

October 24, 2013
Nordic Green Japan 2013

FUJITSU

shaping tomorrow with you

Power of Network and Market for Green Growth

– Learning from Nordic Experiences –

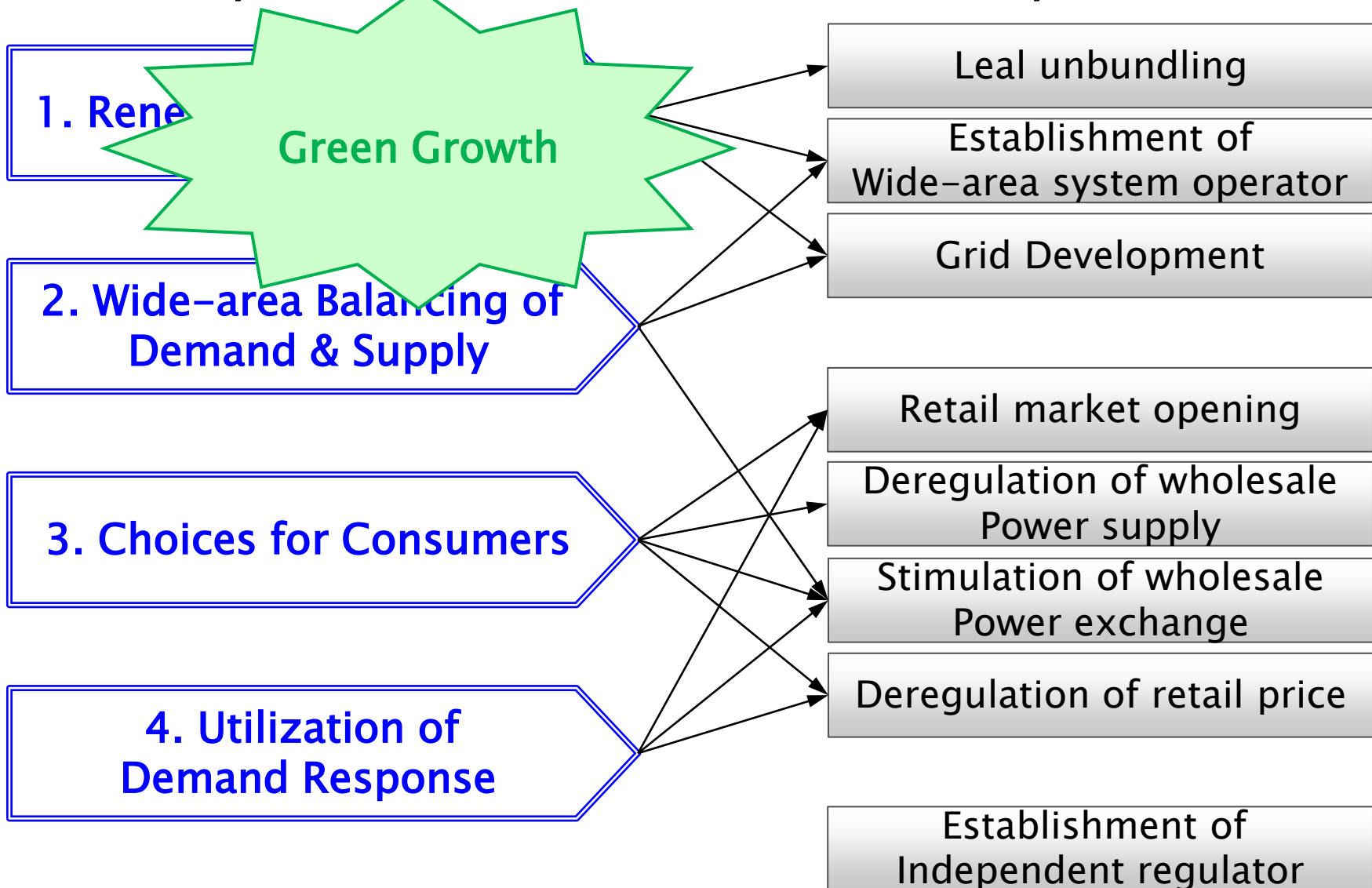
Hiroshi TAKAHASHI, Ph.D.
Research Fellow, Fujitsu Research Institute

