USAID
FROM THE AMERICAN PEOPLE

SARI/EI

IRADe Integrated Research and Action for Development

STUDY TOUR TO EUROPEAN REGIONAL POWER MARKET

AMSTERDAM & PARIS

13th to 19th July, 2014

This publication was produced for review by the United States Agency for International Development. It was prepared by Integrated Research for Action and Development (IRADe) November, 2014

This report is made possible by the support of American people through the United States Agency for international development. The content of this report do not necessarily reflect the views of USAID of the United Sates Government.

TABLE OF CONTENTS

BACK GROUND:

Over the last two decades, the South Asian Region (SAR) has grown at an average annual GDP rate of six percent making it one of the fastest growing areas in the world. The region has a variety of energy resources at its disposal with maximum potential coming from hydropower resources (combined hydro potential is 350 GW). Yet, despite its potential and the impressive macroeconomic growth in the SAR, the South Asian power sector has not kept pace with the demand and the region continues to experience chronic power shortages and poor power quality. Systematic deployment of this potential along with an investment in infrastructure and a market-based electricity trade system can help in harnessing the untapped resources. Currently, compared to its potential, limited cross-border power trading is taking place between India-Bhutan (1300MW), India-Bangladesh (500MW) and India-Nepal (150MW) with a total trade of around 2000MW (all of which are on bilateral basis).

The lack of harmonized/coordinated laws, policies and regulations as well as the absence of a regional power market in South Asia are the key factors hampering the growth of Cross Border Electricity Trade (CBET) in the region. In the South Asian context, the risks associated with forging an intraregional, cross-border electricity project would be greatly minimized if each participating country adopts complementary national energy policies and develops a harmonized/coordinated laws, policies and regulations for CBET. SARI/EI has constituted three task forces comprising of representatives from the governments of different South Asian Country (SAC) to address the issues of: harmonization/coordination of laws, policies and regulations; advancement of physical transmission interconnections, and; formation of South Asian Market for Electricity (SAME).These task forces are guided by a high level Project Steering Committee (PSC) comprising of representatives from the governments of different South Asian Country (SAC) and eminent personalities.

As the process of regional energy cooperation and cross border electricity trade is taking shape in South Asia, it is felt that there is a need to a need to look at international best practices in other regional power markets, learn from evolutionary process of harmonization of legal, regulatory and policy issues concerning cross border electricity trade and operational and design aspects of the regional power markets. Moreover as regional power trade advances to new levels in south Asia, focus will shift from bilateral power trade to multilateral power trade and trade through region power market. Multilateral form of power trade and trade through region power market needs strong regional institutional set up. Therefore it is also important to learn from institutionalization and governance aspects regional cross border electricity trade and regional power market and formation of various governing and enabling institutions in other regional power markets. European regional power market has over the years addressed the above issues and is one of the most successful regional power markets existing in the world Visiting the European power market, will help the members to understand the transition from bilateral to multilateral trading and trading through the regional energy market. Members will use the learnings and understanding from the study tour (market evolution, process adopted for harmonization of legal/regulatory/policy aspects, institutional structure, etc.) in the various activities of the task forces and PSC to promote regional

energy cooperation, Cross Border Electricity Trade and developing a regional power market in South Asia.

In the above context the as part of USAID's SARI/EI program , study tour to European Regional Power Market to Amsterdam & Paris was organized by IRADe in association with the Indian Energy Exchange (IEX), a leading power exchange in India for the members of SARI/EI task forces/PSC and SARI/EI /IRADe Team from 13th to 19th July, 2014.

KEY OBJECTIVE OF THE STUDY TOUR:

The Key objective of the study tour:

1. Understand the legal, regulatory and operational structure of the European regional power markets.
2. Understand and learn from the process of evolution of European regional power markets and regional energy cooperation in Europe.
3. Learn and understand the organizational, governance and institutional arrangements of the European regional power markets and their different roles and responsibilities.
4. Understand the process of harmonization of the legal, regulatory, institutional and operational aspects of power trade among participating countries and development of common rules to facilitate cross-border transfers of energy and transmission services, etc.
    a. Lessons learned from the success story of European regional power markets.
    b. Challenges and constraints faced during the implementation stage.
5. Understand the existing supply, demand, as well as transmission constraints and trading arrangements of the European regional power markets.
6. Learn and assess the approaches and strategy adopted by European regional power markets for attracting investments through competitive electricity markets.
7. Asses and understand various power market regulation and role of regulators in power trading/exchange.
8. Understand the power exchange and various products available in the exchanges, markets for renewable energy in the European power market etc.
9. Learn techniques for cross border transmission allocation, electricity market operation, managing electricity markets, managing transmission system congestion, power trading strategies, pricing mechanisms, open access tariff structures, etc.
10. Integration of Renewable Power and Certificate Market for Renewable Power in Europe.
11. Site visits to system operators, exchanges and power utilities, etc. to gain hands-on knowledge and experiences.

The study tour was aimed to facilitate knowledge transfer and build the capacity of the members from the South Asian Countries (SAC) by giving them an opportunity to obtain first-hand knowledge and experience from the process of evolution of European regional power markets by dwelling upon the legal and regulatory issues, institutional governance, operational and market aspects etc. To achieve the objectives of the study tour, the overall program was designed with a combination of class room training as well as site visits.

STUDY TOUR AGENDA:

DAY 1 (13.07.14), AMSTERDAM	
16:00 Onwards	Canal Tour of Amsterdam, Welcome Dinner and Introduction to the Study Tour
DAY 2 (14.07.14), AMSTERDAM	
	Welcome address by Rajesh K. Mediratta, Director (BD) IEX,India. Introductory Remarks by V.K. Kharbanda, Project Director, IRADe,India.
09:45-11:00 Hrs	**Session -1: Evolution and Integration of European Power Markets** **Speaker: Mr. Bert Den Ouden, Former CEO, APX Group**
	This session will cover : • The process of evolution of European regional power markets and regional energy cooperation in Europe. • Legal, Regulatory and Operational structures of the European regional power markets. • Organizations, governance and institutional arrangements of European regional power markets & their roles and responsibilities.
11:00-11:15Hrs	Tea/Coffee Break
11:15-13:00Hrs	**Session 1 Continues....**
13:00-14:00Hrs	Lunch
14:00-15:15Hrs	**Session 2: Challenges & Solution : Integration of European Power Markets** **Speaker: Mr. Bert Den Ouden, Former CEO, APX Group**
	This session will cover : • Process of harmonization of the legal, regulatory, institutional and operational aspects of power trade among European countries and developing coordination and common rules to facilitate cross-border transfers of energy and transmission services, etc. • Constrained faced during process of harmonization. • Lessons learnt from the success of legal, policy and regulatory harmonization for formation of European regional power markets • Approaches and strategy adopted by European Regional Power Markets for attracting investments through competitive energy markets. • Learn and understand the EU roadmap for creation of Internal Electricity Market (IEM) and current status of IEM . • Probable model for South Asia and road map for harmonization of the legal, policy and regulatory issues in south Asia.
15:15-15:30Hrs	Tea/Coffee Break
15:30-16:30Hrs	**Session 2 Continues.....**

DAY 3 (15.07.14), AMSTERDAM	
09:30–11:00Hrs	**Session 3: Power Exchange and Various Products** **Speaker: Mr James Matthys, COO, APX**

	The session will cover
	• Introduction to Power Market at National level.
	• Existing supply, demand, as well as transmission constraints and trading arrangements.
	• Access and various power market regulation including role of regulatory agencies in structuring and monitoring power exchanges.
	• Spot Market.
	• Other Products in Electricity market.
	• Electricity market operations, managing energy markets and power trading strategies and pricing mechanisms.
	• Reserves/Ancillary & Balancing Market.
	• Basic Concept of Clearing Corporation
	  ○ Roles and responsibilities
	  ○ Rules and procedures
	  ○ Risk Management

11:00-11:15Hrs	Tea/Coffee Break
11:15-13:00Hrs	**Session 3 Continues....**
13:00-14:00Hrs	Lunch
14:00-15:30Hrs	**Session 3 Continues**
15:45 Hours	**Participants to assemble and be seated in the coach for transfer to APX office**
16:00 -17:15 Hrs	**Site Visit 1: APX** APX Group (Power Exchange) (PX) Atlas Arena Amsterdam, Australia Building,Hoogoorddreef 7,1101 BA,Amsterdam. Presentation on "European Market Coupling" by Howard Wright, APX.
DAY 4 I 16.07.14, AMSTERDAM	
09:30–11:15Hrs	**Session 4: Certificate Market for Renewable Power in Europe** **Speaker: Max van Meer, Managing Director, STX Services**
	The session will cover : • Certificate Mechanism in Europe (REC/ROC). • Voluntary REC Market
11:15-11:30Hrs	Tea/Coffee Break
11:30 –13:15Hrs	**Session 5: Integration of Renewable Power in Europe** **Speakers: Guadalupe Vazquez Gonzalez, Renewable Energy Manager, Acciona Energia** **The session will cover :** • Renewable Energy Scenario in Europe • Different markets for Renewable Energy Generation in different European countries. • Solution for Wind and Solar generators.

13:15 -14:00 Hrs	Lunch
14:00 -15:30 Hrs	**Session 6: Electricity Derivatives** **Speaker: Paul Stefiszyn, Director, ESP Consulting**
	The session will cover : • Understanding future options, Contracts for Difference ("CfDs") with case study • Detailed understanding of Margining principal • Detail understanding of Settlement Period • Derivative as hedging tool • Understanding related concepts like cascading of futures contract etc.
	DAY 5 I 17.07.14, AMSTERDAM
07.00 Hrs	**Leave for the Site Visit 2 destination by coach**
09:30–12:00Hrs	**Site Visit 2: TenneT** • Presentation by: Mr Ben Voorhost, COO, TenneT • Presentation on" Balancing, Security of Supply, National Control Centre" by Mr Jaap Hagen Department Head of National Control Centre of TenneT. • Presentation on ' Facilitating the electricity market by TenneT' by Mr.Thomas Donders
12:00- 13:00 Hrs	**Lunch**
13.00-15.30 Hrs	**Travel back to Amsterdam Central Station by coach**
15:30Hrs	**Arrive at Amsterdam Central Station**
17:00-20:35Hrs	**Travel to Paris**
20:35Hrs	**Arrive at Paris NORD Station**
21:00 Hrs Onwards	**Dinner hosted by IEX**
	DAY 6 I 18.07.14, PARIS
09:30 -13:00Hrs	**Site Visit 3: EPEX Spot** (5 boulevard Montmartre,75002 Paris ,France) • Presentation on "EPEX Spot : A power Exchnage at the Heart of Europe: Our role in Wholeshale Market " by Dr. Sandrine Wachon , Head of International Business Development,EPEXSpot,Paris, France. **Site Visit 4: PowerNex** (5 boulevard Montmartre , 75002 Paris ,France) • Presentation on "PowerNext " by Jean-Pierre Goux, Deputy CEO, Powernext, Paris , France. • Presenation by the Jonas Tornquist, Head of Economics & Regulation, EDF
13:00–14:00 Hrs	**Lunch**
14:00 –16:30Hrs	**Site Visit 5: RTE France (**1Terrasse Bellini TSA 41000,92919 LA DEFENCE Ceda France) • Presentation on" European electricity market : evolutions and challenges"by RTE France • Presentation on Electricity markets, cross-border capacityallocation and the role of RTE" by Galileo BARBIERI,RTE France
16:30–18:00Hrs	**Site Visit 6: Alstom Grid (**51, Esplanade du Général de Gaulle,92907 La Défense Cedex France) • Presentation on " Overview of electricity markets" by Eric Goutard, ALSTOM

	DAY 7 I 19.07.14, PARIS
10:00 -12:00Hrs	Study tour Sum-up Feedback session with the participants

LIST OF PARTICIPANTS:

S.NO	NAME OF THE PARTICIPANT	DESIGNATION	ORGANIZATION	COUNTRY	E-MAIL ID
1	Mr. Mohammad Hossain	Director General, Power Cell	Ministry of Power, Energy and Mineral Resources	Bangladesh	mhossain@powercell.gov.bd
2	Mr. Salim Mahmud	Member	Bangladesh Energy Regulatory Commission	Bangladesh	mahmud.salim@gmail.com
3	Mr. Monowar Islam	Secretary	Ministry of Power, Energy and Mineral Resources	Bangladesh	secypower@gmail.com
4	Mr. Yeshi Wangdi	Director General	Department of Hydropower and Power Systems	Bhutan	ywangdi@drunknet.bt
5	Mr. Raju Maharjan	Senior Divisional Engineer	Ministry of Energy	Nepal	rmaharjan024@gmail.com
6	Mr. Sanjeeb Baral	Senior Divisional Engineer	Ministry of Energy	Nepal	sanjeeb.baral@gmail.com
7	Mr. KLRC Wijayasinghe	Director	Ministry of Power and Energy	Sri Lanka	cwijayasinghe@yahoo.com
8	Mr. JGLS Jayawardena	Acting Director (P & D)	Ministry of Power and Energy	Sri Lanka	suljayawa@yahoo.com
9	Mr. Radheshyam Saha	Director	Central Electricity Authority	India	rsaha@cea.nic.in
10	Mr. Harish Saran	Executive Director (Marketing)	PTC India Limited	India	harishsaran@ptcindia.com
11	Mr. Vijay Kumar Kharbanda	Project Director	IRADE SARI/EI	India	vkkharbanda@irade.org
12	Mr. Rajiv Ratna Panda	Senior Project Manager	IRADE SARI/EI	India	rajivpanda@irade.org

Group Photograph:

Sitting (L to R): *I Mr. Yeshi Wangadi I, I Mr. Monowar Islam I, I Mr. Vijay Kumar Kharbanda I, I Mr. Rajesh K. Mediratta I, I* Dr. Salim Mahmud *I, I Mr. J G L S Jayawardena I.*
Standing First Row (L to R): *Mr. Radheshyam Sahal I, I Mr. Raju Maharjan I, I Mr. Mohammad Hossain I, I Mr. Sanjeeb Baral I, I K L R C Wijayasinghea*l *I, I Mr. Rajiv Ratna Panda I, I Mr. R D Jain I, I Mr. Nitin Sabikhi I .*

Sitting (L to R): *Mr. Vijay Kumar Kharbanda, Mr. Monowar Islam,* l*Hon'ble Justice Surendra Kumar,* l *Dr. Bert Den Ouden, MD, Berenschot Energy & Sustainability BV, Netherlands* l *Mr. Harvir Singh* l *Mr. Rajesh K. Mediratta*
Standing First Row (L to R): *Mr. Rajiv Ratna Panda* l *Mr. Radheshyam Saha*l *Dr. Salim Mahmud* l *Mr. YeshiWangdi,* l *Mr. RajuMaharjan,* l *Mr. Mohammad Hossain*l *Mr. Sanjeeb Baral,* l *Mr. J G L S Jayawardena,* l *Mr. Sanjay Srivastava*l *Ms. Ranjana Gupta* l *Mr. R D Jain, Director*
Standing: Second Row (L to R): *K L R C Wijayasinghea I Mr. K S Bandyopadhyay I Mr. Kerman S. Karkaria, I Mr. Mohit Shinghal, I Mr. Nitin Sabikhi* l *Mr Ronald Van Megen, IRM Credit Solutions, Netherlands*

Session 1: Evolution and Integration of European Power Markets
Session 2: Challenges and Solution: Integration of European Power Markets

Speaker: Dr. Bert Den Ouden
Former CEO, APX Group

Presentations Covered-

1. General Introduction Day-Ahead Market and Market Coupling Arrangements
2. Transmission capacity involved in the market coupling
3. Regulation
4. Evolution of the market coupling
5. Commodity prices, Renewable Integration and New
6. Volatility and Interconnectors
7. New Developments in Market coupling

Summary of Session 1 and 2:

Dr. Bert Den Ouden briefed about the development of electricity markets in Europe and the significance of energy and climate policy of the European Union (EU). The main aim of the policy was to open electricity markets for competition and create a common European electricity markets. The cornerstones of EU's energy policy are security of supply, competitiveness and sustainability. The climate and energy policies affect the way how electricity is generated and used.

