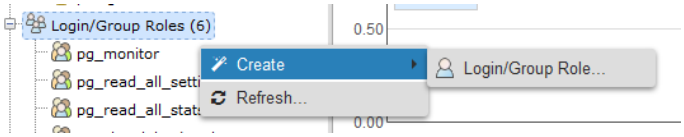


Figure 384. Create - Login/ Group Role

2. The **Create – Login/Group Role**… pop-up appears. In **General** tab enter **Name**. Click on **Save** button.

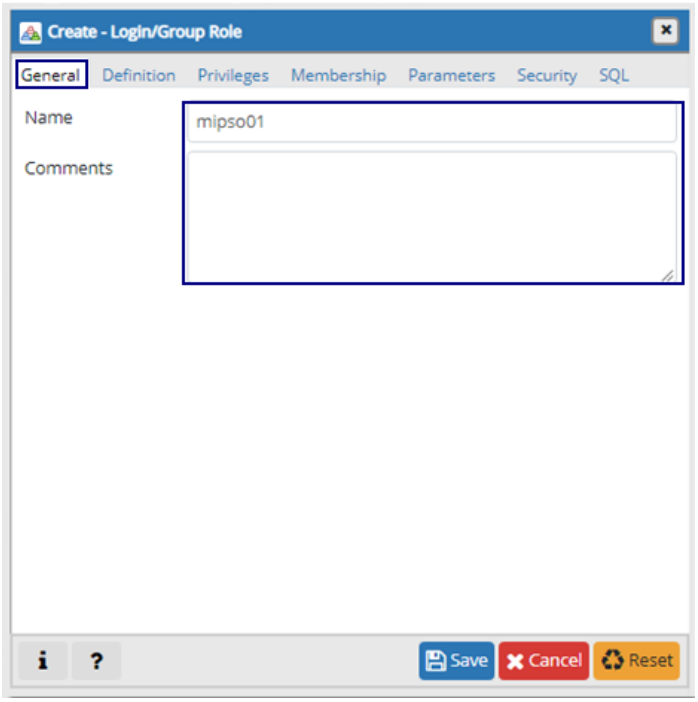


Figure 385. Create User - General Tab Details

3. Click on the **Definition** tab. Enter the password details for the user. Click on **Save** button.

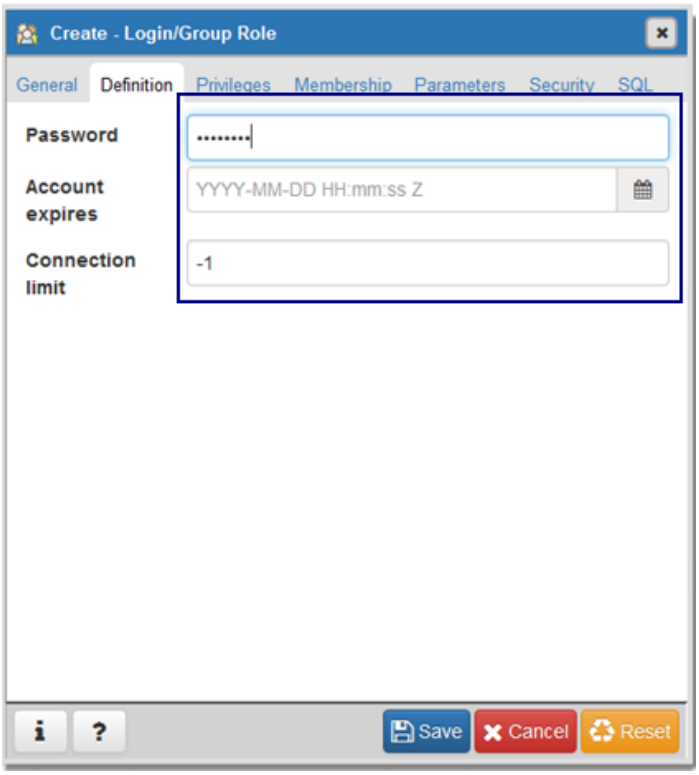


Figure 386. Create User - Definition Tab Password Details

4. In the **Privileges** tab select **yes** for **Can Login?** and click **Save** button. The user is created.