1. Japan's EMR and Renewable Energy

Purposes of Japan's EMR

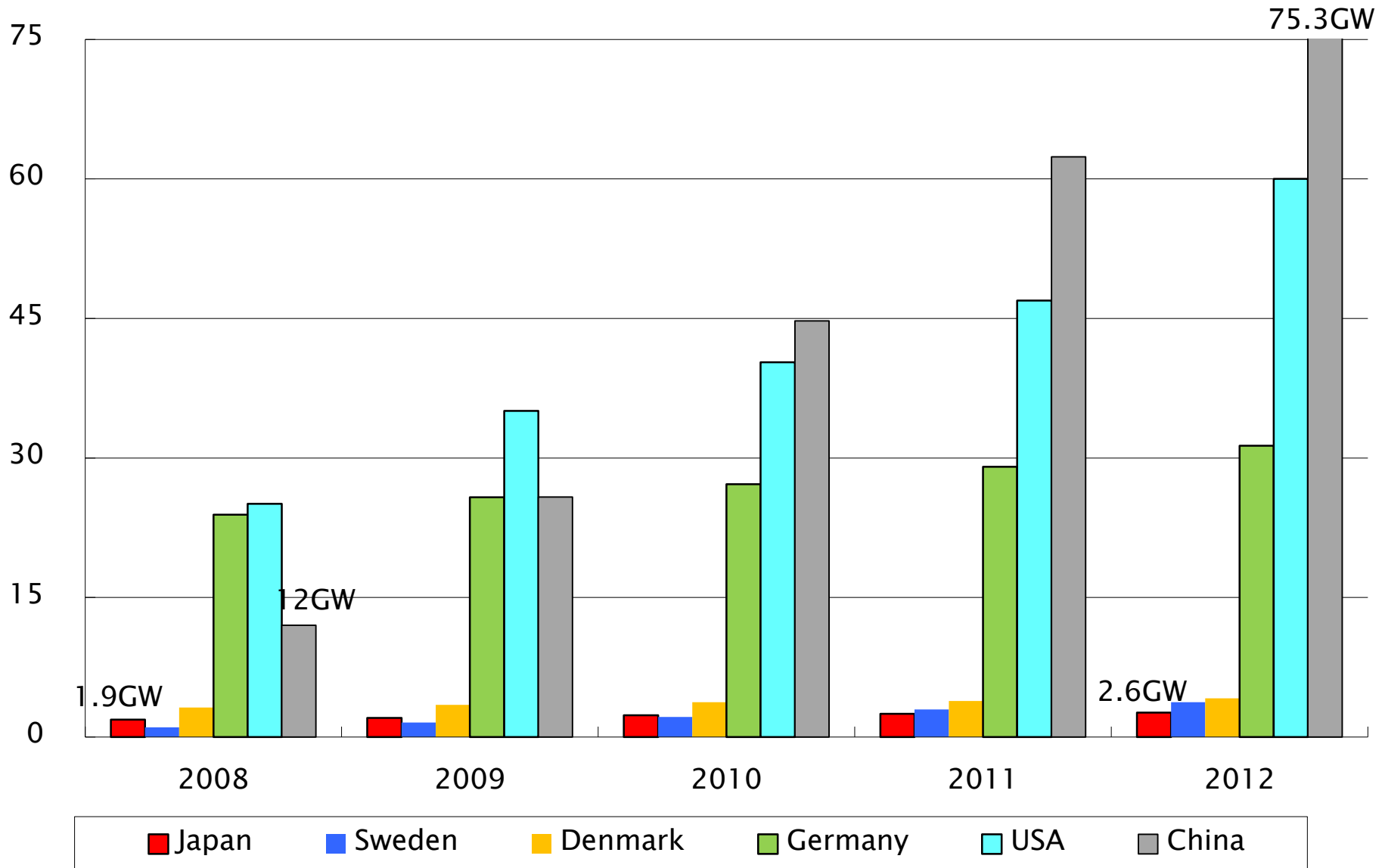
Necessity after 3.11

Policy Measures



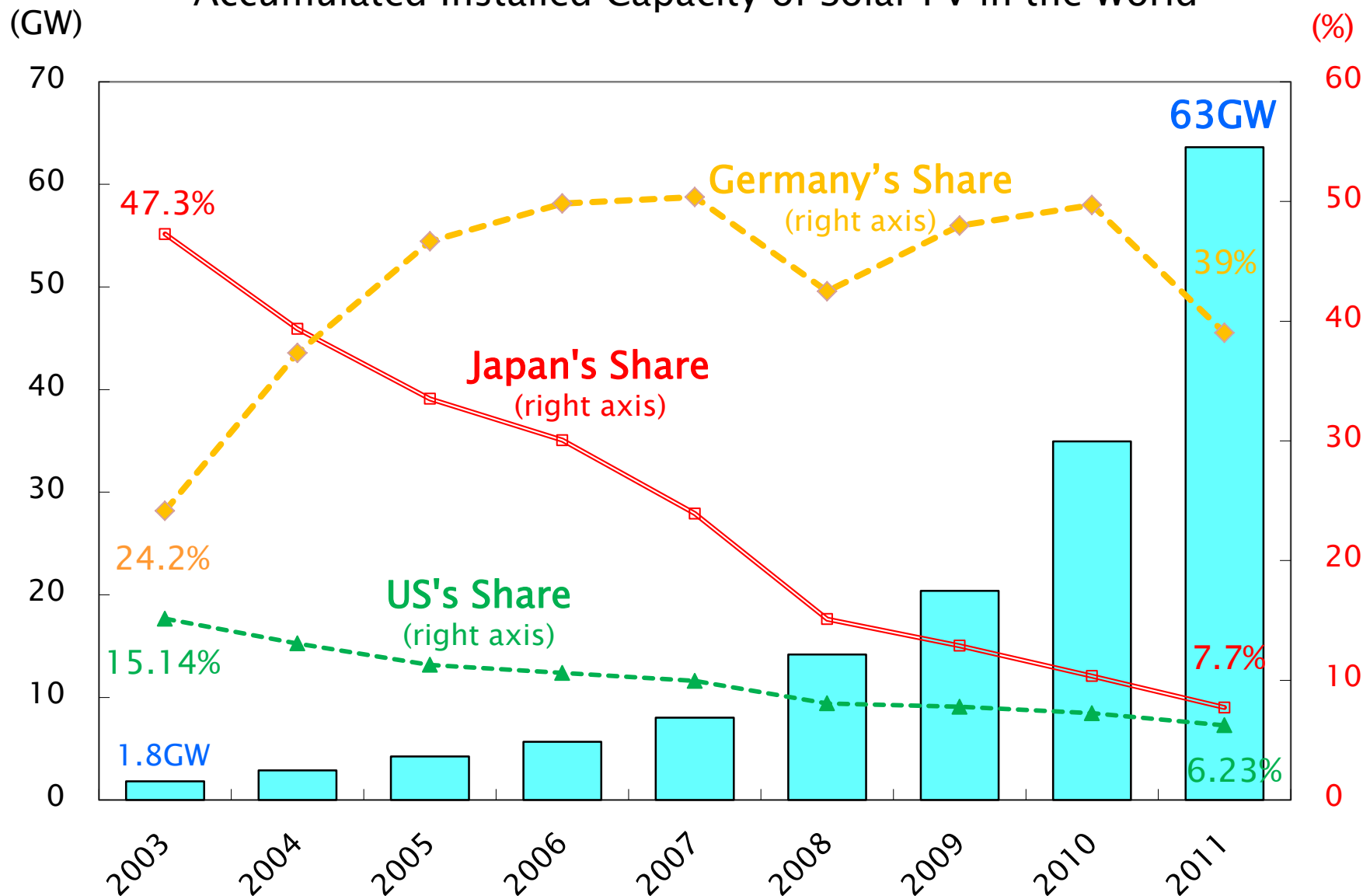
Limited Deployment of Wind Power FUJITSU