Figure 1Dr. Bert Den Ouden during his lecture on Evolution and Integration of European Power Markets and Challenges and Solution: Integration of European Power Markets

Dr. Bert Den Ouden in his opening session gave Introduction to the Day Ahead Market, Market Coupling and Transmission capacity involved in the Market Coupling (MC). Market Coupling is a way of linking separate day ahead (auction style) spot markets using cross border Transmission Capacity. He gave historical perspective of the development of European Market. He summed up the European evolution by giving trajectory of evolution. He said initially, markets were coupled in Scandinavian market with Norway-Sweden (1996), NW (Norway)-SWEDEN-Finland-Denmark (2000). The experience was adopted in Central Europe through Trilateral Coupling (TLC) between

Belgium, Netherlands & France (2006). EU, convinced of the success of the Trilateral Coupling model, included in its 3rd Energy Package in 2008 in its directive (EC/714/2009). The coupling of Central Western Europe (CWE), Scandinavian, and Central South Europe (CSE) was achieved through Price Coupling of Regions (PCR) in 2014. Further, expansion of this market will continue with addition of East European markets in future. He said prices after market coupling began to converge in participating countries (Fig-2).

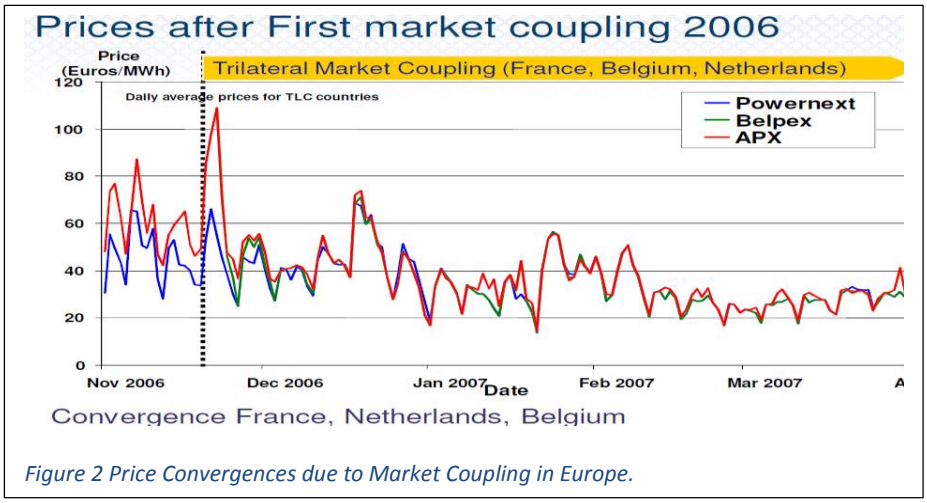


Figure 2 Price Convergences due to Market Coupling in Europe.

He also explained the overall evolution of the price coupling in the Europe (Fig-3). He also explained about the volume coupling process. Dr.Bert while explaining the regulation of power exchanges, said that the Regulation relating to Power Exchanges differ in each Country. In some countries, the exchange is appointed by law. In the Nordic Countries, the exchange is a spin off from earlier optimization initiatives in the energy sector, which was institutionalized later. In many countries, there is/was no formal appointment: the power exchange was started alongside the Over-the-Counter (OTC) Market. Over time, the liquidity on the power exchange increased because of a natural tendency for the trade to concentrate on one market place.

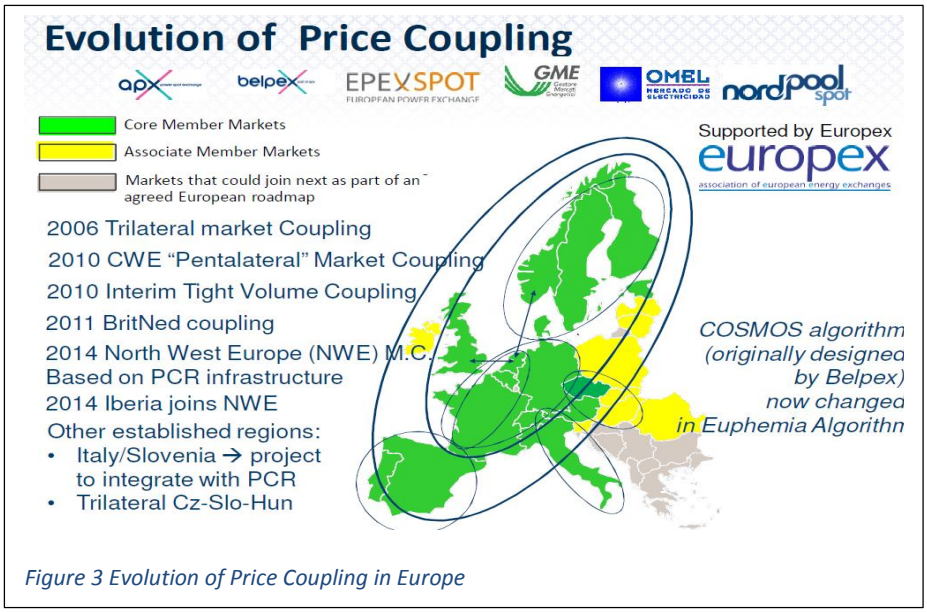


Figure 3 Evolution of Price Coupling in Europe

Session 3: Power Exchange and Various products

Speaker: James Matthys Donnadieu CEO, BELPEX and COO,

Presentations Covered-

1. Fundamentals of Current EU Market Design-
   a. Liberalization of EU Electricity Market and Market Model.
   b. General Principles- Balance Management, Balancing Responsible Party.
   c. Global Day Ahead Position.
   d. Different Market Venues and Market Segments.
2. EU Market Integration
   a. Principles of Interconnection management and EU Target Model.
   b. Day Ahead Market Coupling: Principles
   c. - Day Ahead Market Coupling: Implementation Road Map
   d. - Day Ahead Market Coupling: Auction Characteristics
   e. - Day Ahead Market Coupling: Products & Algorihtm
   f. - Day Ahead Market Coupling: Process & Operations
   g. - Bidding Zone Review
   h. - Flow Based Market Coupling
   i. - Intraday Market Coupling Day ahead, Flow Based and Intraday Market Coupling.

Summary of Session 3:

In the beginning of the session, Mr. James Matthys gave an introductory short presentation on the APX Group highlighting its activities, key financials and history. Mr. Matthys provided an overview of the APX activities in Belgium, Netherlands and the United Kingdom. The APX Activities Includes- Trading Services, Clearing Services, Market coupling and Shipping Services and Data Services.

Mr. Matthys further moved on to discuss about the fundamentals of the current European Market design, where he shared the knowledge on the key issues such as the Liberalization of European Electricity market, its Model, and the general principles. He outlined the initiatives taken at EU (European Union) level to create well-functioning markets fully

Figure 4 Mr. James Matthys making his presentation on the EU Market Integration.

convinced of the enormous potential benefits to be reaped by each European nation. He gave historical perspective of three major directives issued starting with first one in 1996 to create right structure and base for markets to function. The overall Liberalization process of EU Electricity Market is mentioned below.

Liberalization- EU Electricity Market:

1ST Package was issued in 1996: The main aims and objectives are

- Consumer>100 GWh/Y eligible as from 19.02.00
- Free Production
- E-Transport: Natural Monopoly ("Chinese Wall")
- Choice between NTPA(negotiated third-party access) and RTPA(regulated third-party access)
- Freedom to choose supplier for at least > 100GWh consumer.

Second directive was issued in 2003 mandating compulsory creations of autonomous regulators, full legal unbundling between Transmission System Operators(TSO) /Distribution System Operators(DSO) and supplier/generators and market opening for all consumers by 1/07/2007.

The 3rd energy package issued via directive in 2009, mandated the following:

- Ownership unbundling (OU) or Independent System Operator (ISO+) or Independent Transmission Operator,
  - Transmission System Operators (TSOs) enhanced role in regional cooperation.
  - Creation of ENTSOe (The European Network of Transmission System Operators for Electricity) -Energy Networks of TSOs
  - Harmonization and enhanced regulatory competences.
- Agency for the Cooperation of Energy Regulators (ACER) (European agency of regulators),
- EU Network Codes.

He explained about the Internal Energy Market ("IEM") in Europe. The main goal of the IEM is to 1) create Competitive energy market for enlarged European Union 2) enable customers to choose their supplier. He highlighted some of the key obstacle to IEM, and said, historically, markets were vertically integrated on a national basis and cross-border interconnectors have been less developed which acts as an obstacle. He said building new transport capacity is costly and extremely slow which impacts creation of IEM in Europe. To overcome these obstacles in sort term strategy should be to Allocate/Use scarce transmission capacity

Figure 5 Mr. James Matthys answering the queries of the participants during his presentation on the EU Market Integration.

via market-based mechanisms and in long term increase of capacity or new interconnectors and incentivize appropriate locations for new generation units.

He explained about the fundamental of Market Coupling (MC) in Europe and highlighted various benefits of MC. The key benefits of MC are:

- Facilitates development of liquid commodity markets and fosters competition
- Removal risk of trading transmission and energy separately and reduction risk of market abuse since transmission capacity cannot be hoarded.
- Market prices convergence, ultimately towards a single market price if sufficient capacity is available
- Optimum use of cross-border capacity and optimization of the use of the generation global portfolio. The more differences in local production mixes, the larger the social welfare increase resulting from such optimization
- Mitigation of price volatility by 'absorbing' local variations in production.

He said if fully implemented across Europe, will be of the order of €2.5 – €4 billion per year". Towards the end of his session, Mr. Matthys described the EU Market Integration, Principles of Interconnection Management and EU Target Model. He explained about the Multi Regional Coupling in Europe and highlighted some of its key features (Fig-6).

Key Features Multi Regional Coupling

- Decentralized solution; each PX has system (PMB) in place to perform the central calculation
- Central coordination (calculation role) role switches every 2 weeks, is performed by all PX
- Back Up coordinator who takes over in case of issues at Central Coordinator, role switches every 2W
- Back Up Coordinator runs a // shadow central calculation. 0ther PMB operator can run // calculation
- If issues: Incident Committee is triggered by confer. call, allowing for central incident management

Governance
-Market Coupling principles/mechanism: NRA approval
-Contracts:
-PX-TSO (one): Day Ahead Operational Agreement (DAOA): R&R PX vs TSOs
-PX-PX (one): Cooperation Agreement PCR & co-ownership agreement
-TSO-TSO agreements: pre & post coupling arrangements
-PX or CCPs-TSO agreements: shipping contracts
-PX-TSO local/regional agreements: agreements supplementing DAOA to account for local/regional features

Management
-TSO-PX ; TSO-TSO and PX-PX steering committees and operational committees
-Regular reportings to EU and National autorities and NRAs

Next Steps /WiP

- Management of further extentions
- Set up of EU-wide stakeholder committee
- Change procedures / consultation / decision making process / issue resultion

Figure 6 Key Features of Multi Regional Coupling.

He also gave an in depth lecture on the Day Ahead Market Coupling - (Principles, Implementation Road Map, Auction Characteristics, Products & Algorithm and Process& Operations), Bidding Zone Review, Flow Based Market Coupling and Intraday Market Coupling.

Site Visit 1: Amsterdam Power Exchange (APX)

Speaker: Mr. Howard Wright
BD Manger, APX Group

Topics Covered-

1. Market Business Run
2. Multi Regional Coupling
3. NWE Business Process
4. Pre Coupling Process, Post Coupling Process
5. Backup Scenarios, Process Delayed, Fall Back Scenarios and Full Decoupling scenario.
6. PCR Process Timings for NWE
7. Partial Decoupling
11. Decoupling Scenarios

Summary of Site Visit 1:

APX GROUP: APX is Europe's premier provider of power exchange and clearing services for the wholesale power market, operating transparent platforms in the Netherlands, the United Kingdom and Belgium. APX provides exchange trading, central clearing & settlement and benchmark data and industry indices distribution services to over 150 members from more than 15 countries. Belpex SA of Belgium is a 100% subsidiary of APX. As an experienced and innovative European energy exchange, APX offers an efficient, transparent and secure electronic trading environment and provides market data for use by traders, energy suppliers and energy-intensive industries. In addition, APX promotes market innovation and creates new opportunities by working closely with its members, Transmission System Operators (TSOs) and other power exchanges. APX shares the vision of the EU for

Figure 7 Participants learning about the APX power exchange operations.

the realization of a single, integrated market. APX therefore focuses on delivering an integrated electricity market through its involvement in projects such as the North-Western European Price Coupling and the establishment of an integrated European Intraday market. APX will remain a leading force in the design process of market coupling and act as one of its daily operators.

During the site visit to APX, Mr. Wright explained about PCR, which stands for 'Price Coupling of Regions' is the coupling of seven regional power exchanges, APX, Belpex, EPEX SPOT, GME (The Italian Energy Markets Operator), Nord Pool Spot, OMIE and OTE (The Czech Electricity Market Operator) to develop a coupling algorithm embedded in a common system solution, with the goal that this infrastructure, including the algorithm, will be used for European Price Coupling. Price coupling between different market areas allows creating a single exchange zone and consequently single price zones when interconnection capacities do not limit cross-border electricity exchanges. It improves the market liquidity and participates in the creation of a single European Electricity Market.

Figure 8 APX office in Amsterdam, Netherland.

He, further moved on to discuss Multi Regional Coupling (MRC). MRC is the price coupling of multiple regions: Central West Europe (CWE), South West Europe (SWE), Nordic, Great Britain (GB), etc. One of the core principles of the Multi-Regional Coupling is to try to couple as many bidding areas/interconnectors as possible. A partial decoupling is a situation where one or more bidding areas and /or interconnectors temporarily are not participating in the MRC while the remaining bidding areas /interconnectors still participate in the MRC. MRC supports 2 different types of Partial Decoupling situations, depending on the reason leading to the decoupling:

Figure 9 Participants visiting the operational floor and being explained about the Market Coupling Process.

- Partial Decoupling during the Pre-Coupling process.
- Partial Decoupling during the Coupling process.

Pre- Coupling Process:

The Pre- Coupling Process consists of three steps

- Shared Configuration file and systems check (PCR Coordinator Role)
- Receive BritNed, NorNed and CWE's CZCs (Cross-Zonal Capacities) and the FX (Foreign Exchange Rates) (CWE MO Role)
- Validation of all network data in the cloud (PCR Coordinator Role)

Figure 10 Mr. Wright from APX is explaining the Market Coupling process at APX

Coupling Process:

- Receive and Process - Orders.
- Calculation of Results (PCR Coordinator Role)
- Local Preliminary APX Confirmation (PCR Coordinator Role)
- Global Preliminary Confirmation (PCR Coordinator Role)
- Check GPC, allocate results and publish.
- Obtain Final Confirmation (PCR Coordinator Role)
- Send Results and Global Final Confirmation (GFC) to Market, Capacity Allocating Service Company (CASC), TSOs, BritNed, Euro Light and XPCS (CWE MO role)

Post Coupling Process:

- Local Nominations
- Cross- Border Nominations

Participant's visited to Operational department where process of price coupling and day to day operational activities of the power exchanges takes place and the process were explained in detail to the participants.