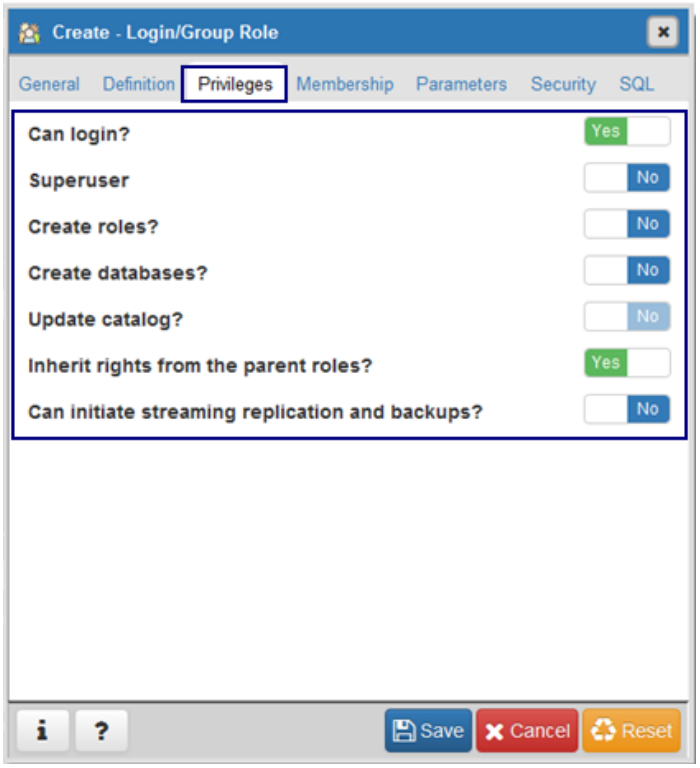


Figure 387. Create User - Privileges Tab Details

CREATING SCHEMA

This section gives the steps to create a Schema.

Ensure that user is able to connect by PostgreSQL admin users "postgres".

Follow these steps to create a Schema.

1. Right click on **Schemas (1)** , then select **Create**, now select **Schema**…

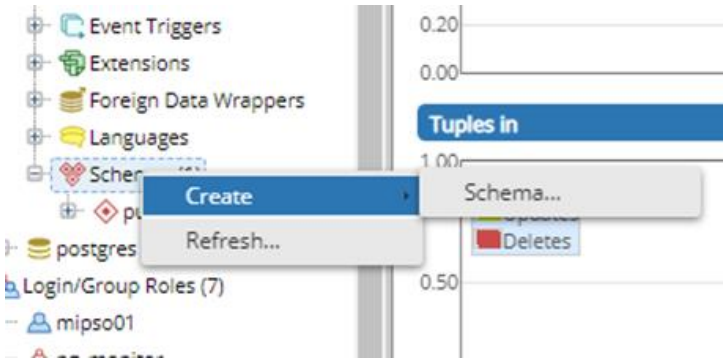


Figure 388. Create Schema

2. The **Create - Schema** pop-up appears. Enter the **Name** and select the owner of the schema (mipso01). Click on **Save** button.