(GW) – Accumulated Installed Capacity of Wind Power in major Countries –



Limited Deployment of Solar PV

- Accumulated Installed Capacity of Solar PV in the World -



“Policy Failures” on Renewables

Obstacles to Deploy Renewables

Reactions by Other Countries

Japan

1. High Cost of Generation	<ul style="list-style-type: none"> - Feed-in Tariff - Subsidies 	<ul style="list-style-type: none"> ○ (2012) △
2. Regulation/Local Opposition on Location	<ul style="list-style-type: none"> - Regulatory Reform - Simpler Transaction - Government's Intermediation 	<ul style="list-style-type: none"> △ × ×
3. Fair Grid Access	<div style="border: 2px dashed red; padding: 10px;"> <ul style="list-style-type: none"> - Grid Unbundling - Priority Access (FIT) <p style="text-align: center;">Electricity Market Reform</p> <ul style="list-style-type: none"> - Wide-area Grid Operation - Pumped Storage Hydro - Smart Grid/DR/Battery </div>	<ul style="list-style-type: none"> × △ (2012)
4. Grid Instability due to Intermittent Output		<ul style="list-style-type: none"> × △ (for Nukes) △

2. Nordic EMR : Power Pool and International Transmission Networks

History of Nordic EMR

NORWAY :

- Regional Monopoly
- Vertical integration : Statskraftverkene

1991

- Energy Act : Market liberalization

1992

- ownership unbundling : **Statnett**  **Statkraft**

1993

- established domestic power exchange : Statnett Marked

1996

SWEDEN :

- joined Norwegian power exchange to create Nord Pool

1998

FINLAND :

- joined Nord Pool



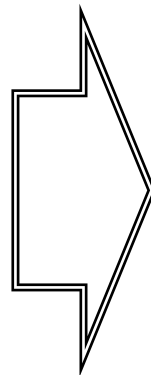
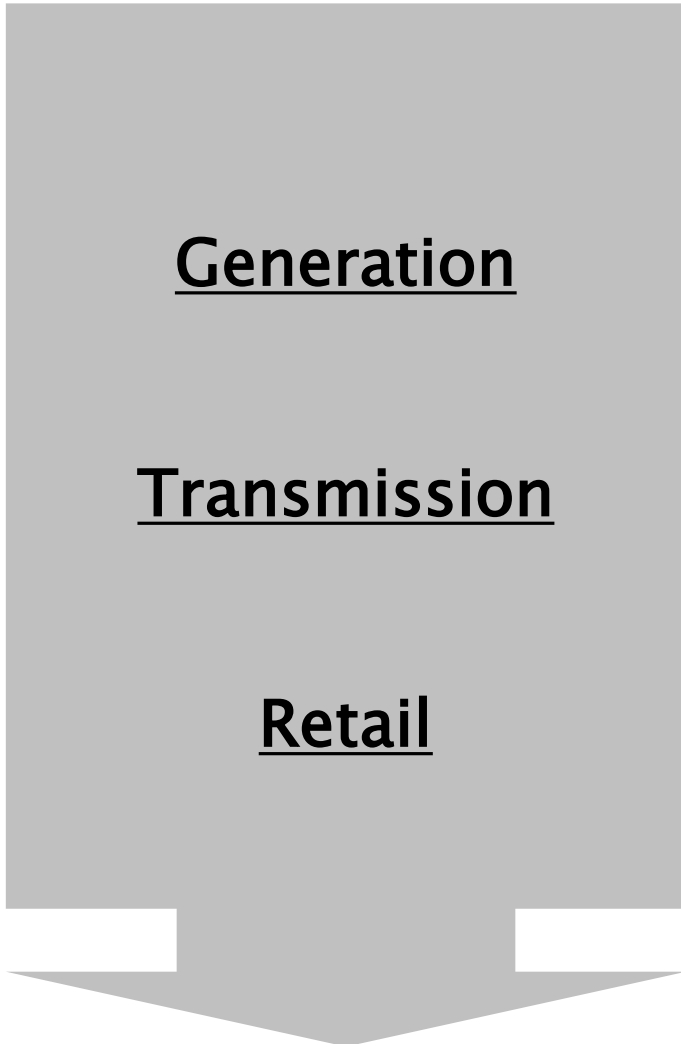
2000

DENMARK :