Session 4: Certificate Market for Renewable Energy in Europe

Speaker: Mr. Max van Meer
Managing Director, STX Services

Presentation Covered-

1. Introduction
2. Feed in Tariffs versus Market Based Mechanism
3. Certificates Mechanism in Europe
4. European Target Compliance Certificate Systems
5. Voluntary Market
6. The Voluntary Consumption Market
7. Guarantees of Origin

Summary of session 4:

Mr. Max van Meer, MD of **STX Services** introduced his company and various services offered by STX. He said there are mainly two support systems in EU for renewable energy. One is Feed-in tariff and subsidies: fixed price for fixed term (Germany, France, Spain, Netherlands and others) and other is Market based mechanism, based on certificate system (7 countries: United Kingdom (UK) , Belgium (BE), IT (Italy), Sweden (SE), Norway (NO) , Poland (PL), Romania (RO). He outlined the Feed-in-tariff and certificate systems prevailing in different European countries and compared the RPO/REC mechanism of India. He also gave salient features of Voluntary market for renewable energy which is better known as Guarantee of Origin (GoO). He shared that Goal of EU is to increase production of RE power to 20% of total consumption. Still production of RE power requires incentives and to support RE power, two main support systems are prevalent in Europe as follows.

Figure 11 Mr. Max van Meer, MD of STX Services making his presentation.

i. Feed-in Tariff (fixed price for fixed term) is prevailing in Germany, France, Spain, Netherlands. He explained the advantage ad dis-advantages of Feed-in-Tariff and said FIT has the advantage of providing a secure investor environment but it has the disadvantages that, generators can get wind-fall profits and government cannot intervene in the intervening period.

ii. Market based mechanisms (based on certificate systems) is prevailing in 7 countries these are UK, Italy, Belgium, Sweden, Norway, Poland and Romania. Advantage of Market Based Mechanism is that, it stimulates competition and therefore lower cost to the end-consumers. Disadvantage is

that, it creates uncertain investor returns and therefore it may discourage investments. Normally, such market mechanisms do not generate fair equilibrium price and require interventions or corrections in due course to avoid risk of very low demand or supply scenarios.

He explained basics of the certificate based trading systems. He explained, if energy suppliers fail to meet the target, they have to pay a fine/penality.Energy producers can sell both the physical electricity and the certificate in the market. In some systems the government will set a guaranteed price for the same. He also shared features of certificate trading systems in Italy. He shared that in terms of market access, most volumes are traded forward on OTC basis. Forward clearing solutions or markets are difficult since there is no reliable reference price. Cross-border certificate purchase/sell allowed only in Norway-Sweden. Italy/Poland/Romania have allowed exchanges to trade. Sweden has most frequent trading.

He also explained Guarantee of Origin (GoO) mechanism exist in Europe (Fig 12). For the promotion of electricity generated from renewable energy the member states of the European Union have acted to create a system in which electricity production based on renewable energy sources can be verified reliably. Guarantees of Origin are issued electronically for a controlled quantity of electricity generation (usually 1 GO per MWh), traded and redeemed (i.e. used) by suppliers as evidence to their customers of the source of the delivered electricity. As per the RES Directive 2009, Article 15.7 says "Where an electricity supplier is required to prove the share or quantity of energy from renewable sources in its energy mix for the purposes of Article 3(6) of Directive 2003/54/EC, it may do so by using its Guarantees of Origen" and Article 15.7 states "Member States shall recognize Guarantees of Origen issued by other Member States in accordance with this Directive exclusively as proof of the elements referred to in paragraph 1 and paragraph 6(a) to (f). A Member State may refuse to recognize a Guarantee of Origen only when it has well-founded doubts about its accuracy, reliability or veracity. The Member State shall notify the Commission of such a refusal and its justification."

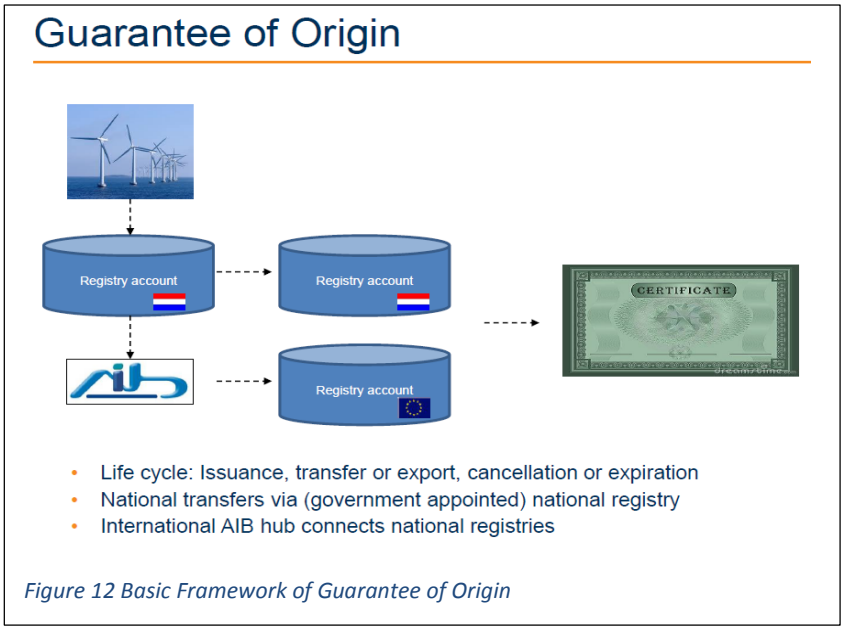


Figure 12 Basic Framework of Guarantee of Origin

1. Each Member State must be able to guarantee the origin of electricity.
2. The information contained in these guarantees of origin is normalized and should be recognized in all Member States.
3. Association of Issuing Bodies (AIB) is the company in charge of issuing GoOs certificates.
4. GoOs are valid for a period of 1 year from the issuance date.
5. GoOs are mainly traded through bilateral contracts (spot/forward) although EEX (European Energy Exchange) have recently launched a future markets for some classes of GoOs (i.e. hydro, win etc.). However, GoOs must be coming from countries with a signed agreement with AIB.

Session 5: Integration of Renewable Power in Europe

Speaker: Ms. Guadalupe Vazquez Gonzalez

Renewable Energy Manager, Acciona Energia

Topics Covered-

1. **Wind Installed Capacity-Overview**
2. **Total Installed Capacity and RES Targets for-**
   - **Spain**
   - **Portugal**
   - **Italy**
   - **Poland**
   - **Germany**
3. **Schemes for developing and promoting Renewables**
   - **Spain**
   - **Portugal**
   - **Italy**
   - **Poland**
   - **Germany**

Summary of session 5:

Ms. Guadalupe began her session by providing an overview and some facts and figures on the worldwide wind Installed capacity. The total wind installed capacity by the end of 2013 (31/12/2013) was 318,137 MW and the average growth of the wind Installed capacity for the last five years is 39,447 MW. This shows that the overall energy sector is progressively moving away from conventional generation technologies towards a renewable energy scenario. She said the Directive 2009/28/EC of the European Parliament establishes a common framework for the use of the energy from renewable sources in order to limit the greenhouse gas emissions and to promote a cleaner transport through the definition of National Action Plans.

She explained about the various incentive/support mechanisms to renewable energies have played an important role in deploying wind power in Europe. The support level for onshore wind broadly varies by country. The predominant mechanisms to support wind are feed-in tariffs (FITs) and tradable Green Certificates. There is a drop in the global wind energy market in 2013 which is largely attributed to the US market collapse that started at the beginning of the year. The reason was the late

Figure 13 Ms. Guadalupe making her presentation on Integration of Renewable Power in Europe

extension of the federal Production Tax Credit (PTC). Ms. Guadalupe further moved on to discuss the country wise wind installed capacity in 2012 and the new capacity installed in the year 2013. China was the largest market in 2013, with a new wind installed capacity of 16,100 MW. Germany was the second country in terms of new wind installed capacity, adding 3,238 MW in 2013. UK came in third place with 1,883 MW, followed by India with 1,729 MW and Canada with 1.599 MW. At the end of 2013 the global cumulative wind installed capacity reached 318 GW, led by China (91 GW), USA (61 GW), Germany (34 GW), Spain (23 GW) and India (20 GW). The five leading countries account for a share of 76.5% of the global wind capacity. Germany remains the EU country with the largest installed capacity followed by Spain, the UK and Italy. 15 Member States have more than 1GW of installed capacity, including two new Member States: Poland and Romania (both had record years installing around 8% of the EU's annual capacity).The power installed capacities of some of the EU countries and renewable energy targets set through the 2009/28/EC directive are given below:

S.NO	COUNTRY	INSTALLED CAPACITY	RES TARGETS DEFINED THROUGH THE 2009/28/EC DIRECTIVE
1	Spain	102,395 MW (2013) 1. Thermal- 36.14 % 2. Renewable- 38.88 % a) Wind- 57.50% b) Solar- 11.13%	38.1 % of total electricity demand in 2020 should be covered with renewable.
2	Portugal	18,546 MW (2012) 1. Thermal- 42.37 % 2. Renewable- 29. 38% (excluding hydro) a) Wind- 76.96 % b) Solar- 4.03 %	55.2 % of total electricity demand in 2020 should be covered with renewable.
3	Italy	128,134 MW (2012) 1. Thermal- 59.92 % 2. Renewable- 22.72 % (excluding hydro) a) Wind- 27.88 % b) Solar- 56.40 %	26.39 % of total electricity demand in 2020 should be covered with renewable.
4	Poland	37,907 MW (2011) 1. Thermal- 89.09% 2. Renewable- 5.37% a) Wind- 79.33 % b) Solar- 0 %	19.13 % of total electricity demand in 2020 should be covered with renewable.
5	Germany	174,238 MW (2012) 1. Thermal- 51.87 % 2. Renewable- 39.95 % a) Wind- 43.12 % b) Solar- 46.70 %	35 % of total electricity demand in 2020 should be covered with renewable.

Table 1Power Installed Capacity of Some EU countries and Renewable Energy Targets.

Session 6: Electricity Derivatives:

Speaker: Mr. Paul Stefiszyn

Director, ESP Consulting

Topics Covered-

1. Fundamentals of Electricity derivatives
2. Spot and Forward Prices
3. Clearing House
4. Margin and Daily Settlement
5. Commodity Price Risk
6. Swaps and Options

Summary of session 5:

Mr. Paul explained the basics of derivatives contracts and how these derivatives contracts are applicable for the power sector. He explained the difference between spot, forward and future contracts. A power forward contract is an agreement between two counterparties for the delivery of electricity at a certain time in the future for a certain price that is agreed and fixed at the start of the contract. Forward contracts often have standard features but can be customized to accommodate any volume and any forward delivery period. On the other hand, futures contracts are standardized contracts with well-specified commitments for a carefully described commodity (quantity and quality) at specified point of time and place in a specified manner (method for closing the contract).

Figure 14 Mr. Paul delivering his lecture on Electricity Derivatives

During his presentation, he highlighted the key differences between normal commodities (like wheat, metal etc.) as opposed to flow commodities (like gas and power etc.). Flow commodities are delivered over a period of time i.e. there is a start and end point. Contracts for such commodities, specifies the delivery period which can be a week, month or quarter. In case of a stepped price contract it is possible to specify different prices for different periods. He explained the utility of the financial derivative contracts to offset any price risk associated with the commodity being traded.

Site Visit 2: TenneT

Speaker: Mr. Ben Voorhorst

Member- Board Management,

Topics Covered-

1. Introduction
2. Role of TenneT as a TSO
3. Development of a North West European Market
4. Strategic Outlook

Speaker: Mr. Jaap Hagen

Head- National Council Centre, TenneT Holding BV

Topics Covered-

1. Load Frequency Control- Balancing in the Netherlands
2. SSC Rommerskirchen (D)- (Security Service Centre)
3. TSO Security Cooperation
4. Control Centers TenneT Netherlands- NCC, CCR, SSC
5. NCC Desks and Tasks
6. Security of Supply
7. Flow between TSO's
8. European Awareness System

Speaker: Mr. Thomas Donders

TenneT Holding BV

Topics Covered-

1. Electricity Market Cornerstones
2. Balancing the Grid
3. Market Integration
4. Future Developments and Challenges

Site Visit 2 Summary: TenneT

TenneT:

TenneT is a leading European electricity transmission system operator (TSO) in the Netherlands and in a large part of Germany. In the Netherlands, the activities are carried out by TenneT TSO B.V. and its subsidiaries. In Germany, the work is performed by TenneT TSO GmbH, TenneT Offshore GmbH and its subsidiaries. TenneT ensure a reliable and uninterrupted supply of electricity for the 36 million end-users in the markets they serve. As a leading TSO, their main duties are to provide (1) power transmission services, by constructing and maintaining a robust high-voltage grid, (2) system services, by maintaining the balance between supply and demand of electricity 24 hours a day, 7 days a week and (3) facilitating a smoothly functioning, liquid and stable electricity market. TenneT is Europe's first cross-border grid operator for electricity, with approximately 21,000 kilometers of (extra) high-voltage lines and 36 million end-users in the Netherlands and Germany, TenneT ranks among the top five grid operators in Europe.

Figure 15 Group Photographs of Participants at TenneT

In the beginning of the site visits, Mr. Ben Voorhost gave an introductory presentation about the organization. Further Mr. Voorhost highlighted the challenges faced by the TSO and gave a brief overview of the development of the North-West European Market and the Strategic Outlook for TenneT.

During his presentation, he mentioned the following key tasks of TenneT as a TSO:

- Transmission Services- Constructing and maintaining a robust high voltage grid.
- System Services- Maintaining the balance between electricity supply and demand 24/7.
- Market Facilitation- Facilitating a smoothly functioning, liquid and stable electricity market.

He also explained about the TenneT strategy 2020 which aimed to 1) Ensuring a continuous supply of electricity, anytime and anywhere, 24 hours a day and seven days a week 2) Offering an excellent price/quality ratio 3) Responding to energy-related developments in society and Contributing to the

achievement of energy-related objectives 4) actively promoting European market integration through targeted investments 5) Creating value for shareholders.

He also briefed about the EU energy policies which aimed at 1) Reliable electricity supply at Competitive prices 2) Level playing field for industry and consumers 3) Extended market for the integration of renewable energy and explained about the European market integrations. He said TSO in Europe requires significant investment to meet the future objectives in a very challenging environment. TenneT is expected to invest around 16 billion US$ over the next 10 years.

Figure 16 Mr. Ben Voorhost delivering his talk and Explaining about the TenneT

In the subsequent presentation made by Mr. Jaap Hagen on Load Frequency Control and Balancing in the Netherlands. He said TenneT is operating the power system of Netherland (TenneT-N) and part of Germany (TenneT-G). TenneT-NL is responsible to operate National Control Centre (NCC), Regional Control Centre (Centre Control Regions Ede) (CCR) and Security Service Centres (SSC), Rommerskirchen. NCC is responsible for i) System operator tasks ii) Transport 380kV- and 220kV-grid and iii) International Coordination. CCR is responsible for operating regional transmission systems of 150 and 110kV. SSC is responsible to coordinate with cross-border TSOs (Amprion, TenneT Duitsland and TenneT-NL) for maintaining security. NCC and RCCs also act as back-up centres. The final presentation was made by Mr. Donders on facilitating the electricity market by TenneT in Europe. In his session, he discussed about the principles of the electricity market and the role of TenneT as a TSO. He highlighted the regulated activities that include reliable transmission of electricity and balancing functions performed by TSO. The same is summarized below:

Figure 17 Mr. Jaap Hagen making a presentation about Load Frequency control and Balancing.

Balancing the Grid:

a) Balancing role as part of international interconnection:

- TenneT is responsible for the Control Area of the Netherlands.
- The Netherlands are part of the meshed grid of continent Europe is responsible for stability of frequency
- Balancing is organized per control area.

b) National Cornerstones

- Program Responsibility- Each connection is part of the portfolio of a Program Responsible Party.
- Market for Frequency restoration of power- TenneT is Single Buyer of the Bid and Offers frequency restoration power from the market.
- Settlement of Imbalance- Financial Incentive for market to remain in balance or to assist the system to restore from an imbalance.

c) Developments

- International Grid Cooperation (IGC) - To prevent counter balancing actions between control areas.
- Integration of European Balancing Markets is a logical next step after the integration of the wholesale markets.
- The EU Network code on Balancing gives framework to further harmonization of balancing markets.
- A pilot between TenneT and Elia (Belgium TSO) studies the possibilities towards integration and harmonization of both balancing markets.