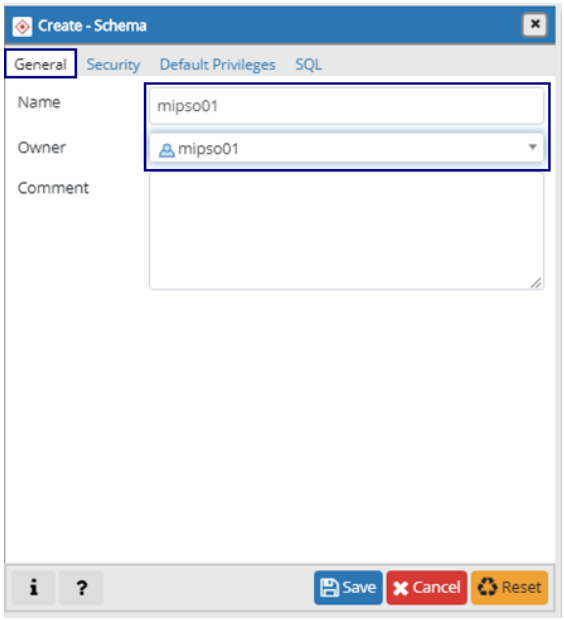


Figure 389. Create Schema - General Tab Details

3. Thus the **Tablespace**, **Database**, **User**, and **Schema** get created.

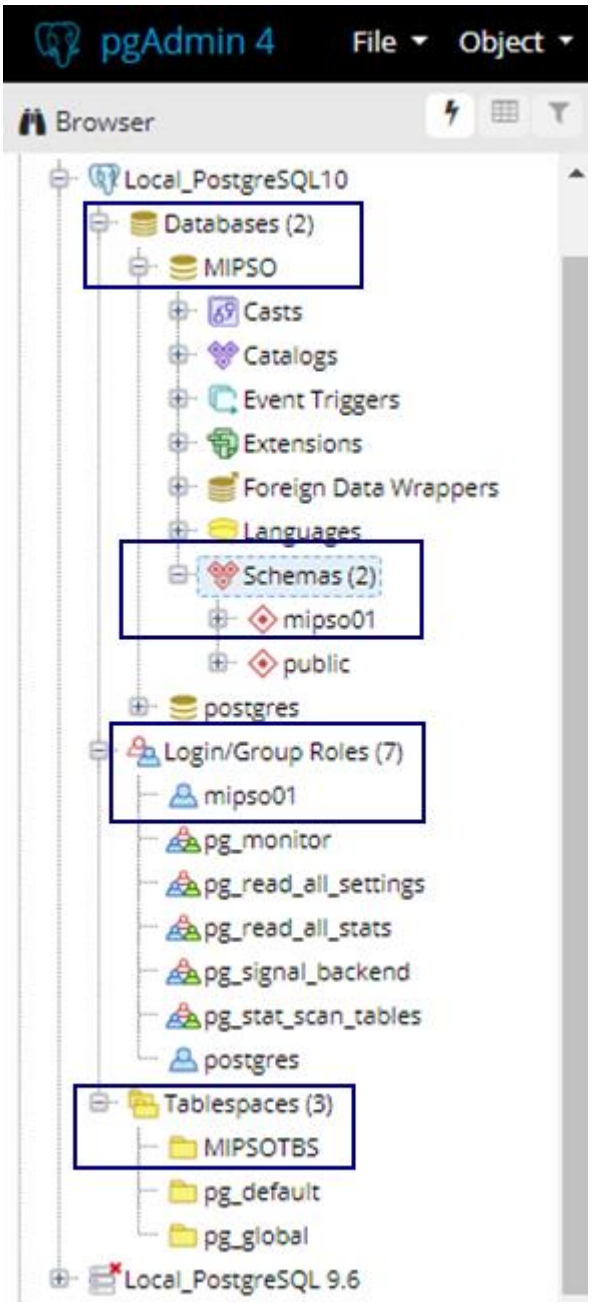


Figure 390. PostgreSQL Installation Completed

2.1.1.7 BACKUP AND RESTORATION OF DATABASE

This section gives the steps to take back-up of the database and steps to perform a restoration.

STEPS TO TAKE A BACKUP

This section gives you steps to take backup of the database.

The user should have access and rights to schedule the task on Windows system for regular backup using script.

1. Create task for the provided script **"AutoBackupForPostgreSQL.vbs"**

Or user can run the following from the command prompt.

```
pg_dump.exe –h localhost –p 5432 –U postgres –F c -b --section=pre-data --section=data --section=post-data -n <Schema Name> -d <Database Name > -f <File Name>
```

Note: Change the <Schema Name>, <Database Name> and <File Name> as per the requirement.

STEPS TO RESTORE BACKUP

Execute the following command from the command prompt

```
pg_restore.exe -h localhost -p 5432 -U postgres -vF c -j 2 -f <File Name>
```

Note: Change the <File Name> as per the requirement.

2.1.1 Installing DISCOM-REPOSE Software

This section gives you steps to install the mandatory software products, libraries, war files and running environment settings that are essential for smooth installation, deployment and running of the DISCOM REPOSE software.

2.1.1.1 SETTING UP WAR FILES AND PROPERTIES (IMAGES TO BE REPLACED)

This section guides you with steps to deploy the DISCOM-REPOSE WAR files on the client machine.

Follow these steps to install the war files.

1. Copy **DISCOM-REPOSE.war** file to the following Tomcat directory. (image to be replaced)

<Tomcat installed directory>\Tomcat 8.0\webapps\

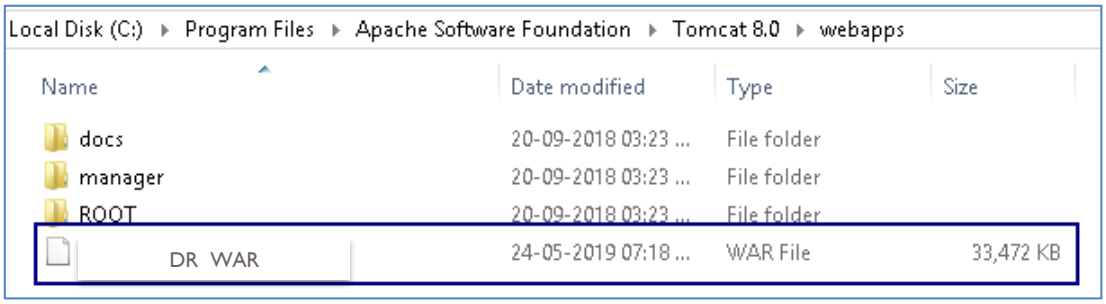


Figure 391. Tomcast Installation Directory

2. Navigate to the “bin” folder under “Tomcat 8.0” and double-click “Tomcat8.exe”.

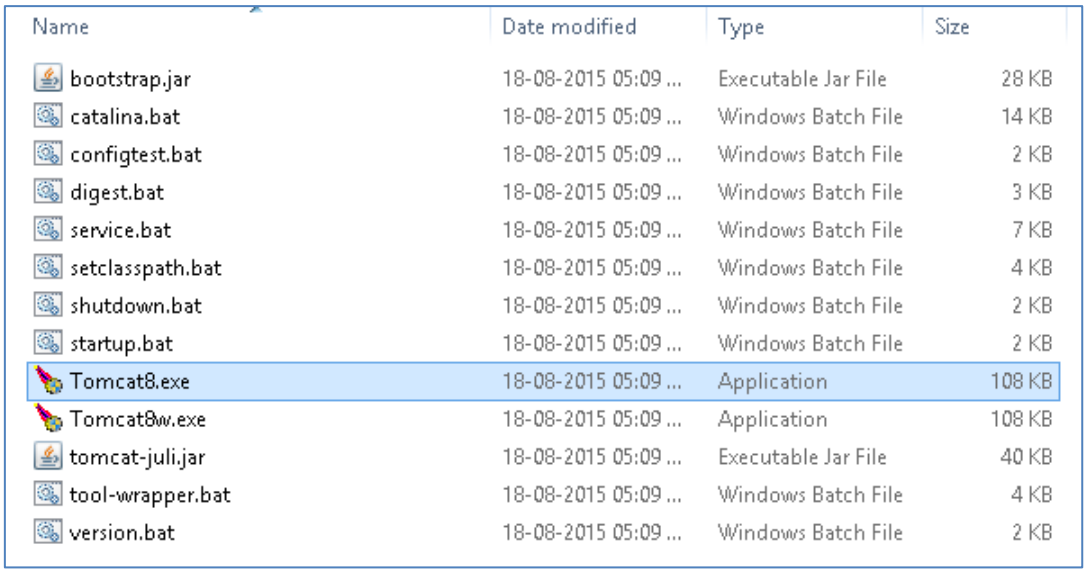


Figure 392. Tomcat Folder

3. The command prompt appears to deploy the war file.

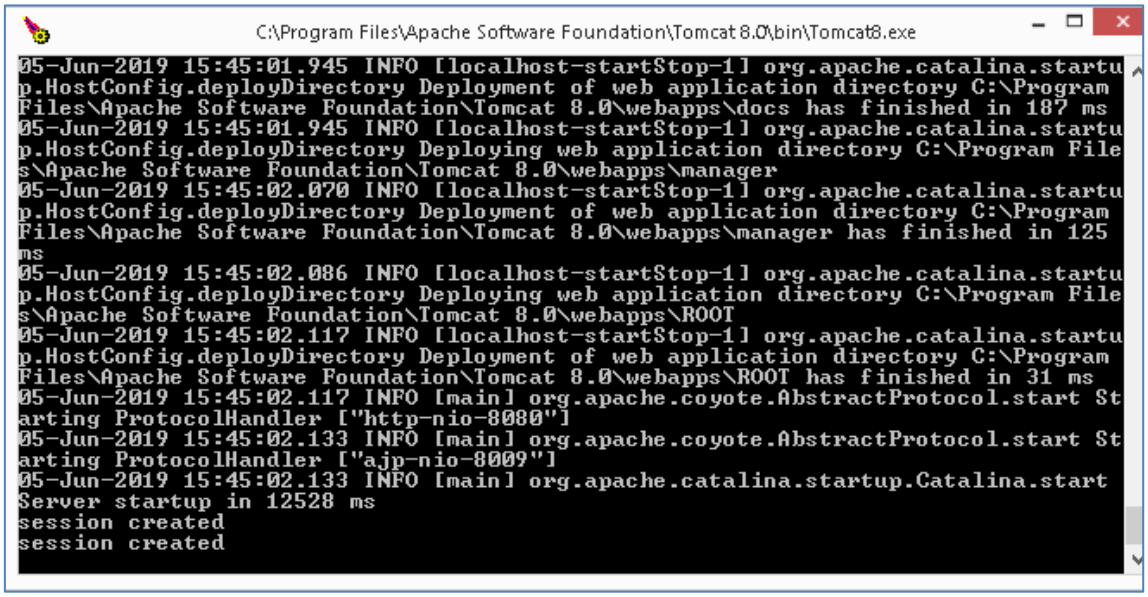
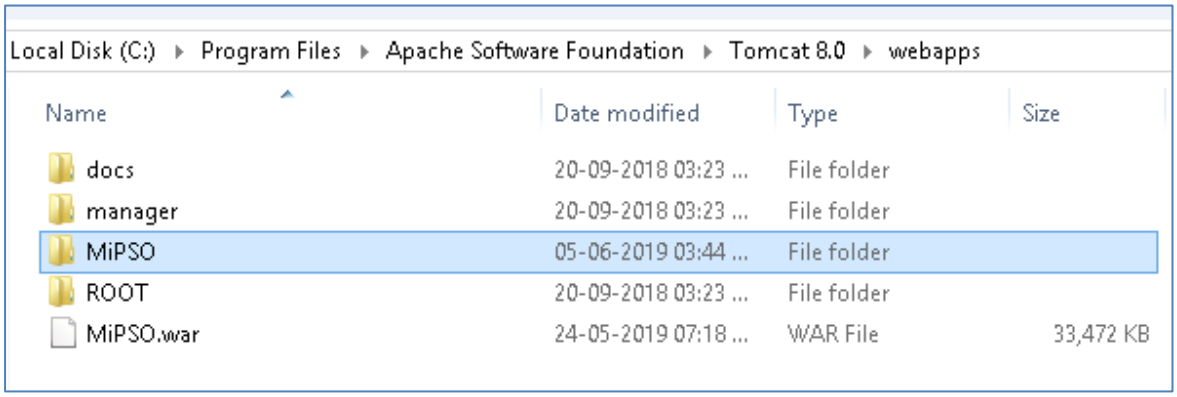


Figure 393. Command Prompt to Deploy

4. Once the war is deployed, the command prompt window closes. Navigate to "webapps" folder and ensure if DISCOM-REPOSE folder is created. (Image to be replaced)

Figure 394. DISCOM Folder



5. Configure the database details by navigating to the following folder under "webapps" MiPSO >> WEB-INF >> "classes" file >>"database.properties".

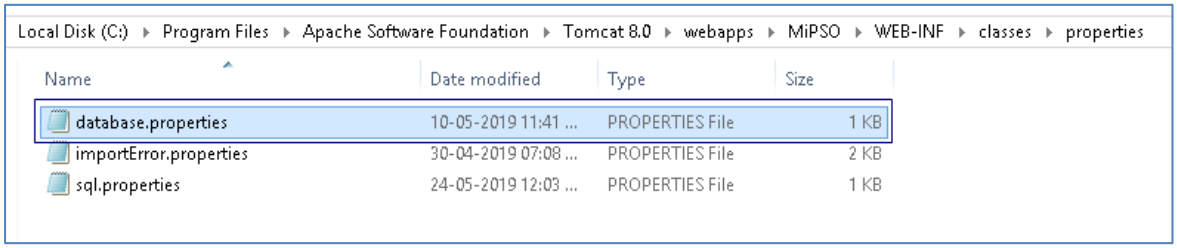


Figure 395. Configure the Database Properties File

6. Edit the values highlighted in red according to the DB details and save the file.

Figure 396. Edit the Property Values according to DB details

```
# jdbc:postgresql://HOST:PORT/SCHEMA
#please change the url as per your requirement whic
url=jdbc:postgresql://PRDCSVR022:5432/MIPSO
databaseusername=mipsotest
databasepassword=mipsotest


inputFileLocation=D:\\Nepal\\LFC
noOfHistoryDaysForVstlf=2
importfilepath=D:\\Nepal\\Import
```

```
# jdbc:postgresql://HOST:PORT/SCHEMA
#please change the url as per your requirement which are in (HO
#url=jdbc:postgresql://192.168.0.52:5432/MIPSO


url=jdbc:postgresql://Prdcsvr022:5432/MIPROLF
databaseusername=miprolftest01
databasepassword=miprolftest01


#url=jdbc:postgresql://192.168.0.35:5432/MIPSO
#databaseusername=mipso01
#databasepassword=mipso01

inputFileLocation=D:\\Nepal\\LFC
noOfHistoryDaysForVstlf=2
importfilepath=D:\\Nepal\\Import
```

Note: Create a folder in any drive other than C drive on your machine to save the reports. Note the filepath.

7. Edit the report variable with the filepath of the reports folder as shown below.

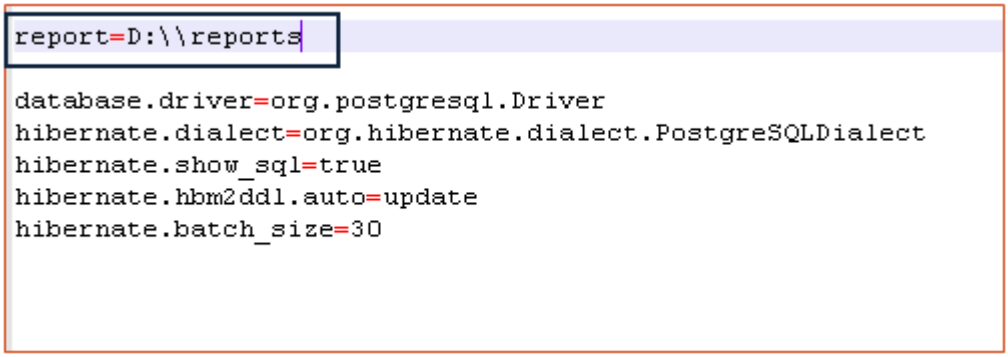


Figure 397. Configuring Reports Folder

8. Edit the following values highlighted in red according to the details to execute the studies.

Figure 398. Study Execution Results Location Configuration

9. Update the following parameters required.
10. Once the property files are configured, navigate to "bin" folder in Tomcat directory and start the service by executing the "Tomcat8w.exe".

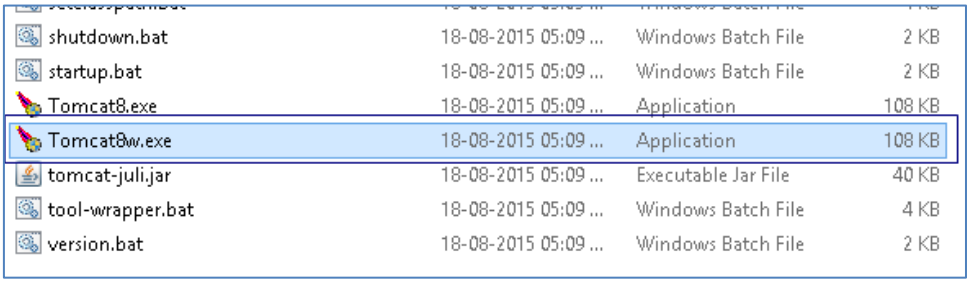


Figure 399. Start Tomcat File

2.1.1.2 REMOVING WAR FILES

Follow these steps to remove war files.

1. Go to **Tomcat** folder (if tomcat is not installed, refer section 3.2). Navigate to the tomcat directory:

   <Tomcat installed directory>\Tomcat X.X\bin
2. Once navigated, run "Tomcat8w.exe".

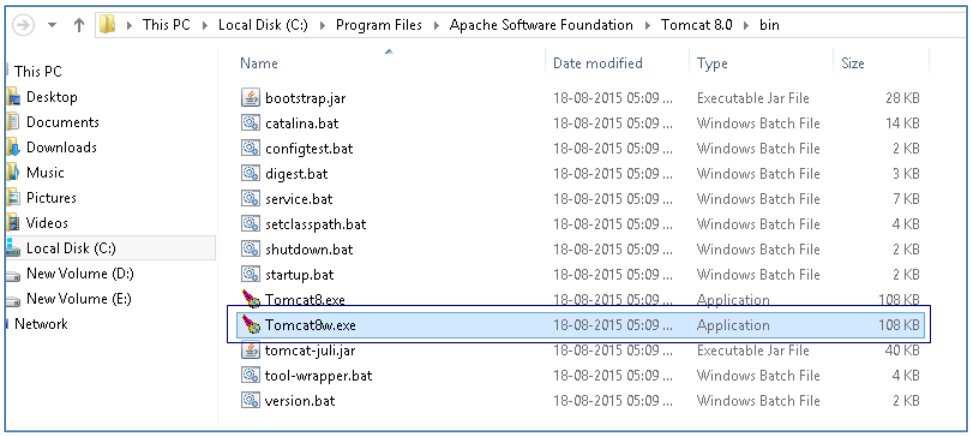


Figure 400. Select Tomcat File to Remove

Note: If there is any error while running Tomcat8w exe, right click the exe and use **Run as administrator** option.

3. The Apache Tomcat Properties Dialog box appears.

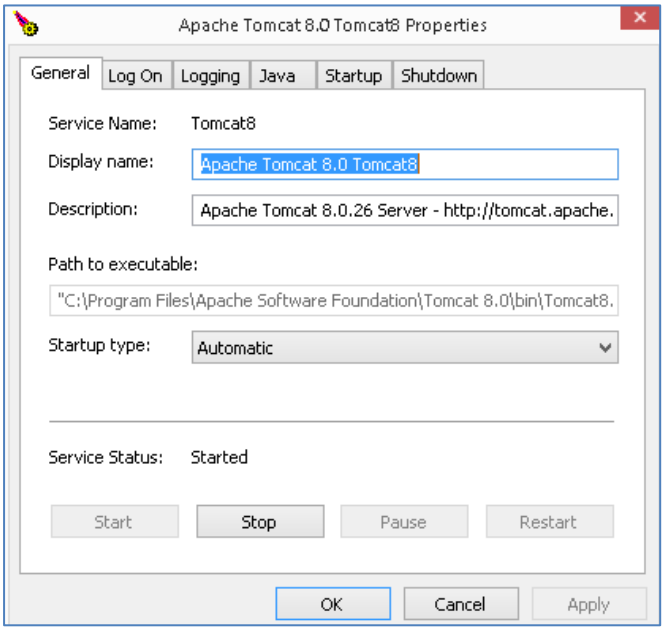


Figure 401. Tomcat Properties Dialog Box

4. Click **Stop** button to stop the service.

5. Once the service is stopped, navigate to "webapps" folder in the Tomcat directory as indicated below and delete the existing "DISCOM-REPOSE.war" file if exists and folder named "DISCOM-REPOSE" if exists.

<Tomcat installed directory>\Tomcat X.X\webapps

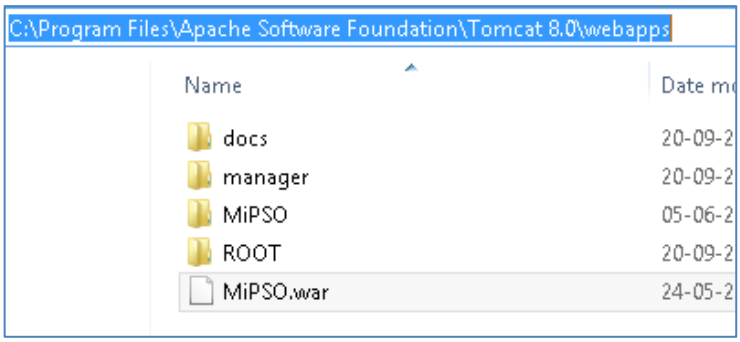


Figure 402. War File to be Removed

Note:

1. Ignore this step if this is the first time installation.
2. After the removal of the old files, the new war can be installed following the steps described in section 2.1.1.1 SETTING UP WAR FILES AND PROPERTIES

United States Agency for International Development (USAID/India)
American Embassy
Shantipath, Chanakyapuri, New Delhi - 110021
Phone: +91-11-24198000