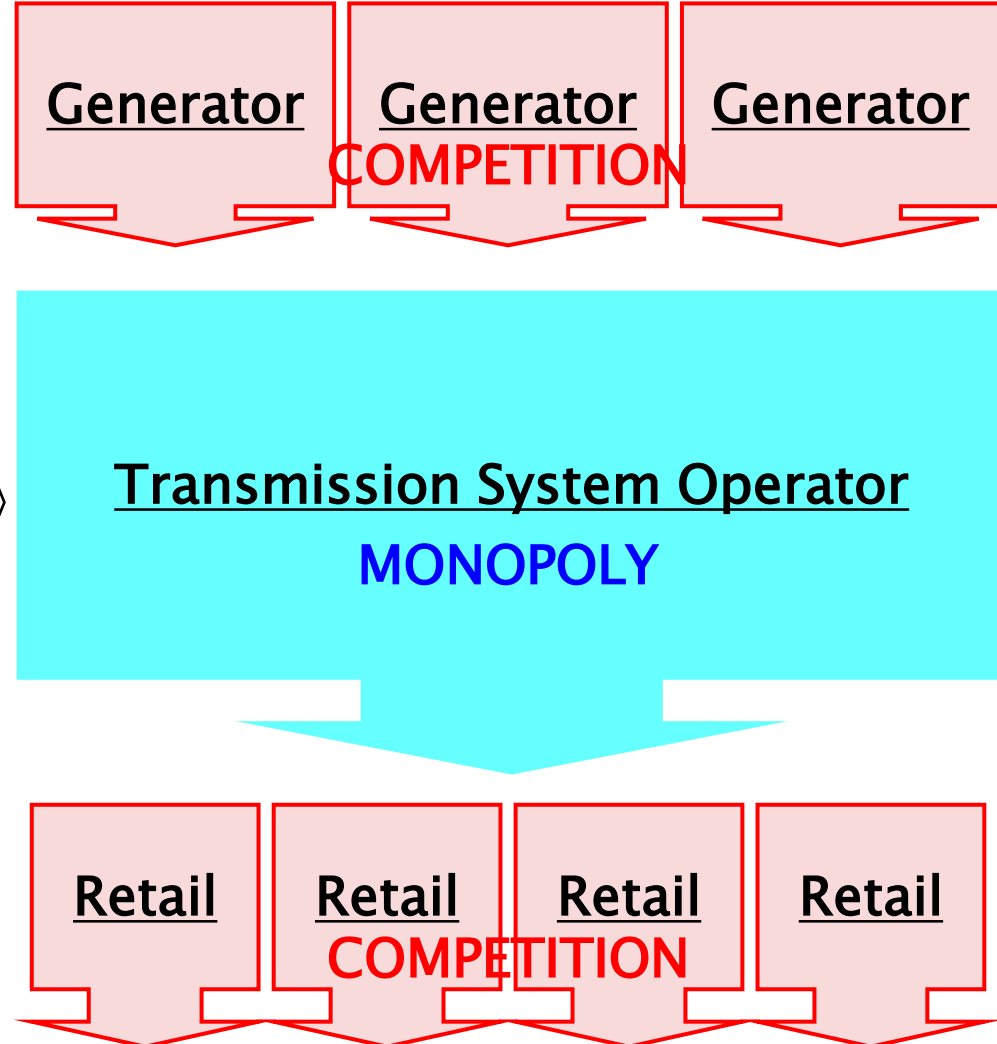
- joined Nord Pool

Horizontal Separation by Unbundling FUJITSU

Vertical Integration

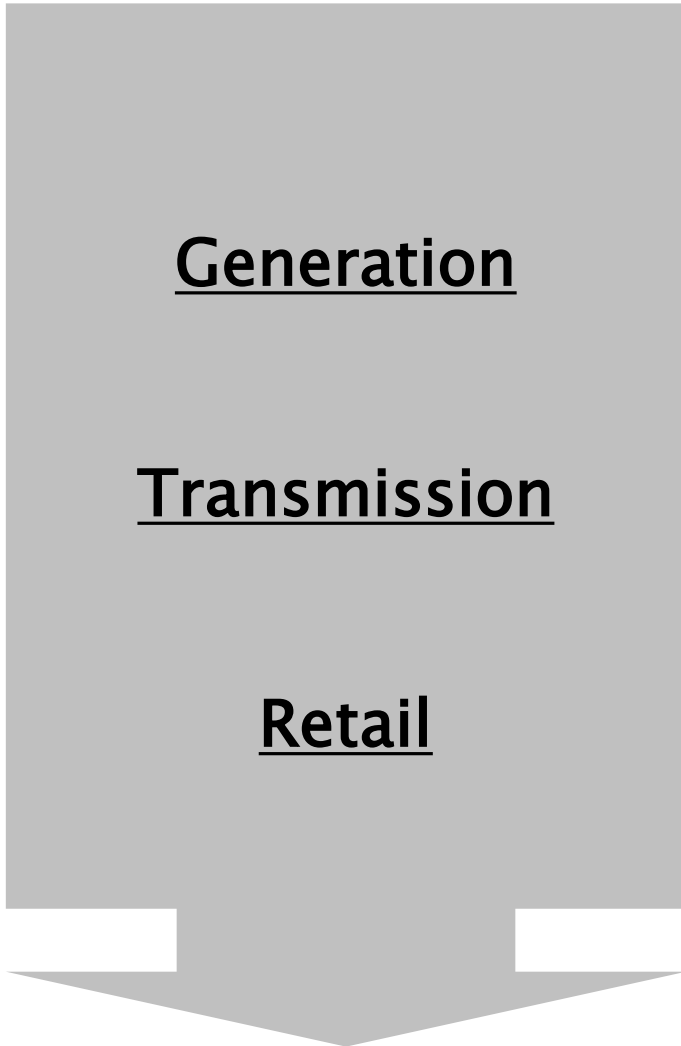


Grid Unbundling

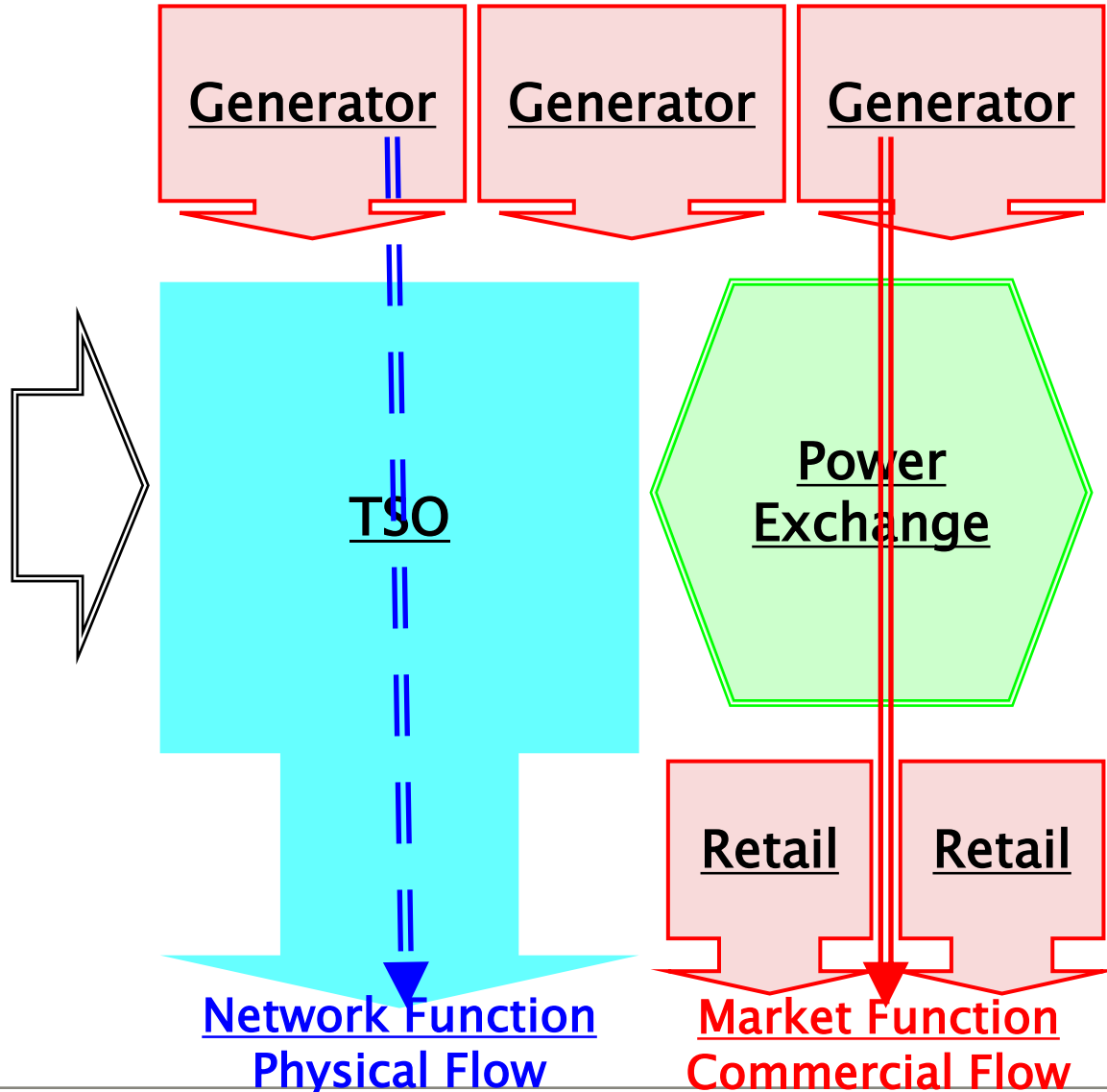


Separation of Market from Network FUJITSU

Vertical Integration



Grid Unbundling



NETWORK : Transmission System Operator

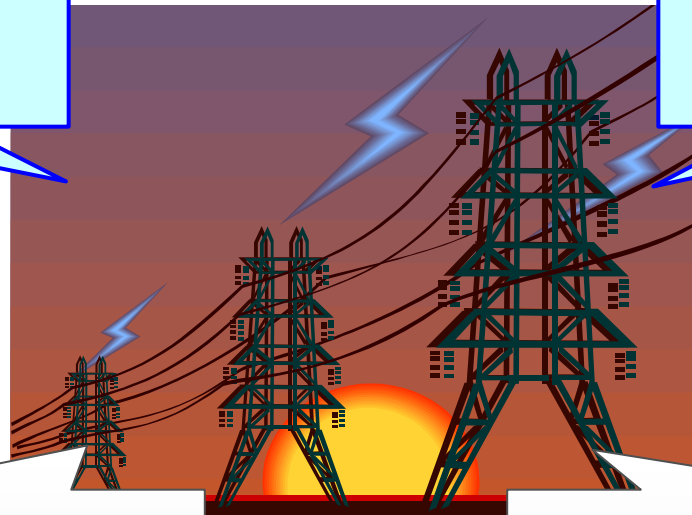
1. Owner of Grid