Figure 18 Mr. Donders making his presentation on "Facilitating the electricity market by TenneT"

Site Visit 3: EPEX SPOT, PARIS, FRANCE

Speaker: Dr. Sandrine Wachon

Head- International Business Development, EPEX SPOT

Topics Covered-

1. The European Power Market
2. EPEX SPOT in a nutshell
3. EPEX SPOT Markets and Products
4. Challenges of the European Power Market

Summary of the Site Visit 3: EPEX SPOT

EPEXSPOT

EPEX SPOT

EPEX SPOT SE power exchange operates the power spot markets for short-term trading in power in Germany, France, Austria and Switzerland, with Germany and Austria forming one price zone. These countries account together for about one third of the European power consumption. EPEX SPOT counts over 200 members. EPEX SPOT is one of the stakeholders in several market coupling initiatives, such as the market coupling in Central Western Europe and the Interim Tight Volume Coupling with the Nordic markets via the European Market Coupling Company (EMCC).

Dr. Sandrine Wachon made a presentation on EPEX spot and explained about the basic principle of organized market which includes 1) access to an anonymous market 2) level playing field between members 3) financial guarantees through the clearing house and 4) calculation and publication of transparent and fair price references. She said Creation of EPEX spot and development of power trading is one of the most visible result of liberalization of European power market.

Figure 19 Dr. Sandrine Wachon delivering his talk on European Power Market

Liberalization of the European Power Market in the Context of creation of EPEX Spot.

- 1996- European Directive on Energy Market Liberalization.
- 1998- Implementation of the directive in German and Austrian Law.
- 2000- Implementation of the directive in the French Law.
- 2001- Establishment of POWERNEXT SA
- 2002- Merger of the former Leipzig Power Exchange (LPX) and the European Energy Exchange (EEX) Frankfurt to EEX AG.
- 17th September 2008- Creation of EPEX SPOT SE, owned by 50/50 by POWERNEXT SA and EEX AG.
- 1st January 2009- Transfer of POWERNEXT Power Spot into EPEX SPOT SE.
- 1st September 2009- Transfer of EEX Power Spot into EPEX SPOT SE.

Power Exchanges bundle supply and demand of companies and professionals of the power business (producers, utilities, banks, industrial consumers) and allow the creation of a neutral market price in a transparent, instant and fair manner.

The Markets of EPEX SPOT: EPEX SPOT market constitutes 1,200 TWh of yearly power consumption, which represents 40% of the EU's Integrated Electricity Market.

EPEX SPOT Markets- Germany/Austria, France, Switzerland, Hungarian Day-Ahead market on behalf of the Hungarian Power Exchange, Coupling Services for Slovakian , Czech and Hungarian Power Exchange (HUPX) .EPEX SPOT has inherent incentive to integrate European power markets. This process is supported by the harmonized cross-border trading system.

Two Main Products at EPEX SPOT

- **Day Ahead**- Blind auction takes place 7 days a week, year-round and contracts of 24 hours of the respective next day are traded. Hourly and Block contracts are available for trading and is integrated in Central Western Europe (CWE) Market Coupling. Trading is conducted via EPEX Trading Systems.
- **Intraday**- Continuous trading and price formation for 24 hours a day, 7 days a week, year round. Contracts can be traded until 45 minutes before the beginning of delivery. Hourly and Block contracts are available for trading, whereas 15 minutes contract on German and Swiss markets allow flexible balancing of portfolio. Cross- Border trading takes place between Germany, France Austria and Switzerland.

Figure 20 Dr. Sandrine Wachon is speaking on EPEX SPOT

Market Coupling: Market Coupling or Price Coupling is a solution to couple markets operated by different Power Exchanges and covers the technical, organizational and legal aspects. Price differences between markets are minimized or eliminated by directly using the cross-border transfer capacity on interconnectors between countries on the Exchange. Offer and demand are widened from a national level to European level. Different Market Coupling initiatives already existed before North West Europe (NEW) launch on 4/2/2014, e.g. in Central Western Europe (CWE) since 10 November 2010, covering Germany, France, Belgium, Netherlands and Luxemburg. Market Coupling is the most concrete implementation of the Internal Energy Market that Europe has ever known.

European Market Coupling benefits include- 1) Optimal use of interconnectors facilitating congestion management 2) reduction of price volatility 3) smoothing effect on negative or positive price spikes 4) Propagation of extreme weather conditions.

Price Coupling of Regions (PCR): The engine of the Internal Energy Market

- Initiated by European Power Exchanges, confirmed by European authorities, Price Coupling of Regions (PCR) is a project dedicated to deliver the Pan-European Price Coupling solution.
- The aim is to develop a single price coupling algorithm to be used to calculate electricity prices across Europe.
- PCR Based on three main principles:
    - One single algorithm
    - Decentralized operation
    - Individual accountability of each Power Exchange
- It will facilitate the road to the overall EU target of a harmonized European electricity market and PCR is the “engine” of the “vehicle” called Multilateral Regional Coupling

Site Visit 4: Power Next, PARIS, FRANCE

Speaker: Mr. Jean Pierre GOUX Deputy CEO, PowerNext

Topics Covered-

1. Powernext
2. Powernext Gas Market Model
3. How could PEGAS, The PAN European Gas Platform?
4. Contractual Framework
5. PEGAS Institutionalization
6. French Registry for Guarantees of Origin
7. Provider of registry solutions to other issuing bodies

Summary of Site Visit 4: Power Next

PowerNext SA:

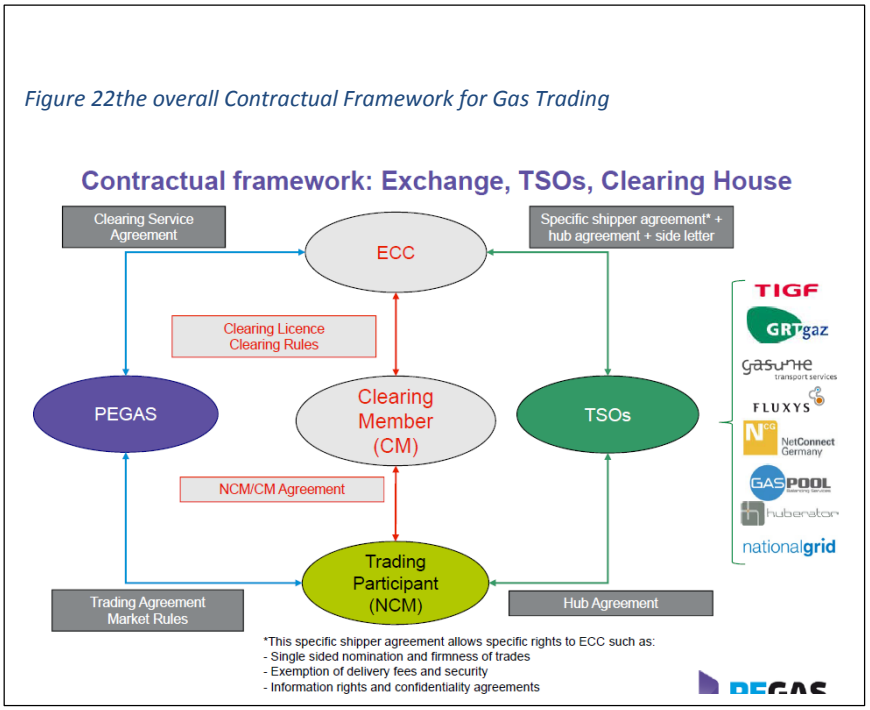
Power-Next, France incorporated in 2001, manages several complementary, transparent and anonymous energy markets: Powernext Gas Spot and Powernext Gas Futures were launched on November 26, 2008 in order to hedge volume and price risks for natural gas in France from Within-Day to the next three gas seasons. Since 1st December 2009, Powernext Gas Spot also allows the Transmission System Operator GRTgaz (GRTgaz is the natural gas transmission system operator located in Paris, France. GRTgaz is a public limited company, a subsidiary of the industrial group GDF Suez (formerly Gaz de France)) to progressively cover parts of its daily balancing needs on the market. EPEX Spot, based in Paris and owned equally by Powernext and by EEX, the German energy organized market, was launched on 1st January 2009 and facilitates 365 days a year, the hourly balancing of physical power delivered the following day on the French, German/Austrian and Swiss hubs. In April 2009, Powernext

Figure 21 Mr. Jean-Pierre GOUX, Deputy CEO making his presentation on Powernext.

contributed the French power derivatives to EEX Power Derivatives, a company dedicated to European power derivatives, based in Leipzig, against a 20 percent equity stake in this company.

Mr. Jean-Pierre GOUX , Deputy CEO of Powernext made a details presentation about the company and its various operations. He said Powernext is a market undertaking based in Paris and operating as a "regulated market" (RM) Powernext currently designs and operates state-of-the-art electronic trading platforms for spot and derivatives markets in the European energy sector. He said in the near future, Powernext plans to broaden its product offer to other areas, either by operating on its own or in partnership with other exchanges through servicing. Powernext develops and operates its own markets and establishes partnerships to help other exchanges setting up new markets. He also explained the overall contractual frameworks for gas trading (Fig-22). The Powernext has own shares in various exchanges or companies in the commodity sector.

Figure 22the overall Contractual Framework for Gas Trading



Powernext Gas offers:

- Spot contracts on all three PEG Nord (The Gas exchange point – North), PEG Sud(The Gas exchange point - South (Point d'échange de gaz – Sud), PEG Transport Infrastructures Gaz France (TIGF)
  - Within-Day
  - Day-Ahead
  - Week End
- Futures contracts with physical delivery on PEG Nord
  - The next 3 Months
  - The next 2 Quarters
  - The next 3 Gas Seasons
- OTC Clearing services on Futures

The PEGAS Community (Pan European Gas Cooperation)

PEGAS is cooperation between European Energy Exchange (EEX) and Powernext. In the framework of this cooperation, both companies combine their natural gas market activities to create a pan-European gas market.

Members benefit from one common gas trading 'Trayport' platform with access to all products offered on the exchanges: spot and derivatives products for the German, French, Dutch and Belgian market areas. Furthermore, spread products between these market areas are offered on the same trading platform.

The PEGAS Community:

- **140 Members registered on PEGAS**
  - 131 registered Members on PEGAS Spot, 931 trading accounts
  - 114 registered Members on PEGAS Futures, 554 trading accounts

Among Powernext Members

- 3 Industrial (Dalkia, Solvay, Petroineos)
- 6 Financial (Barclays, Goldman Sachs, JP Morgan, Macquarie, Morgan Stanley, Societe Generale)

Clearing Services by ECC (Clearing Services by ECC)

- As central counterpart, ECC is in charge of physical settlement and therefore is active as a shipper on all involved European TSOs.
- Payment of the delivered energy is processed every day; therefore securities deposits are small.
- Expert in risk management:
  - Advanced margining models on Spot and Futures (daily settlement of profits and losses and a margin system comprising various security levels).
  - Minimized deposits due to cross margining (positions netting between different maturities / commodities).
  - Advanced IT systems and procedures (members' acceptance, credit limit, default management).
- 372 market participants already active on ECC.

PEGAS Institutionalization:

- The physical and regulatory focus of Powernext and EEX is a key success factor of the PEGAS initiative.
- Powernext partnership with French TSOs initiated
  - GRTgaz market based balancing since 12 April 2007
  - GRTgaz PEG Nord / PEG Sud market coupling initiative since 1st July 2011
  - TIGF balancing interventions since January 2012
- EEX partnership with the German and Dutch TSOs
  - NetConnect Germany (NCG) and Gaspool market based balancing since 2008
  - NCG purchase of gas on Dutch Title Transfer Facility (TTF hub)
  - Quality specific (H&L) gas products launched on October 1st 2013
- Strategic studies with major infrastructure operators are currently being run:
  - Combined storage / transport / exchange services
  - International market coupling
  - Congestion Management Procedures (CMP) (overselling and buy-back)

Site Visit 5: RTE France

Speaker: Mr. Bruno MailH
Manager-BD, RTE International

Topics Covered-

1. Brief Presentation on RTE/ RTE International
2. EU Policies and Market Reform
3. The French Market Design
4. Current Challenges of RTE after 15 years of Competition- Main Issues
5. RTE Strategy

Speaker: Galileo BARBIERI, RTE International

Topics Covered-

1. Electricity markets, cross-border capacity allocation and the role of RTE
2. Process for Scheduling for OTC, DAM and Intraday Markets
3. The process for scheduling Cross Border Power Transactions
4. Imbalance Settlement in France
5. Cross Border Coordination for Transmission Capacity and Scheduling
6. How RTE role has changed with the Market Coupling?

Summary of the Site Visit 5: RTE France

Réseau de transport d'électricité

RTE (Réseau de Transport d'Électricité):

Réseau de Transport d'Électricité (Electricity Transmission Network), usually known as RTE, is the electricity Transmission System Operator of France. It is responsible for the operation, maintenance and development of the French high-voltage transmission system (approximately 100,000 circuit kilometers (62,000 mi)) is Europe's largest. RTE is a wholly owned subsidiary of the partially public-owned French generator Électricité de France (EdF), headquartered in Paris. RTE's transmission

system operates at voltages of 63 kV, 90 kV, 150 kV, 225 Kv and 400 kV. RTE deems the 63 to 150 kV circuits to be “high voltage” and the 225 kV and 400 kV “extra high voltage”.

Presentation on “European electricity market: evolutions and challenges” was given by Mr. Bruno MailH.

Mr. MailH gave a brief introduction of RTE, the transmission and system operator of France. RTE operates system of 500BU wheeling of electricity including cross-border transactions of 95 BU. He gave details of French power system. The power system consists of:

- Generators: 628 power plants of EDF, ENDESA France, Suez -Gaz de France and other generators (co-generation, household waste, wind farms, etc.)
- Distributors: 27 distribution companies, including ERDF (Electricité Réseau Distribution France) which is the major one, and other LDCs (Local ones)
- Industrial sites: 534 sites directly connected to the transmission network.
- Suppliers: With 175 trading or supplying companies, who buy and sell energy on the wholesale market or supply consumers directly, these supply companies are RTE's customers.
  He summarized broad features of European sector which are:

  - ✓ Europe consists of 32 interconnected countries
  - ✓ Current Installed capacity: 850 GW
  - ✓ Consumption: 3,400 TWh/year
  - ✓ Peak Load: 500 GW
  - ✓ Physical exchanges: 400 TWh/year
  - ✓ Population: 500 Million

For bringing of competition in French power market, following implementations were carried out:

- Cross border capacity allocation mechanisms were developed.
- Balancing of market for real time supply demand
- Adjustment and congestion management
- Household half hourly consumption estimation

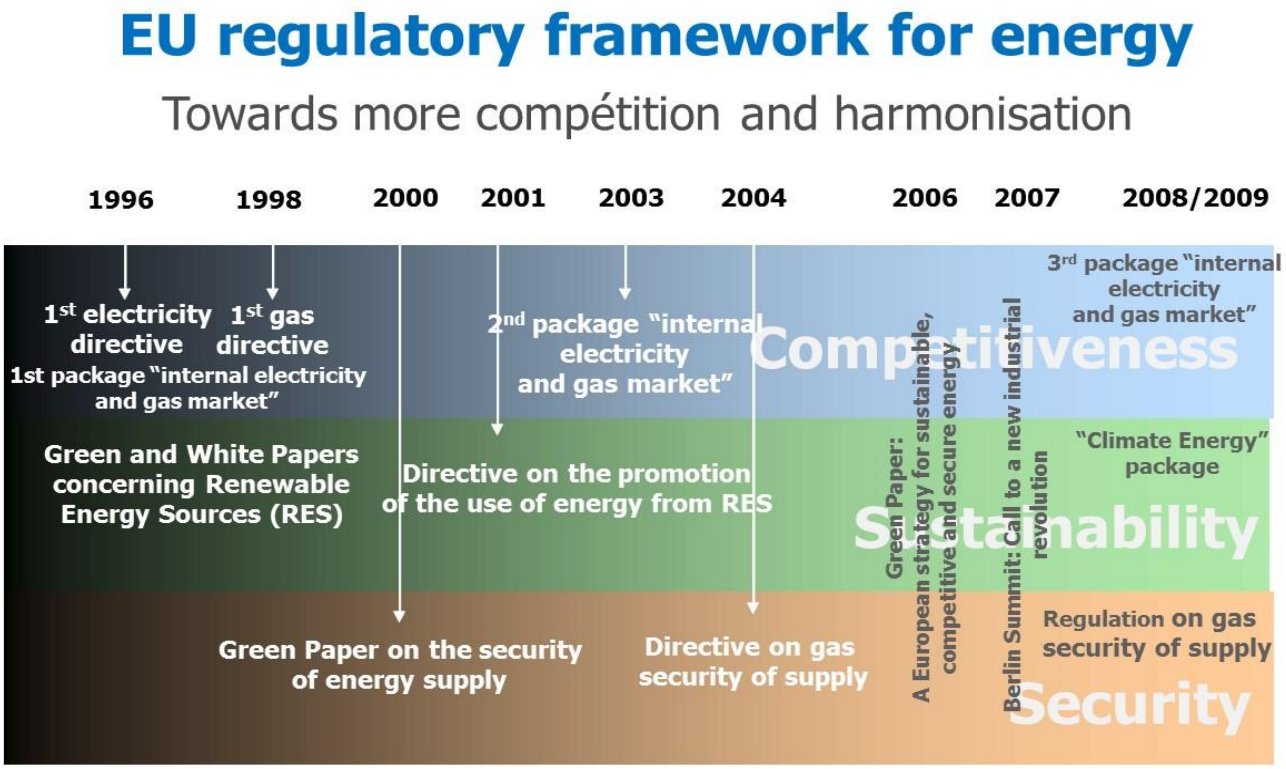
Under the French Electricity Market, he explained the following:

- Hub/Portfolio model: clear separation between the physical dimension and the trading dimension (A widely accepted European standard, open to OTC and exchanges trades)
- Forward, day-ahead and intra-day markets
- RTE handles the physical issues, providing a smooth playing field to the market participants
- The market rules are set up in contracts between the Users and RTE .Market participants are required to sign contracts with RTE for following:

Figure 23 Mr. MailH making his presentation on RTE, European electricity market: evolutions and challenges

- ✓ **Grid Access Contract:** Right to inject/draw physical electricity at connection point
- ✓ **Contract to access to interconnector:** Right to sell/buy across interconnectors
- ✓ **Contract to day-ahead/intra-day scheduling and to balancing market rules-** right to make offers in balancing market
- ✓ **Contract for balancing party: -** Right to merge in a "perimeter" a set of connecting points and contractual delivery subject to imbalance settlement price. Right to exchange energy blocks between balance perimeters.

The balancing market: Mr. MailH explained the concept of Balance Responsible Party (BRP). Imbalance calculation is done for each half hour (30 mins) and for each BRP based on all schedules for injection (including up/down balancing energy). The Balancing Market (BM) enables RTE to activate power reserves of generation plants, in order to restore the system supply demand balance and solve network congestions. It is based on a permanent, transparent and open call for tender process. Balancing offers are submitted by participants at gate closures taking place every hour and they are for upward or downward power flexibility that goes with technical conditions and a price. Generators connected on the transmission network are mandated by royal decree to offer their unused capacity. Consumers eligible to reduce (or increase) their consumption can also offer their capacity. Foreign players with flexibility can also offer to the balancing market through interconnections. Around 40 players participate in balancing market and a balancing volume of 8 TWh (50% upward). Almost 2/3 of the players are from foreign countries (mainly Switzerland and Germany). Presentation on "Electricity markets, cross-border capacity allocation and the role of RTE" was given by Galileo BARBIERI. The presentation explained the need for integration of electricity systems and markets. He also explained about the EU regulatory framework for energy. The evolution of EU regulatory framework for energy is shown below.



He also explained overall market reform in France and mentioned various steps that has been taken for market reform. He said Cross border electricity trade have increased consistently over the years starting with 70BU/year to 400+ BUs in 2012. Energy transition from conventional to renewable energy is also pushing the cross border volumes and its requirement. To meet the EU target and Germany has built of 35.6 GW of Solar PV has also necessitated its integration. For integrating markets, we need i) Hardware and ii) Software: Software includes operational rules, technical management of the system and market design (the rules of the market mechanisms, and the roles and responsibilities of market parties).Rules need to have

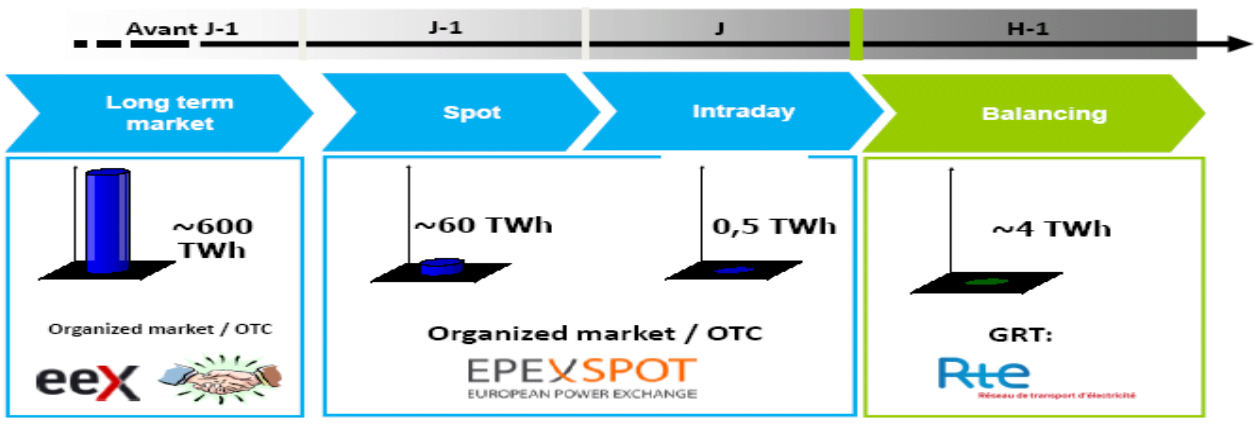
- Efficiency -The rules for the economic optimization
- Flexibility- In order to cope with rapidly changing conditions
- Security- Market rules must be coherent with security

He also explained the concept of BRP which connects physical participants with the market. There are about 150 BRPs in France. BRPs can access cross border market. Cross border transactions are possible either by procuring transmission rights or in day-ahead markets where transmission capacity is allocated through implicit auctions.

Figure 24 Mr. Galileo BARBIERI making his presentations on the "Electricity markets, cross-border capacity allocation and the role of RTE"

He compared OTC market with exchange based market and outlined the benefits of exchanges. Distinct advantages mentioned were: transparency, no counterparty risks and standard products. Due to such perceived benefits, exchanges have emerged all over Europe: EPEXSpot, OMIE, Nordpool Spot, SEMO (Ireland), N2EX & APX (UK), EXAA (Austria), GME (Italy), Opcom (Romania), HUPX (Hungary), PolPX (Poland), PXCentral Europe, Belpex (Belgium) etc. The power markets in France provide both long-term and short-term products. The figure below shows the Exchanged volumes by time frame in France.

Figure Power Exchange volumes by time frame in France



a) **Long term transmission allocation->Explicit Auctions of Physical Transmission Rights (PTRs)**

- Physical Transmission Rights (PTRs) with Use It or Sell It (UIOSI) provision
- Sold by TSOs, through a central allocation platform ((Capacity Allocating Service Company (CASC), Coordinated Auction Office(CAO))
- They give the right to import or export electricity over an interconnection
- Sealed auction, single round
- Settlement at the Marginal price

b) **Implicit Auction:** Implicit Auction favoured for day-ahead markets. The coupling of regions has been achieved through Price Coupling of Regions (PCR). Details are as below:

- PCR project is an initiative of seven PX: **APX, Belpex, EPEX Spot, GME, Nord Pool Spot, OMIE and OTE** covering the electricity markets in Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Italy, Latvia, Lithuania, Luxemburg, the Netherlands, Norway, Poland, Portugal, Spain, Slovenia, Sweden and the UK PCR Organization.
- All PXs are connected to each other through Multiprotocol Label Switching (MPLS) using secure channels.
- Each PXs is connected to the related TSOs for receiving capacity information and sending the required information (nominations, clearing info) as today. This is the responsibility of each particular/regional PX.
- A data sharing solution is created based on the implementation at each PX of a PMB (PCR Matcher Broker) which is responsible of interfacing the PX systems with the rest of the PXs.
- Each PMB is in continuous connection to the other PMBs, access to the internal PX market information, validates it, and publishes it to the PCR Cloud.
- The PCR ensures that each PX runs the same common algorithm (Euphemia) with the same data and the same configuration parameters.
- PCR results are provided by the Coordinator PX. Operator PXs may verify results through a shadow matching for internal and validation purposes.
- Hot Backup Coordinator takes over the operations in case of failure

CORESO (Coordination for Electricity System Operators) is forum for TSOs to handle congestion. CORESO was created on the 19th of December 2008 by RTE and ELIA in order to improve the management of congestions. National Grid (UK) joined CORESO in March 2009. Terna and 50Hertz joined Coreso in November 2010.

- Activity performed for capacity calculation: Creation of a common grid model / common base case for Central West Europe (CWE) for capacity calculation
- Additional activities in real time (24h/24 and 7days/7)

- Real time follows up of constraints on the network and provides some recommendations for congestion management to France and Belgium
- Provide some recommendations to the United Kingdom regarding the congestion management linked to the DC Cable.

CASC.EU (Capacity Allocation Service Company) for the explicit allocation (**http://www.casc.eu/en**).

The creation of CASC-CWE is one of the actions following up a Memorandum of Understanding (MoU) signed by the Ministries, regulators, TSOs, power exchanges and representatives of the market participants of the 5 CWE countries. TSOs, in their role as market facilitators, should facilitate the cross-border congestion management processes towards market actors wherever possible, e. g. by creating a single point of contact, using same IT-tools and aiming for harmonised rules. This should result in common coordinated congestion management methods and a common procedure for the allocation of transmission capacity i.e. the explicit auctioning of transmission capacity. For this they created CASC-CWE. Clearance from the European Commission was obtained on August 14th 2008, thus opening the way for this important leap towards integrating the five electricity markets into a regional electricity market for Central-West Europe.

- Its main objective CASC is to manage the allocation of capacities on borders on behalf of TSOs –Single point of contact for all the Market Participants
- Unique set of Rules for Explicit Allocations on all borders
- Harmonized format of exchanges (ETSO standard – ECAN)
- Since November 10th, 2010, twelve (12) shareholders: Tennet B.V and GmbH, ELIA, RTE, TERNA, IPTO, ELES, APG, Swissgrid Transnet BW, AMPRION and CREOS and in October 2013: Energinet.dk and Statnett become CASC.EU Shareholders.

Site Visit 6: Alstom Grid Overview of Electricity Markets

Speaker: Mr. Eric Goutard

Global S/W Engg. Dir. Alstom

Topics Covered-

1. Introduction
2. ALSTOM Solutions for Electricity Markets
3. Case Studies

OVERVIEW

Alstom Grid

Alstom Grid is one of the power grid companies who design, manufacture, supply and support products and services for power transmission and smart grid technology including software for grid and market operations. Alstom is a global leader in the world of power generation, power transmission and rail infrastructure and sets the benchmark for innovative and environmentally friendly technologies.

Mr. Eric GOUTARD made a presentation about the ALSTOM and overview of electricity markets. He said Alstom's main activities are in Market & Grid Management were explained during the presentation:

Figure 25 Mr. Eric GOUTARD is making his presentation on "Overview of electricity markets"

He said various market Challenges are

- Integrate intermittent renewable energies.
- Maximize energy flows with minimum losses.
- Bringing power to all while preventing outages.
- Smarten existing power equipment across networks worldwide.

He highlighted about the Alstom's Presence in India and some of the key highlights are mentioned below.

- 765 kV AC (EHV) Substation orders awarded to Alstom grid.
- Commissioned 765 kV s/s for PGCIL at Bhiwani in 2012 and commissioned the first fully integrated 765kV transformer at Vadodara.
- India's first 765kV AIS substation project for NTPC Sipat in 2009

- 28 Substation with Alstom Technology: 17 turnkey projects and 11 projects to be equipped with Alstom Grid Products.

Market Design: He gave an overview of the market design across the globe and drew a comparison between US and European Market Design.
The major difference is in US Market Design- Responsibility for Market Operation (least cost solution) and System Operation (Grid Reliability) are under the same organization, where as in European Market Design- Responsibility for Market Operation (least cost solution) and System Operation (Grid Reliability) are under two separate organizations- Power Exchange and TSO. He also highlighted about the various services offered by the Alstom for markets in South Asia and Europe.

Key Lessons Learnt from the study tour:

- **Long-term bilateral contracts**: The process of Cross Border electricity Trade initiated with long term bilateral contracts and setting up of bilateral Cross Border Electricity Trade Transmission Infrastructures.(Presently 32 European countries are interconnected)
- **Strong Political Mandate.** Strong political mandate gave a clear road map at European Union (EU) level which translated in to conducive legal, regulatory and policy framework for Cross Border electricity trade and creation of electricity market.
- **Coordination of regulations and Forum of Regulators.** To ensure effective coordination of regulations, **Agency for Cooperation of Energy Regulators (ACER)** was formed as an EU body in 2010 as forum of National Energy Regulators. The overall mission of **ACER** as stated in its founding regulation is to complement and coordinate the work of national energy regulators at EU level and work towards the completion of the single EU energy market for electricity and natural gas. **No regional regulatory authority/commission**.
- **Bottom up approach**. Market Integration vis-a-vis market couplings were industry pushed, which were subsequently adopted/formalized by EU.
- **Coordinated Power Exchanges:** National power exchanges of EU countries coordinates among each other on a common platform for the purposes of cross border electricity trade transactions. **No regional power exchange.**
- **Coordination among Transmission System Operators (TSO):** To ensure effective coordination among TSO of EU countries, ENTSO-E was established as the association of TSOs by the EU institutions with key legal mandates for coordinated, reliable and secure operations of the interconnected electricity transmission networks, facilitating the cross border network development, enhancing the creation of internal electricity market across the European countries etc.

- **Access to network:** Non Discriminatory open access to network and access to cross border interconnectors has been made completely market based.
- **Role of Government in Building Cross Border Trade Infrastructure:** Push for cross border interconnections, largely supported/funded by the Governments but on purely commercial principles.
- **Market Creations:** EU laws are mandated to allow choice of suppliers to all their consumers. Therefore, vibrant electricity markets evolved within countries. Further liquidity was improved with the establishment of coupling among EU countries. Agencies involved in these markets are: TSOs, Regulatory Authorities and Power Exchanges etc.
- **Access to cross border interconnectors:** Access to cross border interconnectors has been made completely market based. Exclusive rights to cross-border capacities have been abolished by EU. Further most of the long-term contracts have been converted to Contracts for Differences (CfD) in Nordic market.
- **Role of Government in cross border interconnections:** Push for cross border transmission interconnections, largely supported/funded by the Governments but on purely commercial principles.
- **Transmission system operators :** Need to have very strong and effective transmission system operators (in EU it develops the overall market design and takes care of balancing)
- **Renewable Integration:** The Directive 2009/28/EC of the European Parliament establishes a common framework for the use of the energy from renewable sources in order to limit the greenhouse gas emissions and to promote a cleaner transport through the definition of National Action Plan.
- **The 2030 policy framework**: The framework for climate and energy as proposed by the European Commission aims to make the European Union's economy and energy system more competitive, secure and sustainable. A centre piece of the framework is the target to reduce EU domestic greenhouse gas emissions by 40% below the 1990 level by 2030. Increasing the share of renewable energy to at least 27%. The EU Commission proposes of an increasing the share of renewable energy to at least 27% of the EU's energy consumption by 2030.
- **Promotion of Renewable Energy:** To promote renewable energy, there are two main support systems are in place in EU 1) Feed-in tariff : fixed price for fixed term (Germany, France, Spain, Netherlands and other) and 2) a Market based certificate mechanism (7 countries: UK, BE, IT, SE, NO, PL, RO).