- maintenance
- construction



2. Operator of Grid

- grid access
- balancing



※ NOT own generators

- responsible for stable supply
- balancing through market

※ Monopoly

- officially approved tariff
- open grid access

MARKET : Demand & Supply Balancing

Supply : Generators



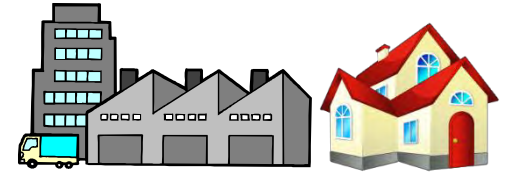
Financial Market

1220TWh/EUR43.6 bln/year

NASDAQ OMX

6 years before actual consumption

Demand : Consumers



Spot Market

286TWh/EUR10.7bln/year

nordpool spot

1 day before actual consumption

Real-time Market

1.8TWh/year

Managed by TSOs

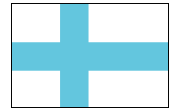
15-20 minutes before actual consumption



Statnett



ENERGINET/DK



FINGRID

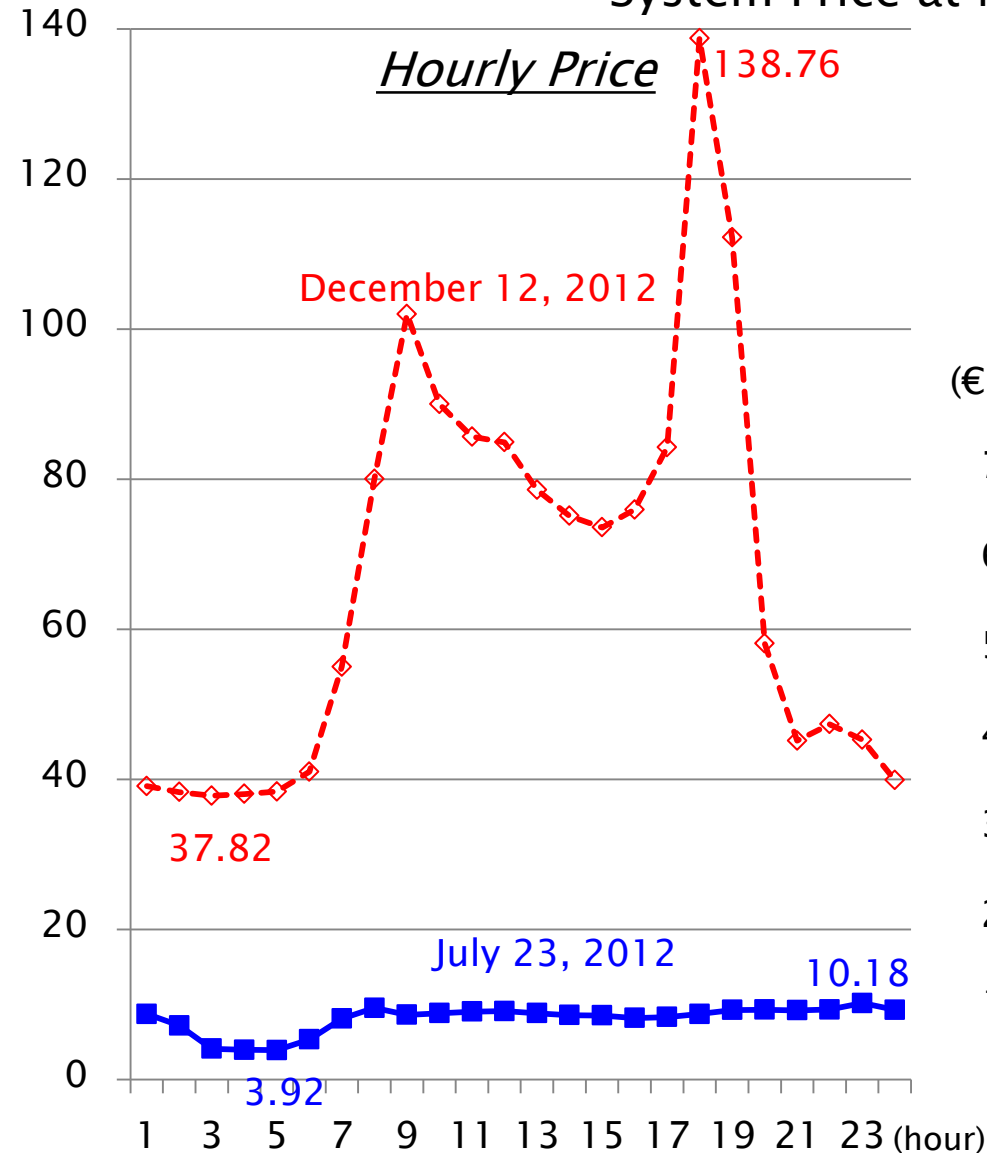


SVENSKA KRAFTNÄT

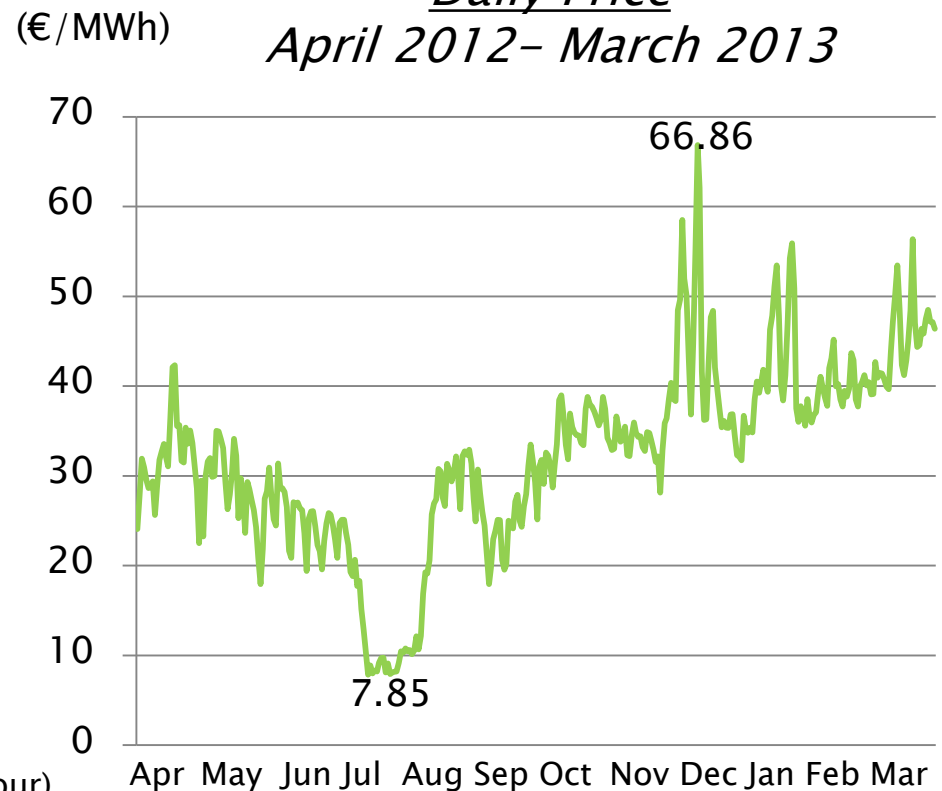
Nord Pool : Fluctuating Prices

(€/MWh)