- **limiting feed-in tariffs :** There is increasing trend of limiting feed-in tariffs for certain number of years (about 12 years) or limiting percentage IRR to certain extent (about 8%). Currently renewable generators are being forced to sell power in the spot market, so that, it can be scheduled and TSOs can manage intermittency through systematic dispatch processes. Spain, Germany, UK, Denmark have been pushing renewables to sell in the spot market (PXs).
- **Electricity futures market**: There is no long term market for sale of electricity beyond 5 years in almost all European countries. The price is being hedged by generators and suppliers (DISCOMs) through futures market. The vibrant futures market is key in reducing cost of entry for hedging against price risks. Futures market of electricity, are being regulated by financial regulators and spot markets are being regulated by electricity regulators.
- **Balancing market:** Imbalance created at the country level is being managed by respective TSOs through liquid balancing market. The TSOs collect bids from generators and suppliers (demand response) for both up and down regulations. The TSO trigger the offers received from the market in the merit order of stack as and when imbalance is observed. All generators with unutilized capacity are mandated to offer their generation in the balancing market. The cost of managing imbalances (settlements) is borne by the causer of imbalance.
- **Voluntary market for RECs:** Guarantee of Origin (GoO) is the instrument created to trace the origin of RE generation and these are converted into certificates and sold in the exchange/OTC markets.

Schematic Diagram of Overall Institutional Governing Framework in Europe (Netherland and France)

Country level

European level

Policy

European Union I European Parliament I European Commission

- Top body to decide all matters pertaining to free flow of all goods (including electricity) among Member states.
- Security of electricity supply, rules for internal electricity market, inter transmission system operator, Transmission pricing compensation mechanism, access to the network for cross border trade, integration and promotion of Renewable energy

Regulator

CRE (France), ACM (Netherlands)

- Independent body responsible for regulating the Electricity Market
- Guaranteeing right of access to network
- Ensuring independence of SOs
- Contribute to building European Internal Market for Electricity and Gas

Agency for Cooperation of Energy Regulators (ACER)
Electricity Regulators Forum-Florence

- **ACER**: Established in 2010 IEU Regulations (EC/713/2009)
- Complement and Coordinate the work of national energy regulators at EU level and work towards the completion of the single EU energy market for electricity and natural gas.
- **ERF:** Established in 1998
- Meet and Discuss creation on Internal energy market
- Participation from TSOs, National regulators, PX, member State, EU, trader, consumer etc.

Generator

EDF (France)
RWE AG, Vattenfall, GDF Suez (Netherlands)

DISCOM

ERDF (France)Alliander, Enexis (Netherlands)

TSO

RTE (France)Tennet (Netherlands)

RTE in France: responsible for operation& development of HV trans. system.TenneT (TSO for Netherland), responsible for overseeing 380 and 220 kV grid in NL and interconnections with neighbors

European Network of Transmission and System Operators for Electricity (ENTSOE-E)

- Established in 2009 under EU mandate
- 41 TSO from 34 European Countries
- **Key Objectives:** Completion of Internal Energy Market I Integration of Renewable I Focal point for all technical and market related matter

PX

EPEX SPOT, APX

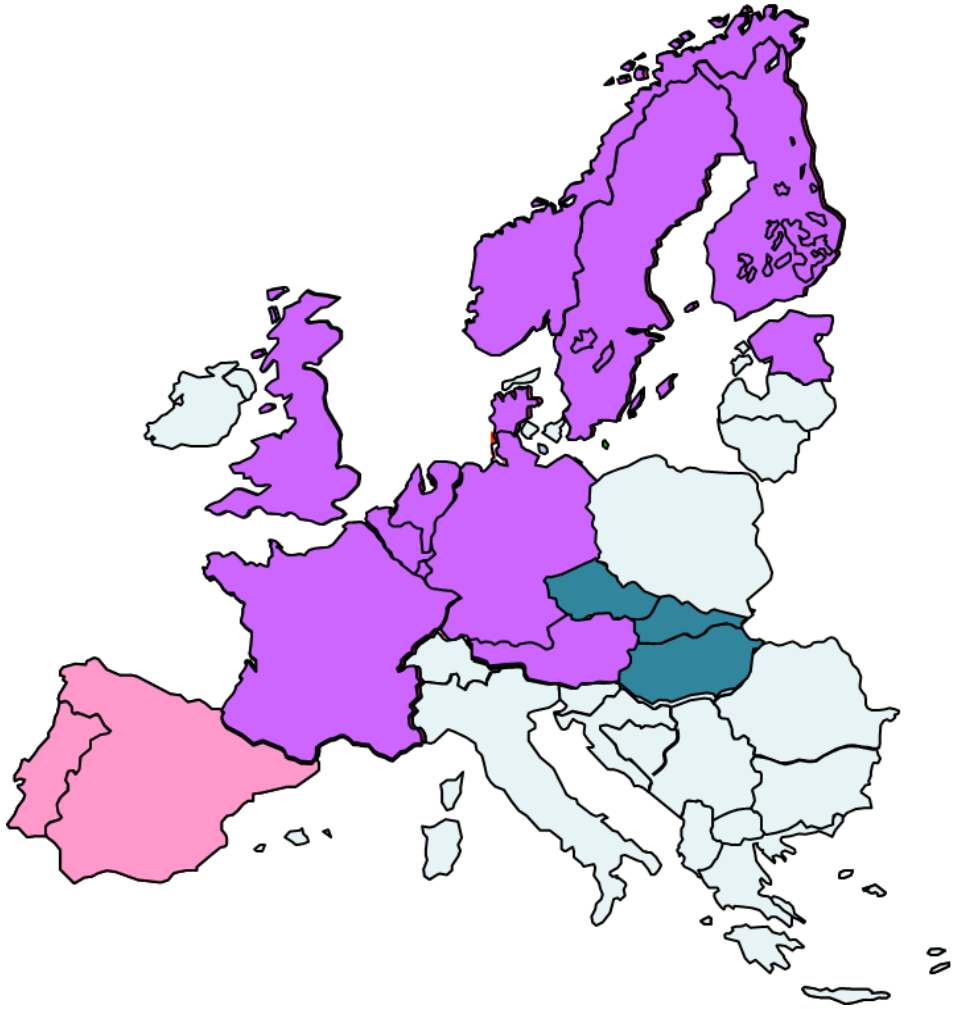
Power Exchanges in Paris and NL, operate day-ahead, futures and balancing market

PCR Coupling of NE (EuroPEX)

Integration of 7 PXs with a single price coupling solution for calculating prices across EU and allocate cross border capacity on a day-ahead basis.

Figure 26 Status of European Market Coupling until Feb, 2015

European Market Coupling until february 2014



(1) Nordic Coupling (splitting) - 1993

(2) Trilateral coupling France, Belgium, Netherlands - 2006

(3) Iberic coupling, Spain and Portugal - 2007

(4) Partial coupling between Germany and nordic countries – 2009

(5) Coupling CWE – Nordic - 2010

Estonia - Finland via Estlink

(6) Coupling Hungary – Czech Republic - Slovak- 2012

(7) Nord-West Europe Coupling – begin 2014

Figure 27 Evolution of Market Coupling in EU

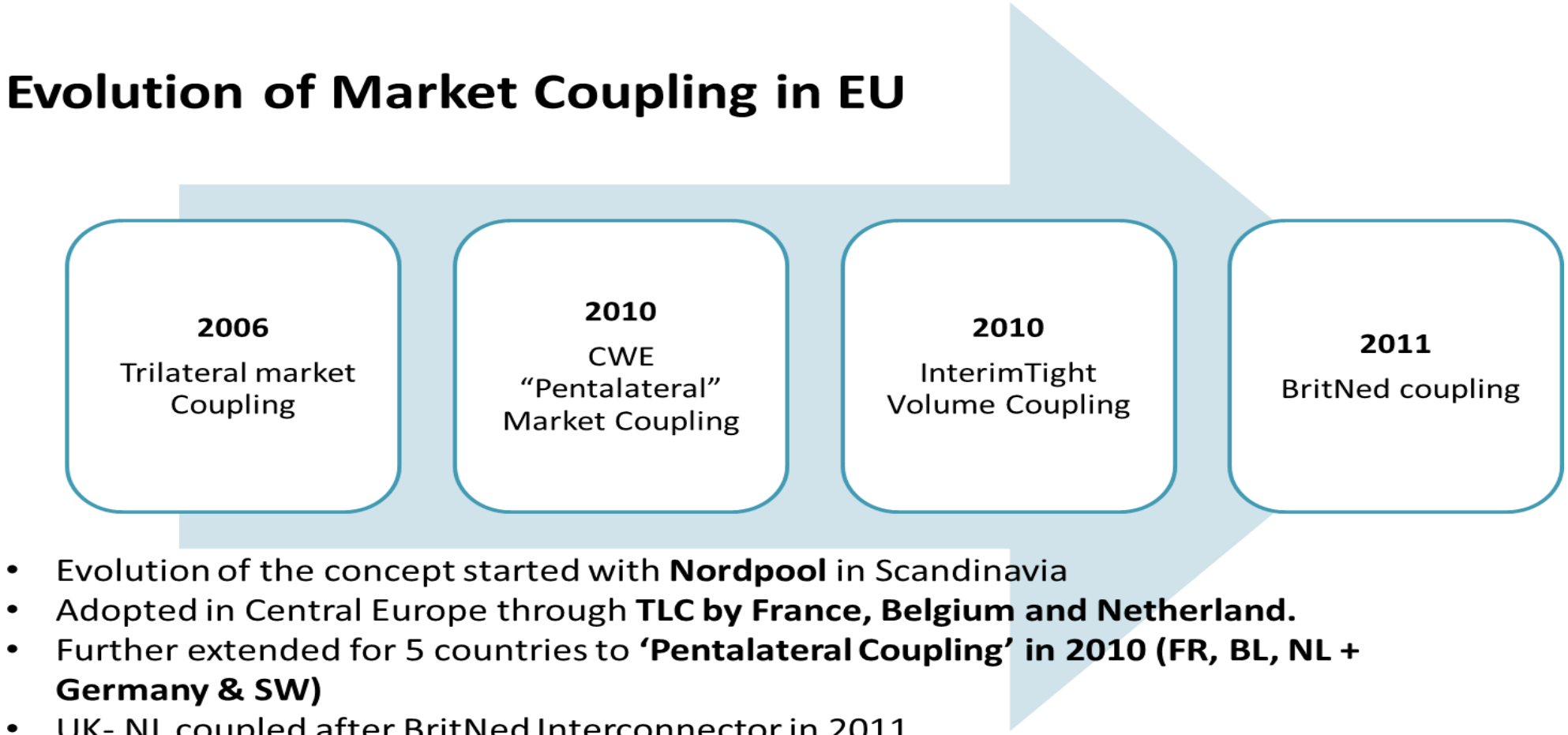


Figure 28 Market Coupling Timeline in EU

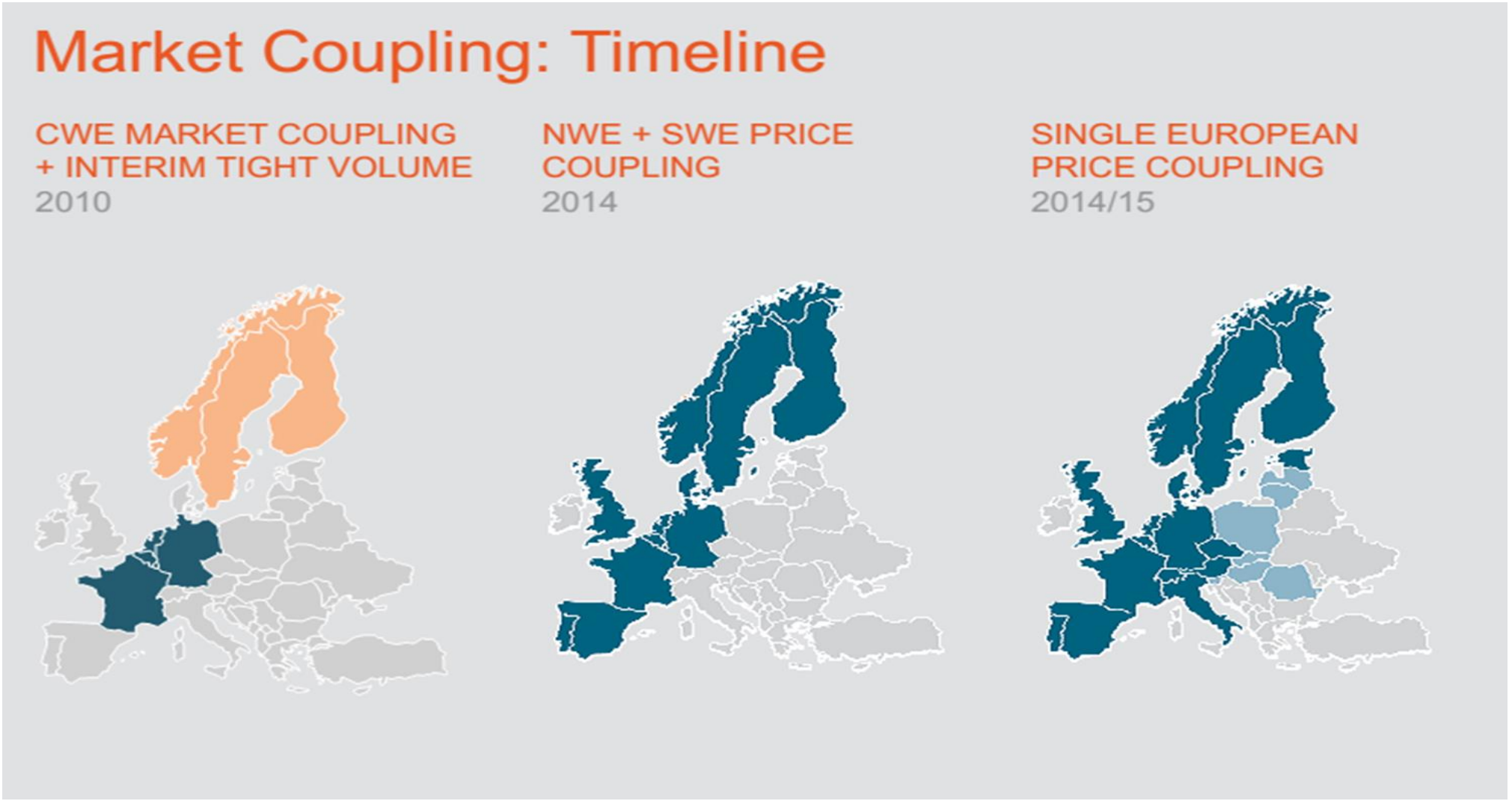


Figure 29 Current Market Volume through Coupling in Europe and its Comparison with India.

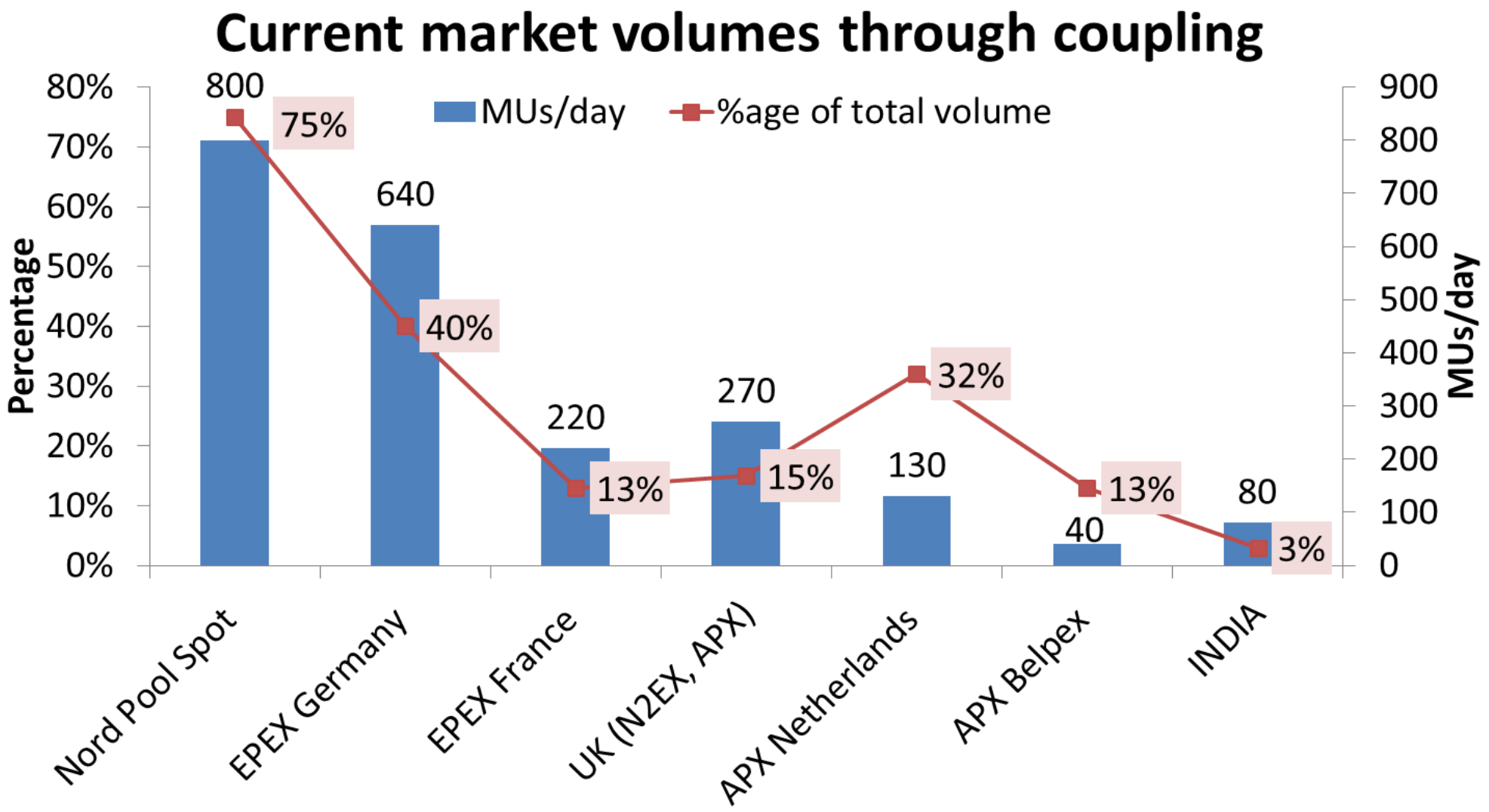
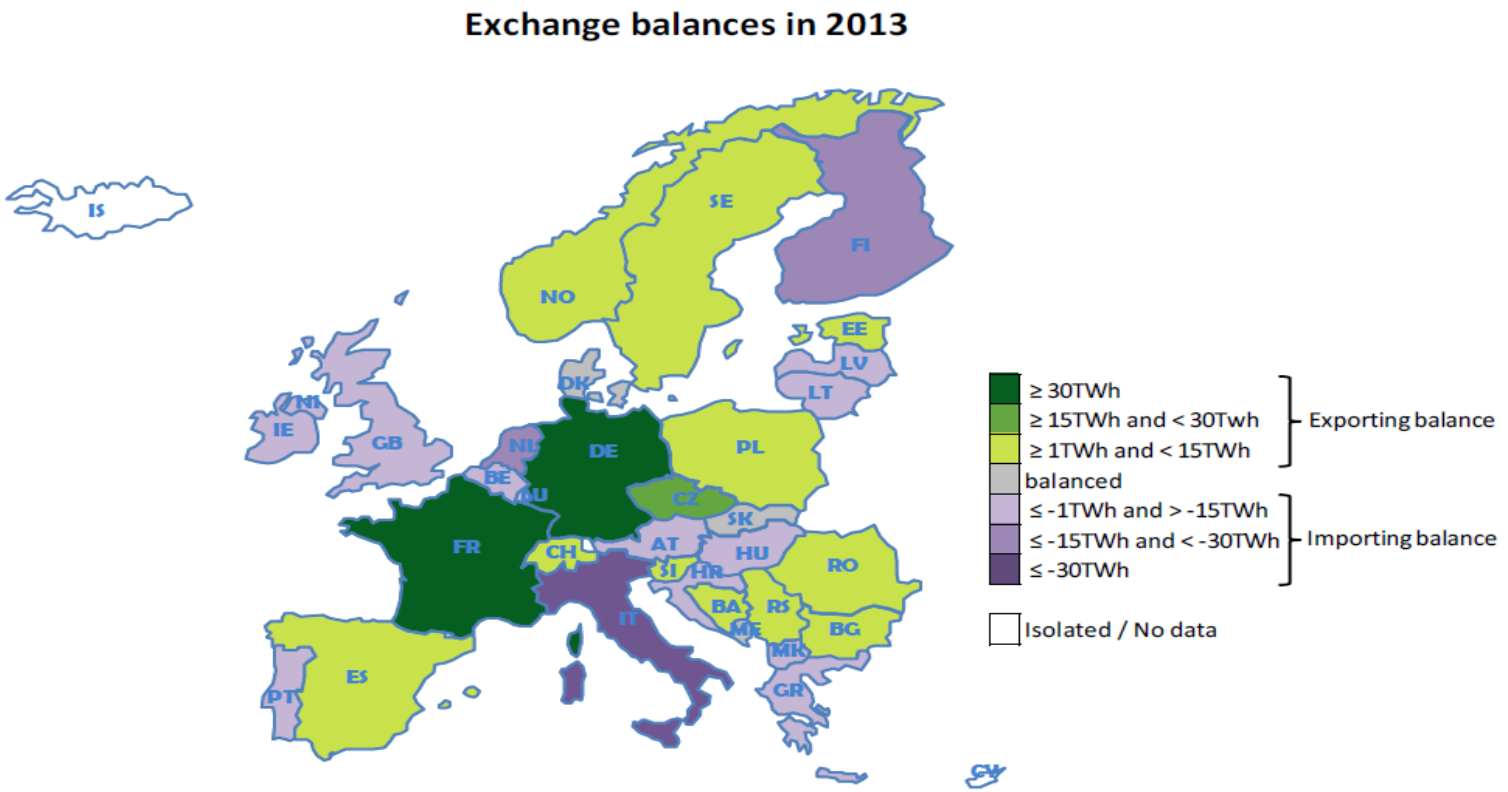


Figure 30 Europe Exchange Balances in 2013



Balance of exchanges is the balance between energy physically flowing out of the country and energy physically flowing in. It is also equal to the balance of commercial transactions of each country (exports minus imports). Yet, in an interconnected system where electricity may spread out through various paths, energy physically flowing through a specific border between two countries usually differs from the commercial transactions between these two countries.

Figure 31 Evolution of Exchanges Balances between 2012 and 2013

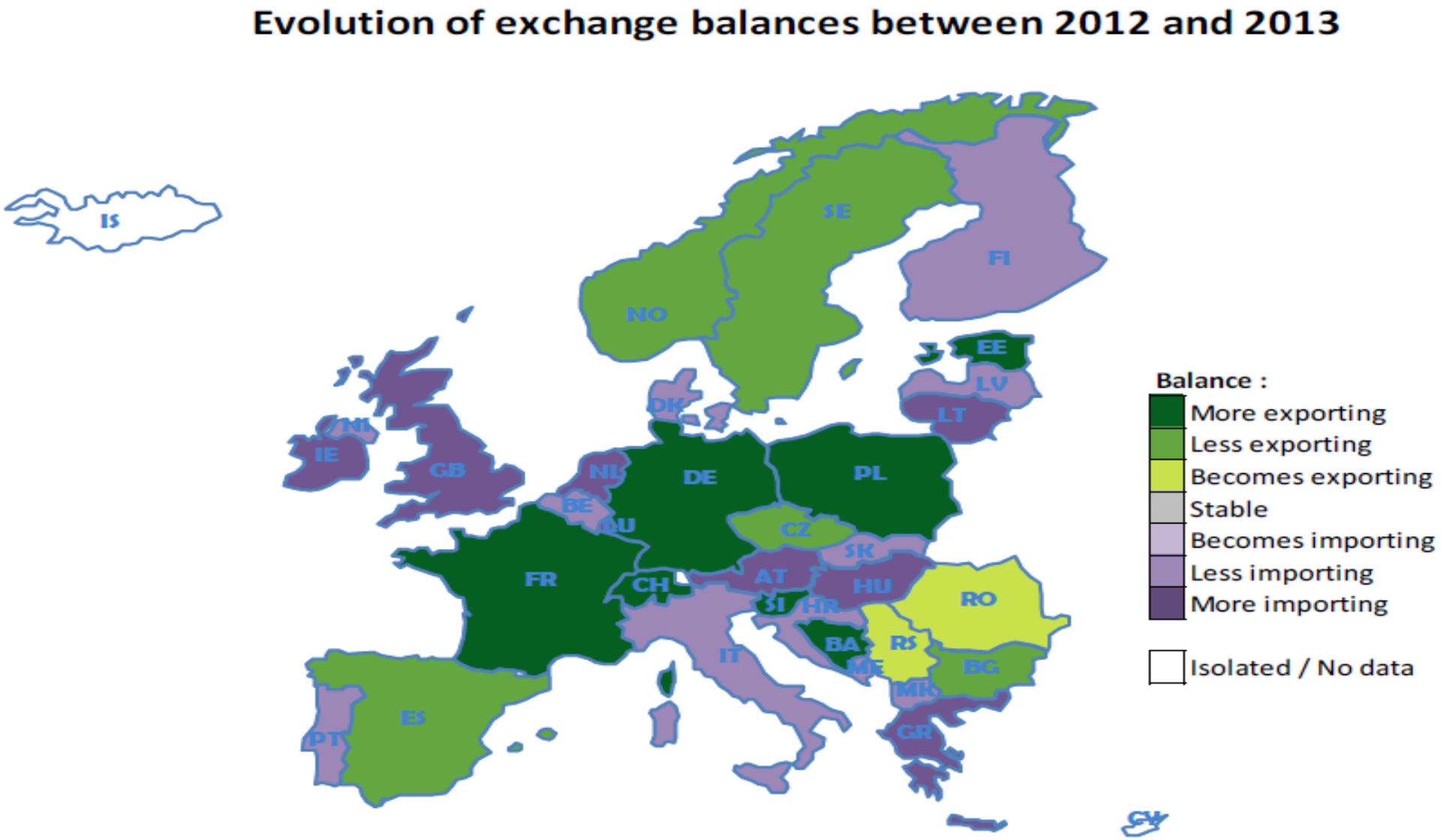
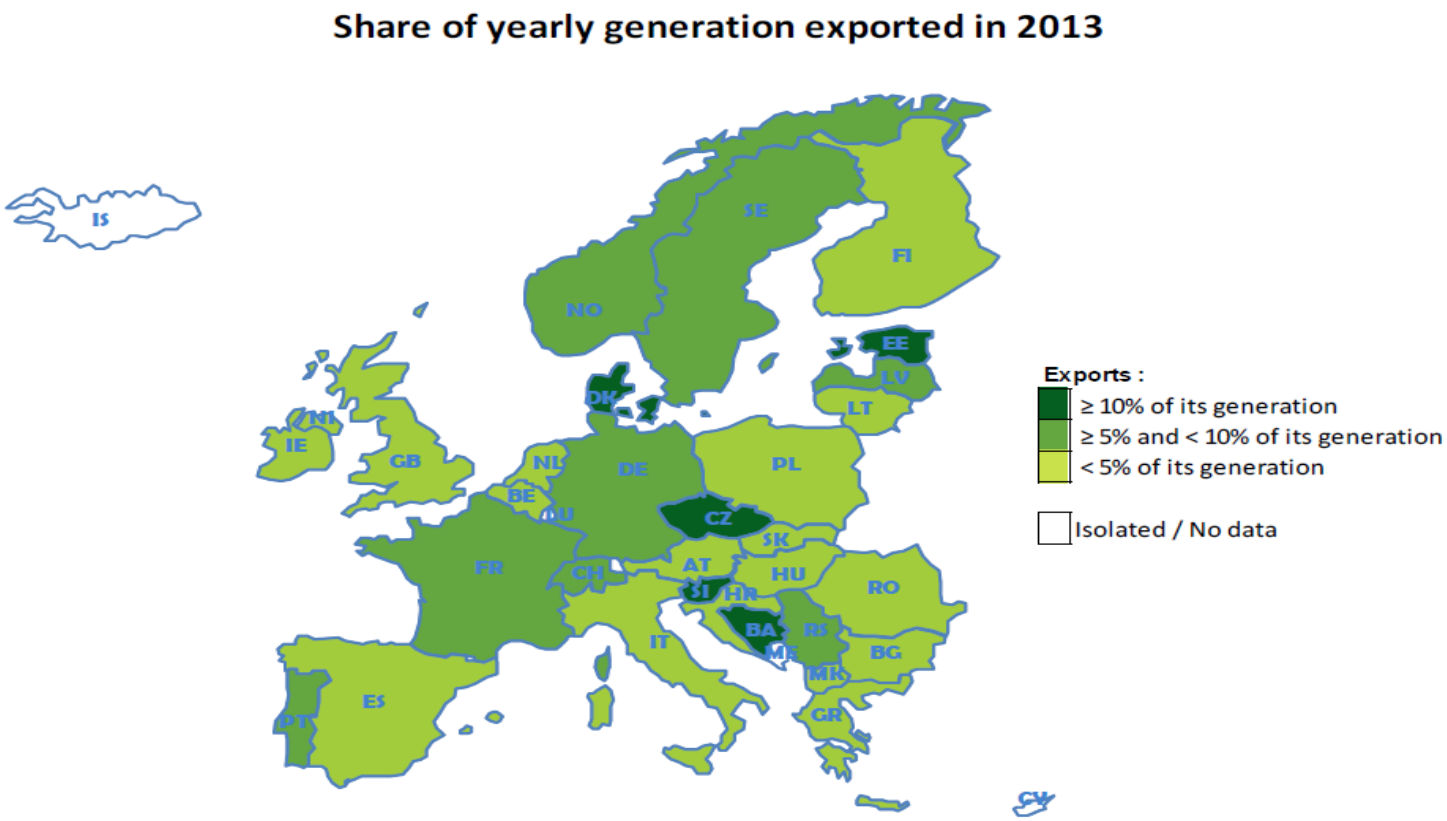


Figure 32 Share of yearly generation exported in 2013 of EU countries



On each hourly time slot, the balance of exchanges of a country may be positive or negative. Adding these balances separately gives the amount of net exports and the amount of net imports of the country respectively. The ratio between net exports and generation of the country represents the share of its yearly generation which is physically exported to its neighbours. It reveals the use of the ENTSO-E interconnected network for the purpose of economic exports, without taking into account physical loop flows and transit-flows.

Figure 33Maxium Hourly Generation of exported in 2013 of EU countries.