– System Price at Nord Pool Spot –



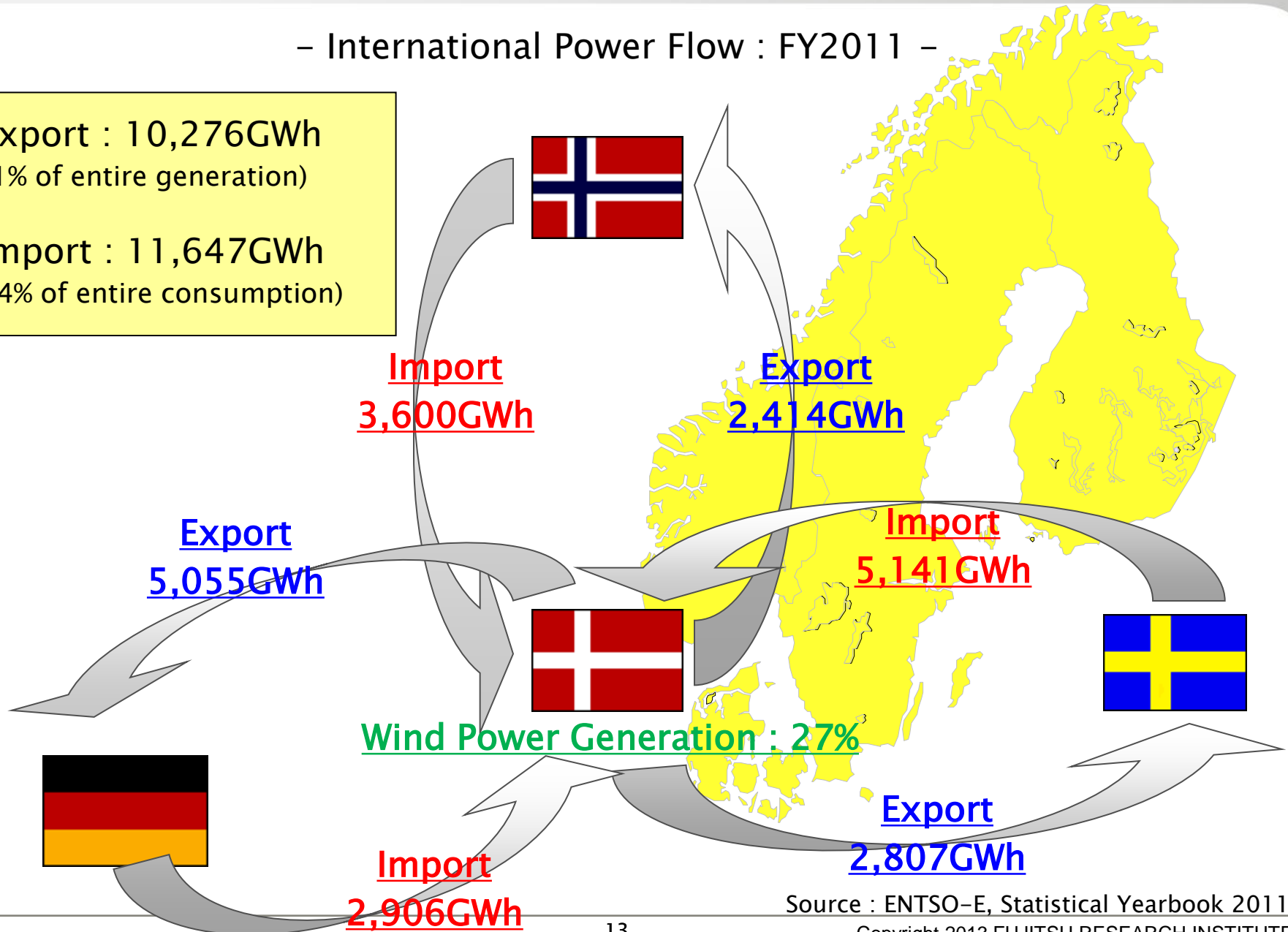
Daily Price
April 2012 – March 2013



DENMARK : Cross-border Grid Operation

- International Power Flow : FY2011 -

- Export : 10,276GWh
(31% of entire generation)
- Import : 11,647GWh
(34% of entire consumption)



Source : ENTSO-E, Statistical Yearbook 2011

NorNed : International Grid

World's Longest Submarine Power Cable

- HVDC cable : 580km/700MW/450kV
- Jointly constructed and operated by Statnett and Tennet

History

- 1994- : Started preparation
- 2005 : Decided construction
- 2008 : Started operation

Finance

- Cost of construction : €600 million
- Revenue : €74 million/year



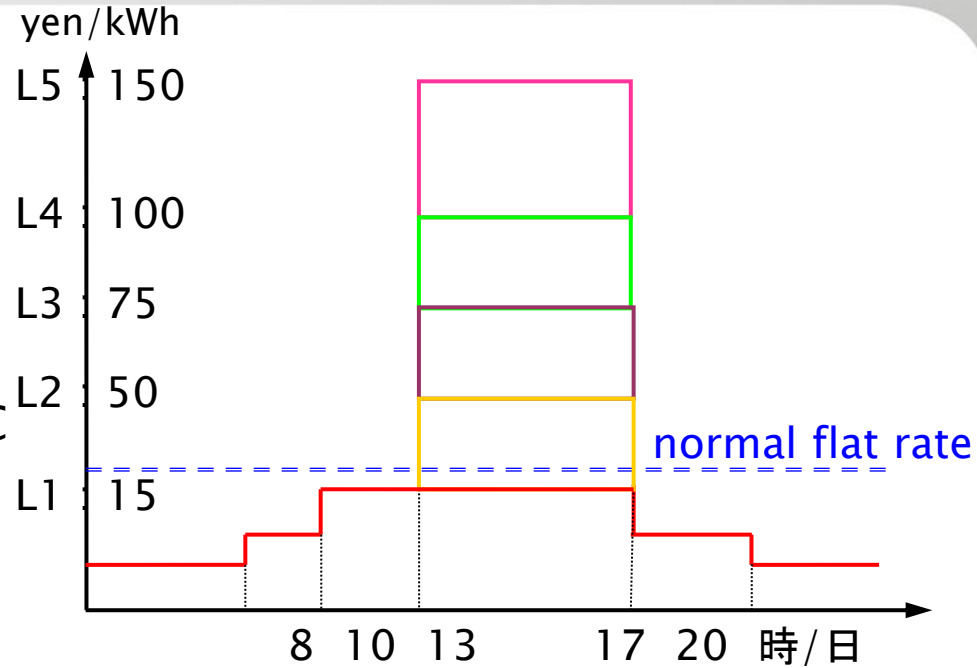
Statnett



JAPAN : Demand Response

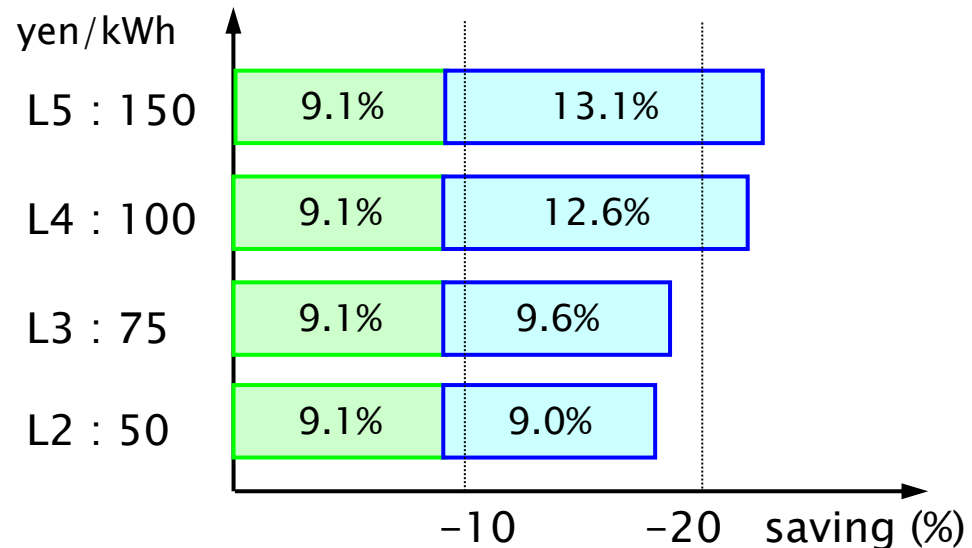
Kitakyusyu Pilot Project for Smart Community

- CEMS in Higashida town
- 45 companies, 225 households
- When highest temp. goes over 30°C
- TOU + CPP : level 2-5



Effect of Power Saving

- Standard TOU : -9.1%
- Dynamic CPP : -9.0-13.1%
- Electricity bill : -12.6%



3. Policy Proposals for Japan

Deployment of Renewables

- Outcome of Feed-in Tariff : As of June, 2013 -

Capacity : MW	Accumulated as of June, 2012	Newly Operated since July, 2012	Newly Certified since July, 2012
Residential PV	4,700	1,379 PV 95%	1,633
Industrial PV	900	2,120	19,755 Last-minute push
Wind	2,600	66	805
Small Hydro	9,600	2	79
Biomass	2,300	98	639
Geothermal	500	1	4
<u>TOTAL</u>	<u>20,600</u>	<u>3,666</u>	<u>22,914</u>

Access Limit to Renewables

Renewables Feed-in Law

- priority grid access to renewables stipulated
- excluding the cases “threatening stable power supply”

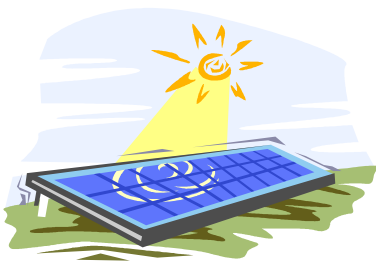
Wind Power



Access limit sustained

- 560MW in Hokkaido : no new offerings
- countermeasure : wide-area grid operation

Solar PV



Access limit newly announced in Hokkaido

- 700MW limit for 500kW-plus solar
- 400MW limit for 2MW-plus mega-solar
- countermeasure : 60MWh battery

Wide-area System Operator

Establishment of “OCTO”

- independent? stronger authority?
- grid construction : international connection

Stimulation of Market

Larger and Transparent Market

- more bidding by utilities
- real-time balancing market

Grid Unbundling

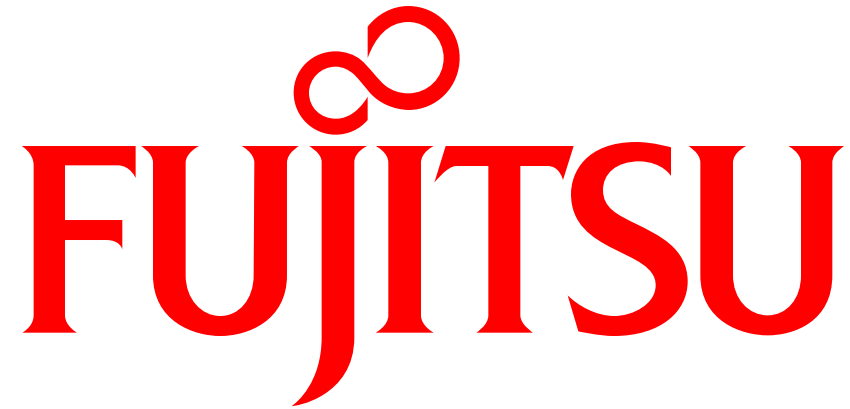
From Legal to Ownership Unbundling

- guarantee of priority access
- M&A for economy of scale

Independent Regulator

Independent and Professional

- monitor & stimulate market competition
- supervise network business



shaping tomorrow with you