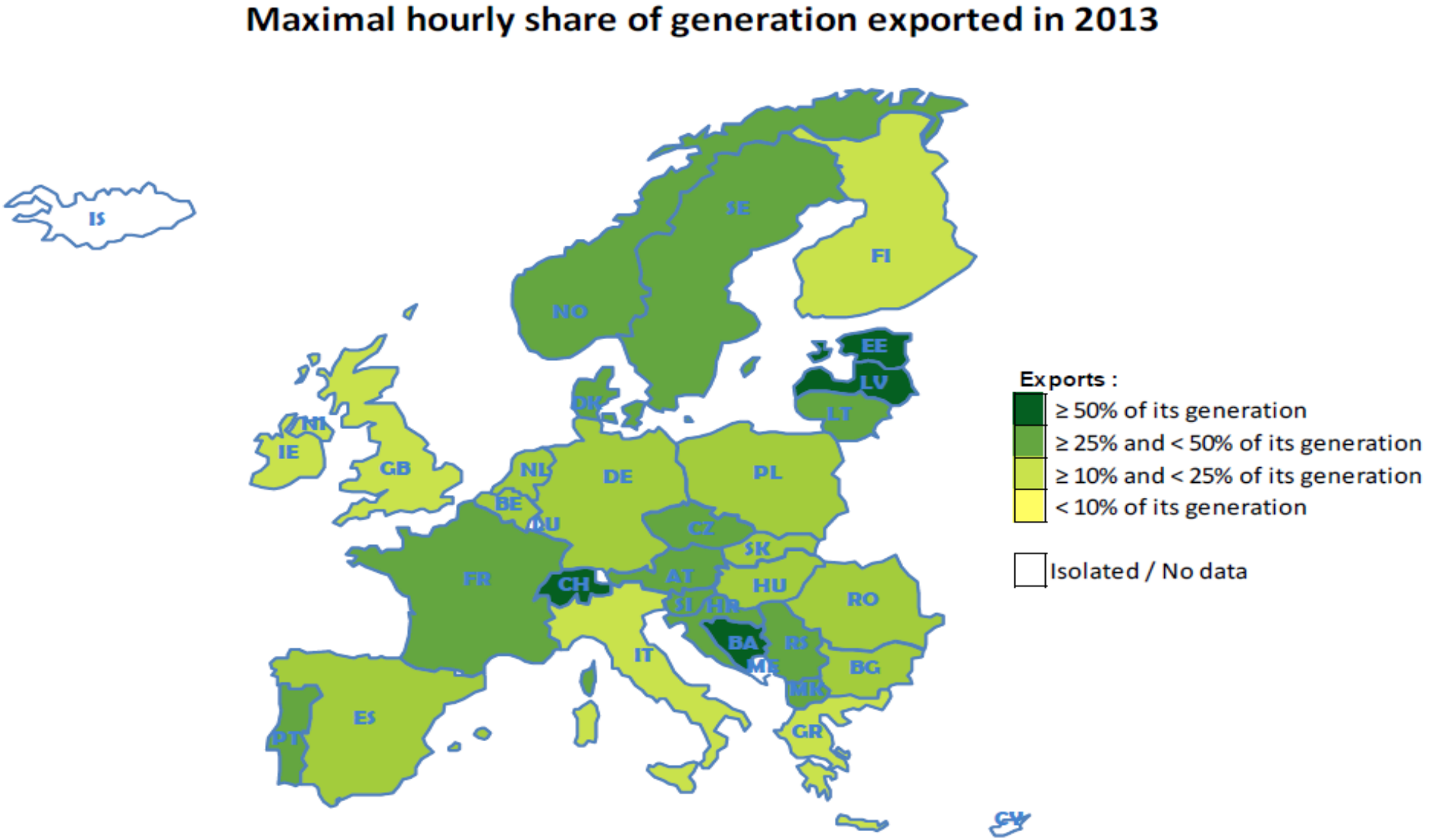
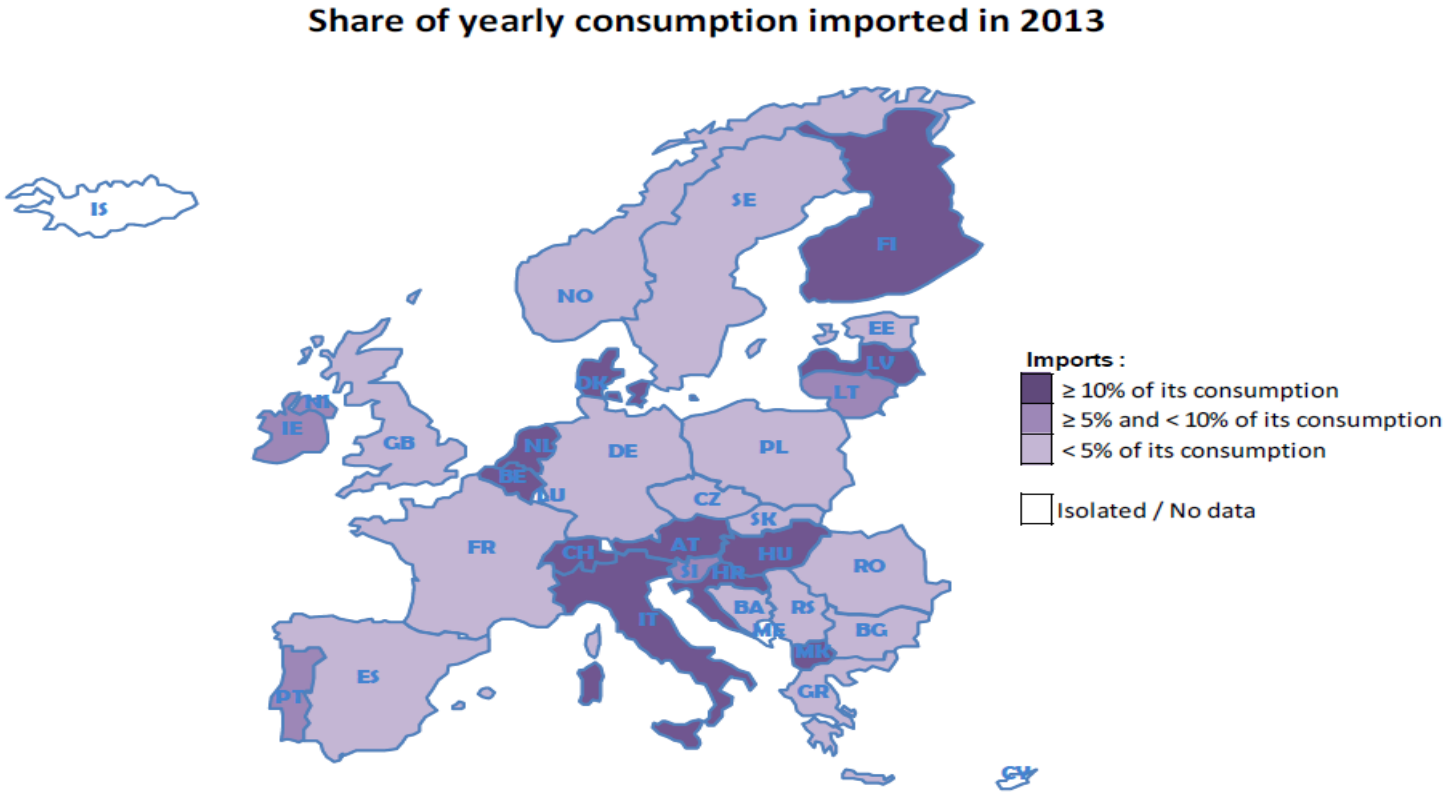
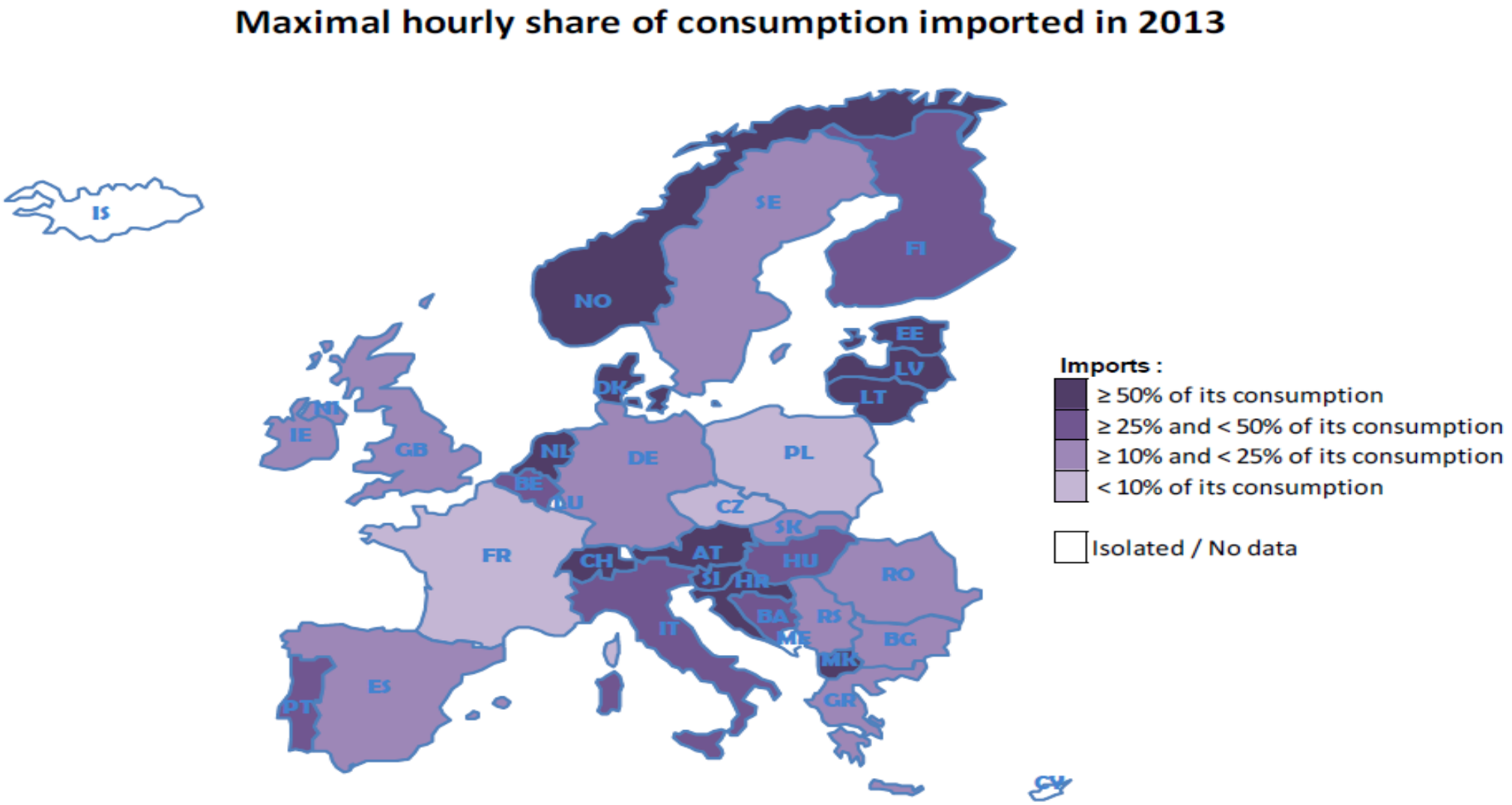


Figure 34 Share of Yearly Consumption imported in 2013 of EU countries



The ratio between net imports and consumption of the country represents the share of its yearly consumption which is physically imported from its neighbours. It reveals the use of the ENTSO-E interconnected network for the purpose of economic imports, without taking into account physical loop flows and transit-flows.

Figure 35 Maximum Hourly Share of Consumption Imported in 2013 of EU countries.



ABOUT SOUTH ASIA REGIONAL INITIATIVE/ENERGY INTEGRATION:

Over the last two decades South Asia has been one of the fastest growing regions in the world, with an average annual growth rate of 6% as measured by GDP per capita. Yet despite this impressive macroeconomic growth, the energy sector in the region has not been able to keep pace, and continues to experience chronic problems of shortage of supply and poor quality of service. South Asia's energy security dilemma is one of the signal energy development challenges of the 21st century critical to the economic future of almost 1.5 billion people and the political future of one of the world's most volatile regions. Given this dilemma the only long-term solution is the sustained increase in regional energy cooperation among South Asian nations. South Asia Regional Initiative/Energy's (SARI/E) role over the past decade in advocating energy cooperation in South Asia has transited to the next phase of advancing regional energy integration and Cross-Border Energy Trade in eight South Asian Countries (Afghanistan, Bangladesh, Bhutan, India, Pakistan, Nepal, Sri Lanka & Maldives). This new phase titled South Asia Regional Initiative for Energy Integration (SARI/EI) is designed to build upon SARI/Energy's successful initiatives of the past to move South Asian countries towards increased regional energy security. The program will address policy, legal, and regulatory issues related to energy in the region; promote transmissions interconnections; and work towards establishing a regional market exchange for electricity.

Integrated Research and Action for Development (IRADe) through a competitive process was selected by U.S. Agency for International Development (USAID) for the implementation of the South Asia Regional Initiative for Energy Integration (SARI/EI) program. During this five year program (2012-2017), SARI/EI programme will work to promote integration of energy systems and enhance Cross-Border Energy Trade (CBET) among the participating South Asian countries.

PROGRAM MESSAGE:

The main message of the program is to "Promote integration of Energy Systems and enhance Cross-Border Energy Trade (CBET) among the South Asian countries by focusing on the following three development outcomes for overall socio-economic development of the region:

1. Harmonize Policy, Legal and Regulatory Issues:

The key result of the Harmonization of Policy, Legal and Regulatory Issues component is to create the enabling systemic conditions for a sustainable market for investment and implementation of Cross-Border Energy Trade.

2. Advance Transmission System Interconnections:

The key result of the Advancement of Transmission System Interconnections component is to create the enabling, systemic conditions for a sustainable market for investment and implementation of sub-regional bilateral transmission interconnections beginning with the eastern sub-region of South Asia.

3. Establishment of South Asia Regional Electricity Markets:

The key result of this component on Establishment of South Asia Regional Energy Market is to create the enabling and systemic conditions for a sustainable market for energy trading and exchange among the South Asian countries.

The overarching objective of the South Asia Regional Initiative for Energy Integration (SARI/EI) program is to develop a common template for technical and commercial aspects of power exchange among the South Asian countries. It intends to create the right enabling environment to support the establishment of a South Asian electricity market, gain consensus and support from the key decision makers and stakeholders in the South Asia region.

Organizers

US Agency for International Development (USAID):

The US Agency for International Development (USAID) is an independent government agency that provides economic, development, and humanitarian assistance around the world in support of the foreign policy goals of the United States. USAID's mission is to advance broad-based economic growth, democracy, and human progress in developing countries and emerging economies. To do so, it is partnering with governments and other actors, making innovative use of science, technology, and human capital to bring the most profound results to a greatest number of people.

Integrated Research and Action for Development (IRADe):

IRADe is a fully autonomous advanced research institute, which aims to conduct research and policy analysis and connect various stakeholders including government, on-governmental organizations (NGOs), corporations, and academic and financial institutions. Its research covers many areas such as energy and power systems, urban development, climate change and environment, poverty alleviation and gender, food security and agriculture, as well as the policies that affect these areas.

INDIAN ENERGY EXCHANGE (IEX):

INDIAN ENERGY EXCHANGE LTD. (IEX) is India's premier power trading platform. Providing a transparent, neutral, demutualized and automated platform for physical delivery of electricity and Renewable Energy Certificates (REC), IEX enables efficient price discovery and price risk management for participants of the Electricity and REC market. IEX have the requisite expertise, in relation to organizing the study tour, as it is regularly organizing study tours on Regional Power Markets. IEX is playing and key role in setting up the common market for trading power among SAARC nations.

Photographs from the Study Tour: