Renewable Energy Sources integration, balancing, operation: problems & solutions

BULGARIAN PHOTOVOLTAIC ASSOCIATION

6th South East Europe Energy Dialogue, Thessaloniki , May 30-31st, 2012

The future is here. It's just not widely available yet.

William Gibson (founder of the concept "cyberspace")

Contents

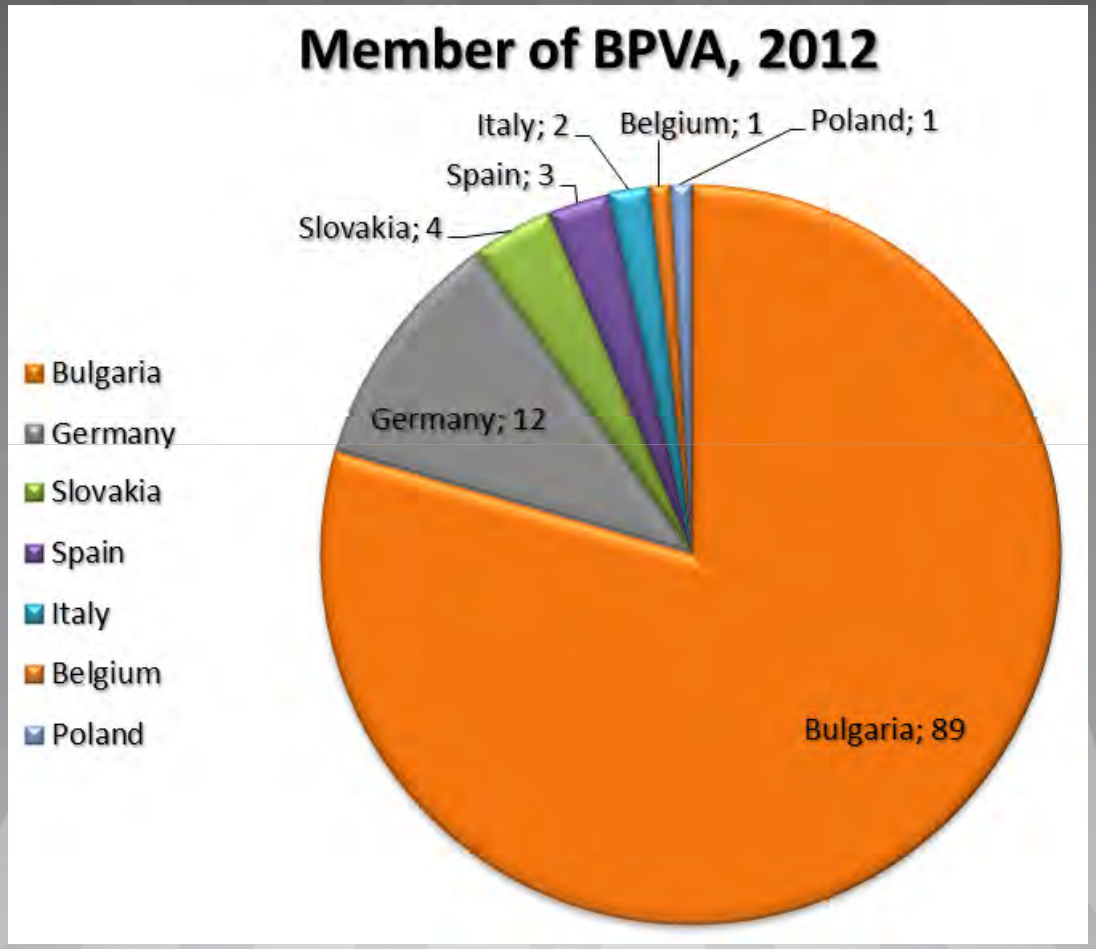
- ✓ BPVA
- ✓ Bulgarian PV market
- ✓ Directive 2010/31/EU
- ✓ Smat grid
- ✓ Integration
- ✓ Balancing
- ✓ Operation

BPVA

September, 16th 2009 – 17 founding members

May, 1st 2012 – 110 members

BPVA


Member of BPVA, 2012
Italy; 2
Belgium; 1
Poland; 1
Spain; 3
Slovakia; 4
Germany; 12
Bulgaria; 89
Bulgaria
Germany
Slovakia
Spain
Italy
Belgium
Poland

BPVA


3E International Group
3VM
ALUKÖNIGSTAHL
ABS ADVANCED BUSINESS SOLUTIONS
ALUMIL Building excellence every day
ARIES
ARNI
AGPA engineering Equipment & Engineering
bica
BLS ENERGIEPLAN
BNNS solar systems
BNRG RENEWABLES 'Generating wealth'
bpv | BRAUN PARTNERS
BCI JSC
CALRAYS
CanadianSolar
ClimaCom CLIMATE CONTROL SYSTEMS
CMS Reich-Rohrwig Hainz
CRANE RENEWABLE ENERGY
DAY ENERGY RD GROUP OF COMPANIES
DEJAR SOLAR
ЕКОЕЛ БГ ТОК ОТ ПРИРОДАТА
Eco power 2009 PHOTOVOLTAIC SYSTEMS
egnatia Bulgaria
ENERGIMIDT
ENERRAY Solar solutions
ENERTHINK
enfinity energy for life
enprom.bg
Environmental Investment Partners
EVN naturkraft
ФУТЕКОВА ХРИСТОВА & ТОМЕШКОВА
GECO Global Energy Company
gehrlicher SOLAR
GES GREENTECH
GLB
HELIOS POWER
HENSEL
hillsmith Solar
HORIZONT IVANOV
IBERDROLA
ИНТЕРСЕРВИЗ УЗУНОВИ АД
juwi Energy is here
KLC law firm
Smart Energy Power™
IPS
KANTILENA
КЪЛВАЧА ИНЖЕНЕРИНГ
ПОПОВ слънчеви системи
SINE CARE
MARTIFER SOLAR
MATI
SEMO
Memukc
ПРОФИЛ-И PROFIL-I
phoenix SOLAR
ProCon УПРАВЛЕНИЕ НА ПРОЕКТИ & КОНСУЛТИРАНЕ
REC Solar
PHOTOVOLTAIC BULGARIA
sedna power plants
SHARP
Schneider Electric
SIEMENS
SKY SOLAR
SMA
SolarBulgaria
СОЛАР ВИЖЪН
Solar consulting
SOLAR ENTERPRISE
SOLARINVEST REFLECTING THE FUTURE
solarpro HOLDING
ETEM
СТРИМОНА
STS SOLAR
SunEdison simplifying solar
SunInvest Tradind AD
SunSERVICE
"ELECTROLUX- Tabakov & Sons" Ltd.
ViaExpo
VJF
WOODWARD
voestalpine EINEN SCHRITT VORAUS

BPVA

OUR GOALS

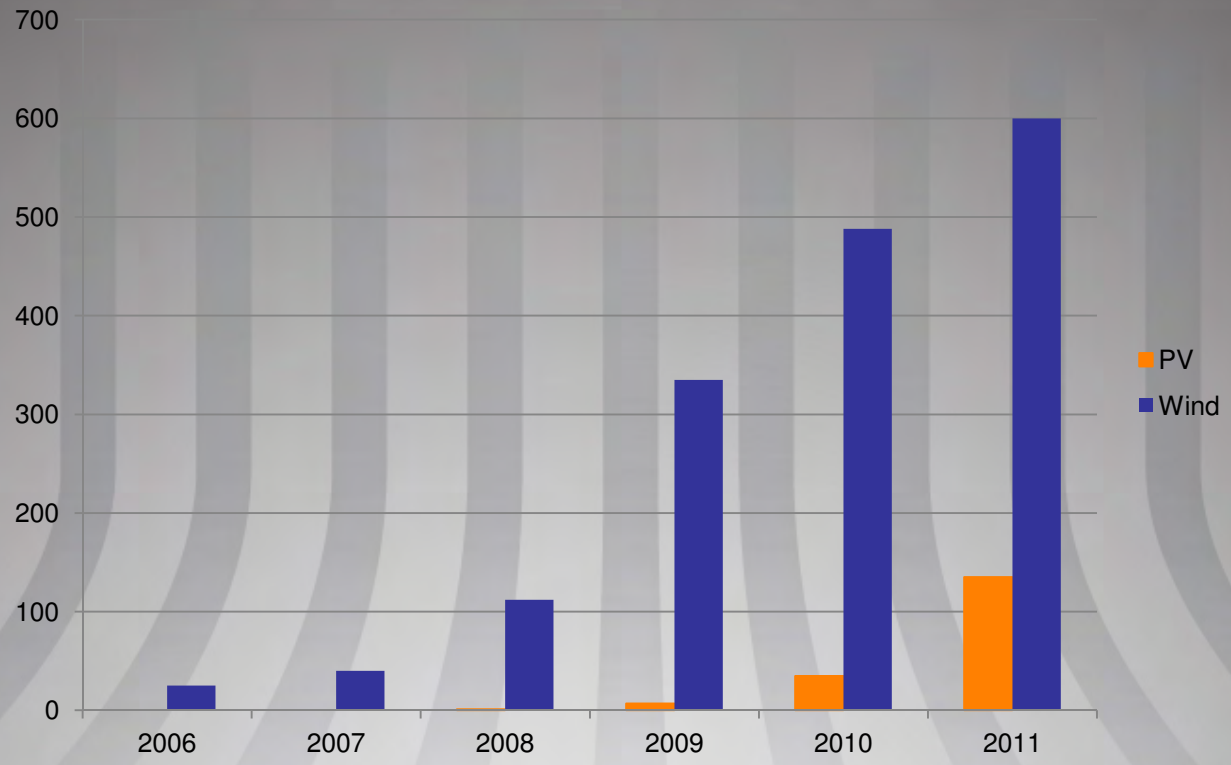
- Positive investment framework (legal, financial, technical etc.)
- Job creation & transfer of know-how
- Sustainable market development

PV MARKET DEVELOPMENT IN BULGARIA

- Slow start in 2008-2009 — 1 MWp
- BPVA since Sep. 2009 — total of < 25 MWp in 2010
- Boom of new capacities since Q3 2011 — apprx. 120 MWp in 2011
- Today - around 300 MWp (HV&MV)…going above 500 MWp as of June 30th ???

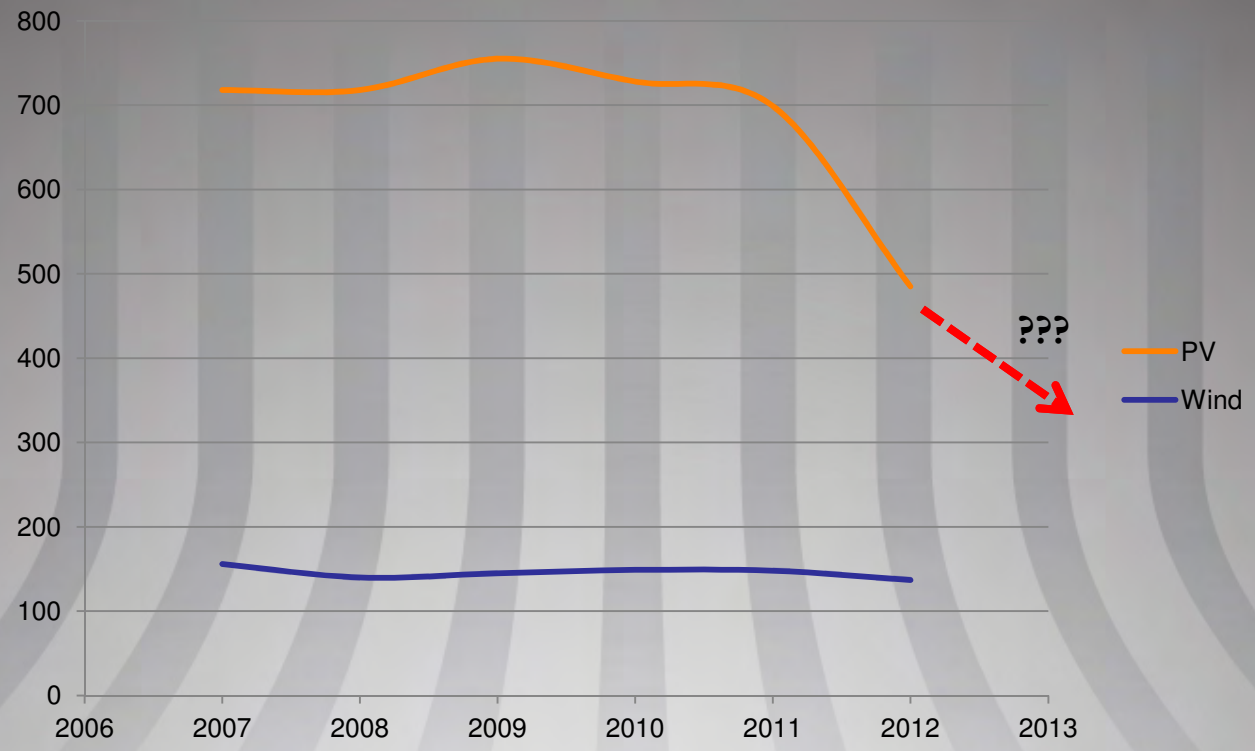
PV MARKET DEVELOPMENT IN BULGARIA

Installed capacities for PV and Wind in Bulgaria 2007 – 2012, MW



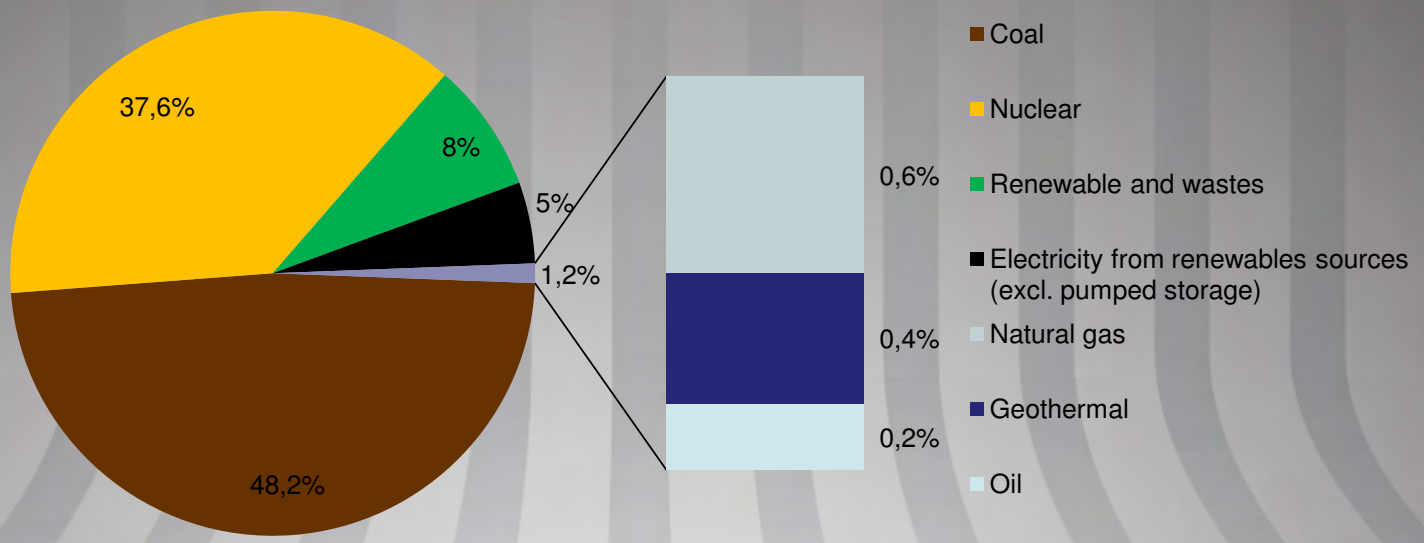
PV MARKET DEVELOPMENT IN BULGARIA

FiT for PV and wind: 2006-2012, BGN/MWh



PV MARKET DEVELOPMENT IN BULGARIA

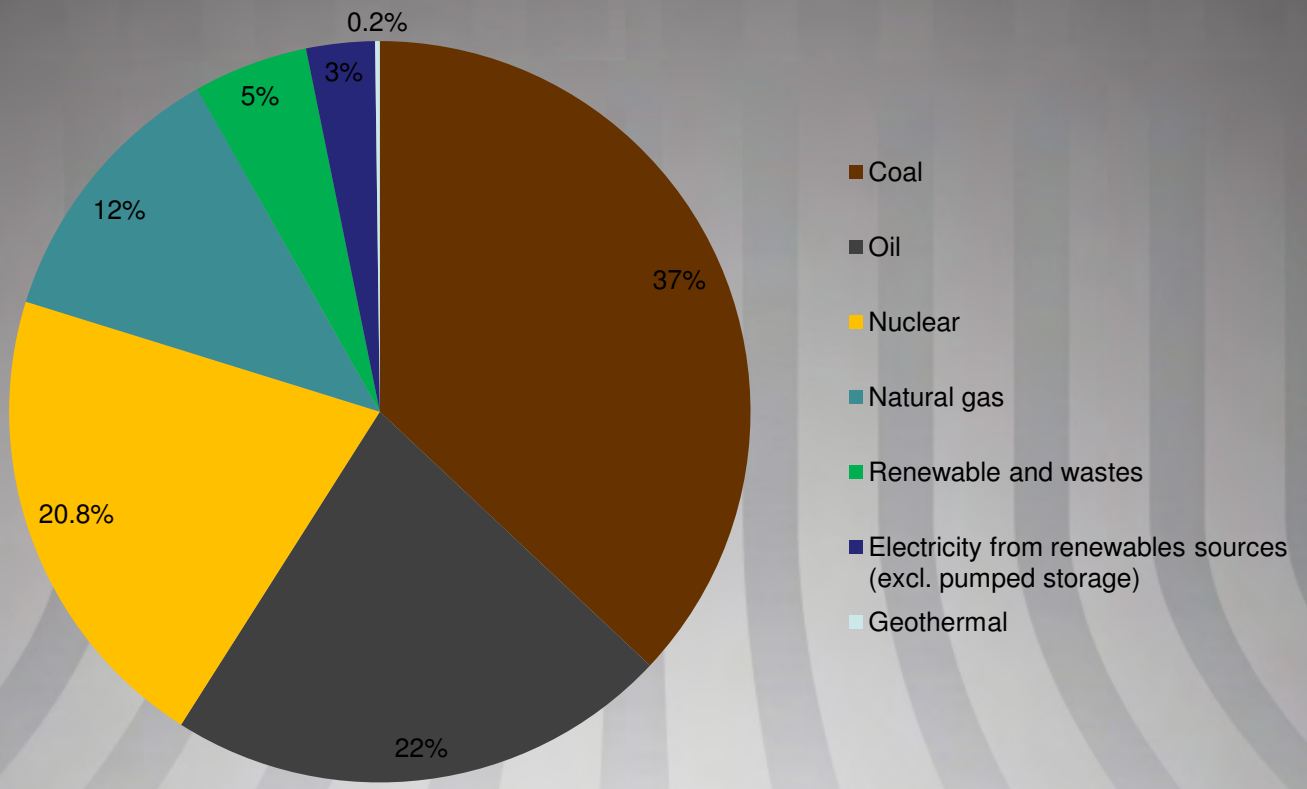
Bulgaria Energy Production Mix 2010



Source: Overall Energy Balance Sheet 2010, NSI

PV MARKET DEVELOPMENT IN BULGARIA

Energy Consumption Mix Bulgaria 2010



Directive 2010/31/EU of 19/05/2010 on the energy performance of buildings (recast)

Poorly known in the energy sector

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Directive 2010/31/EU creates entirely different business environment for the utility sector, especially the EDCs

Directive 2010/31/EU of 19/05/2010 on the energy performance of buildings (recast)

Example:

In Bulgaria, 2012 > 70 % of the electricity generation is consumed by the domestic sector

Diversity of new services:

- ✓Huge data volumes analysis
- ✓Нарастващ обмен и предоставяне на данни
- ✓IT/EMS/ERP/CRM/SCADA/… implamentationa & integration
- ✓Data integration
- ✓Multilevel & bidirectional customer relationship management – prosumers
- ✓Guarantees
- ✓Financial / legal services
- ✓ net-metering,
- ✓Green certificates, CO2, subsidies, green loans
- ✓load flow control and power quality improvement
- ✓…….

Comprehensive energy management, now what?!

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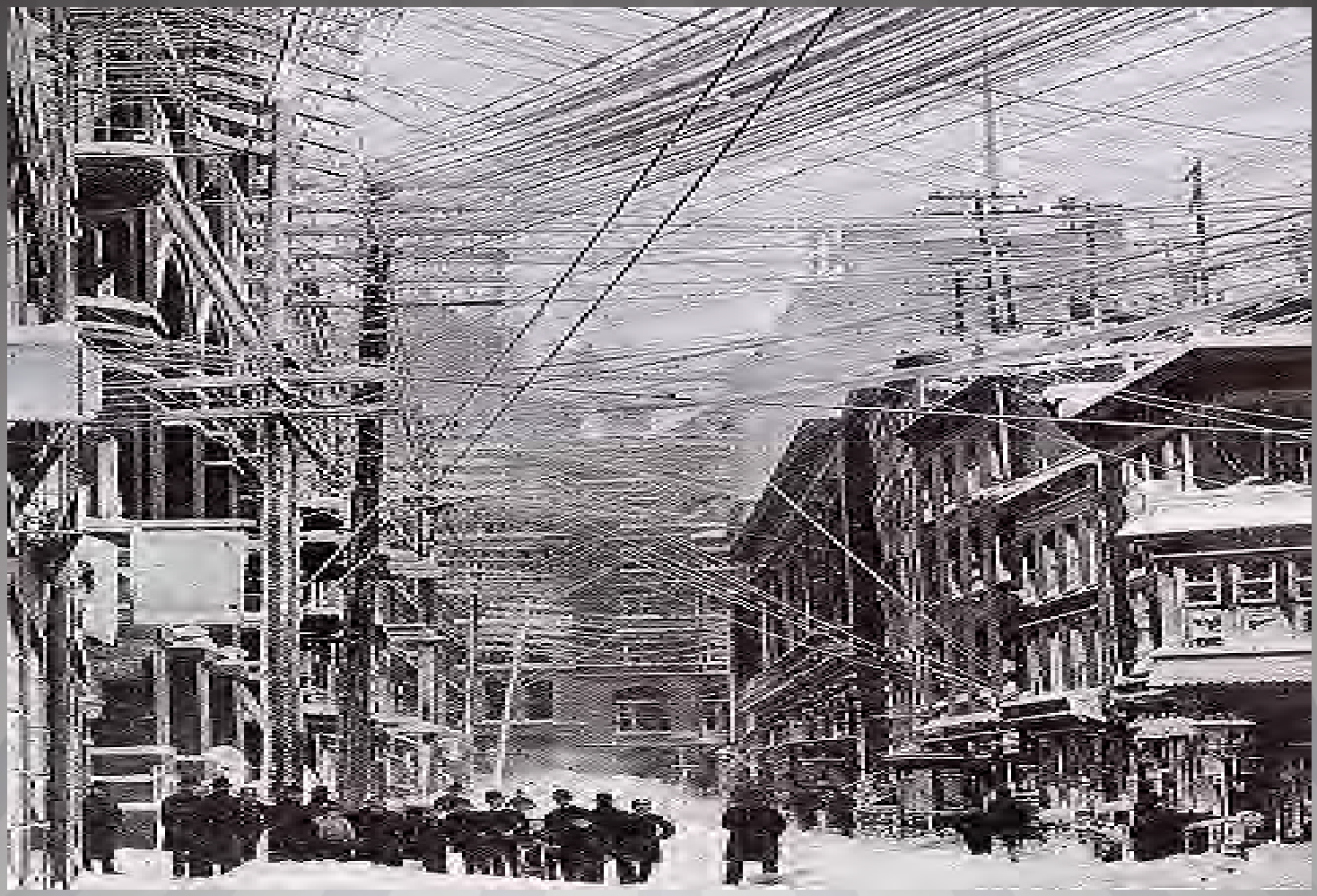
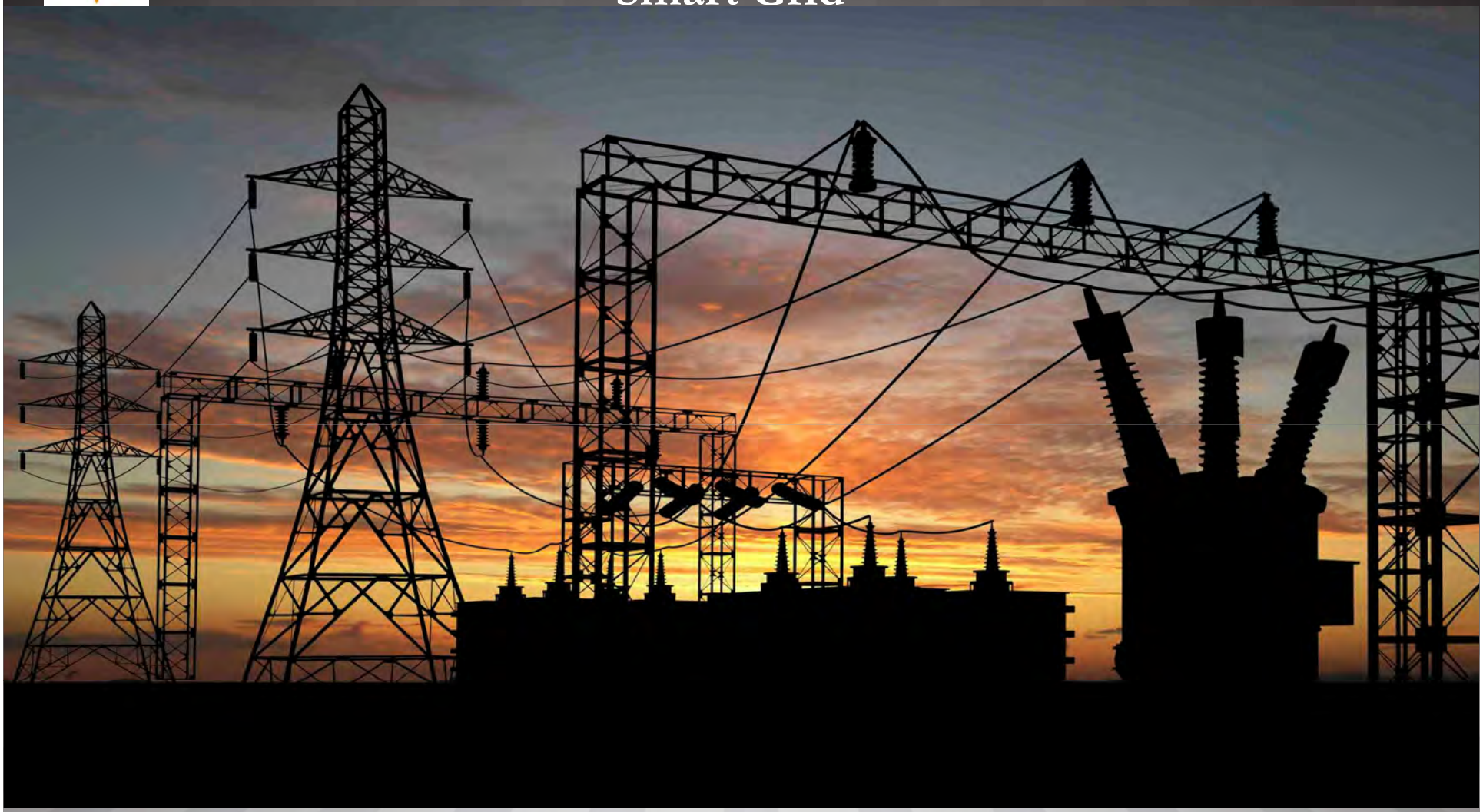
How open source operating system changed the world in 10 years

Smart Grid



New York, 1888

Smart Grid



Somewhere in "the developed world", 1988

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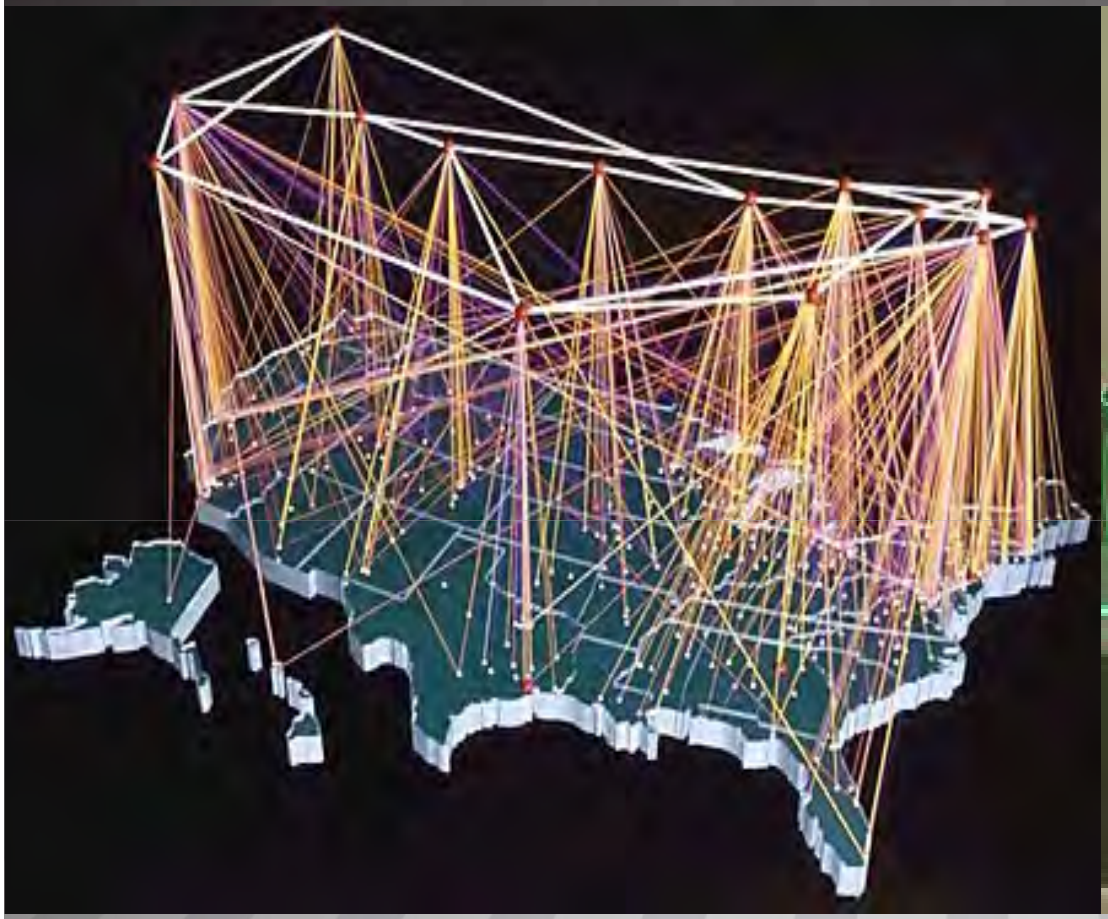
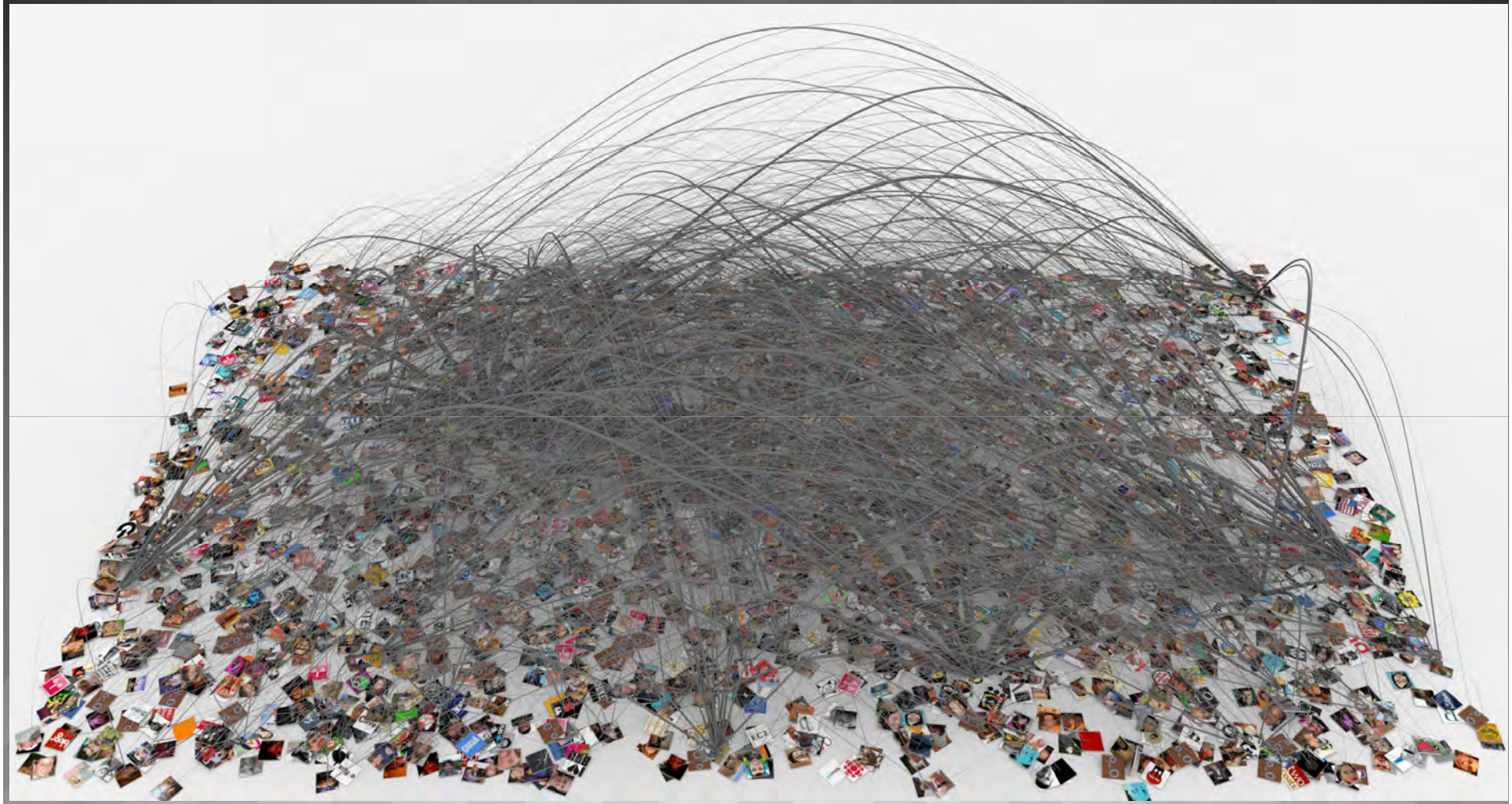
Smart Grid



2012 ?

Smart Grid



21.12.2012…

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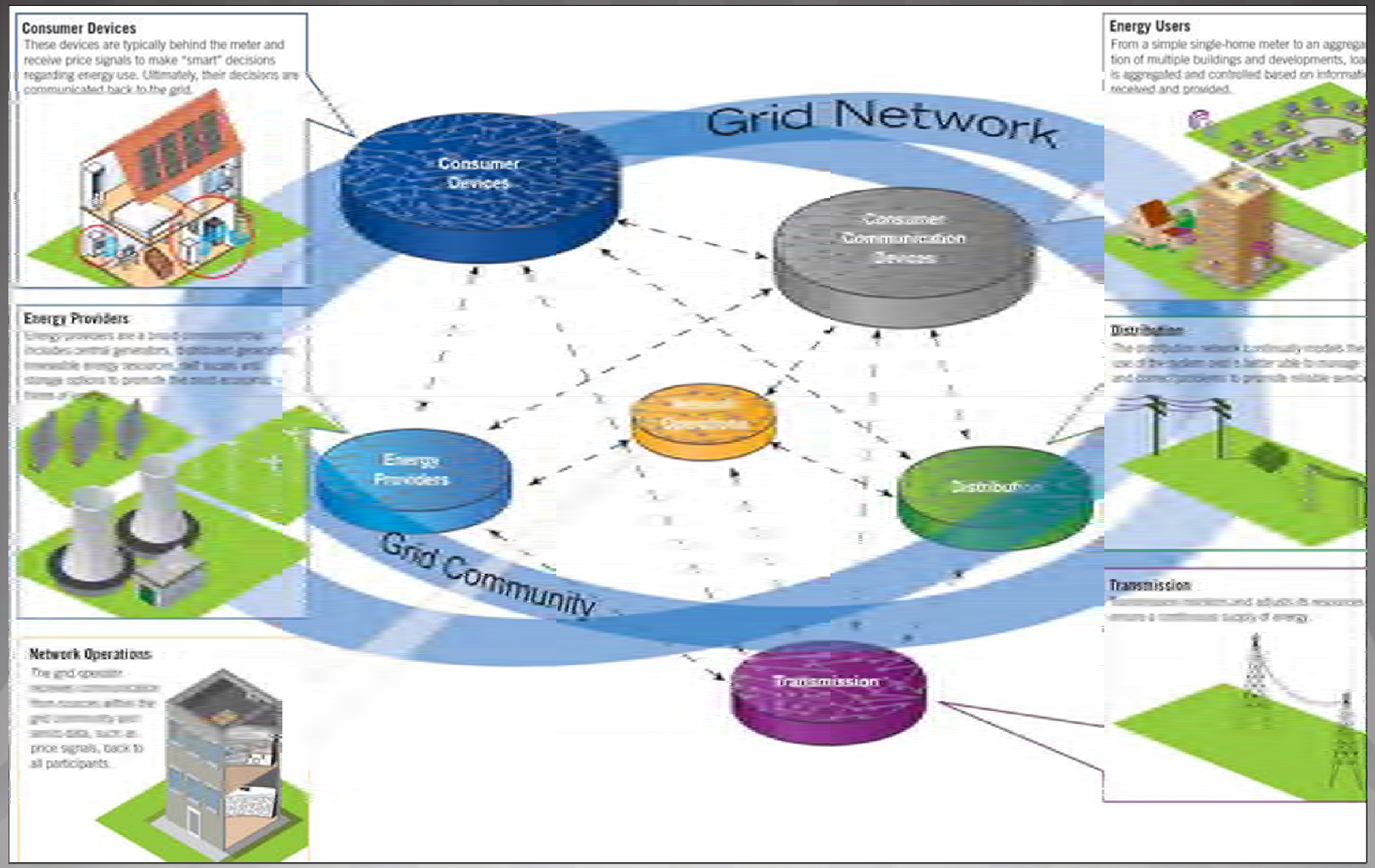
Smart Grid

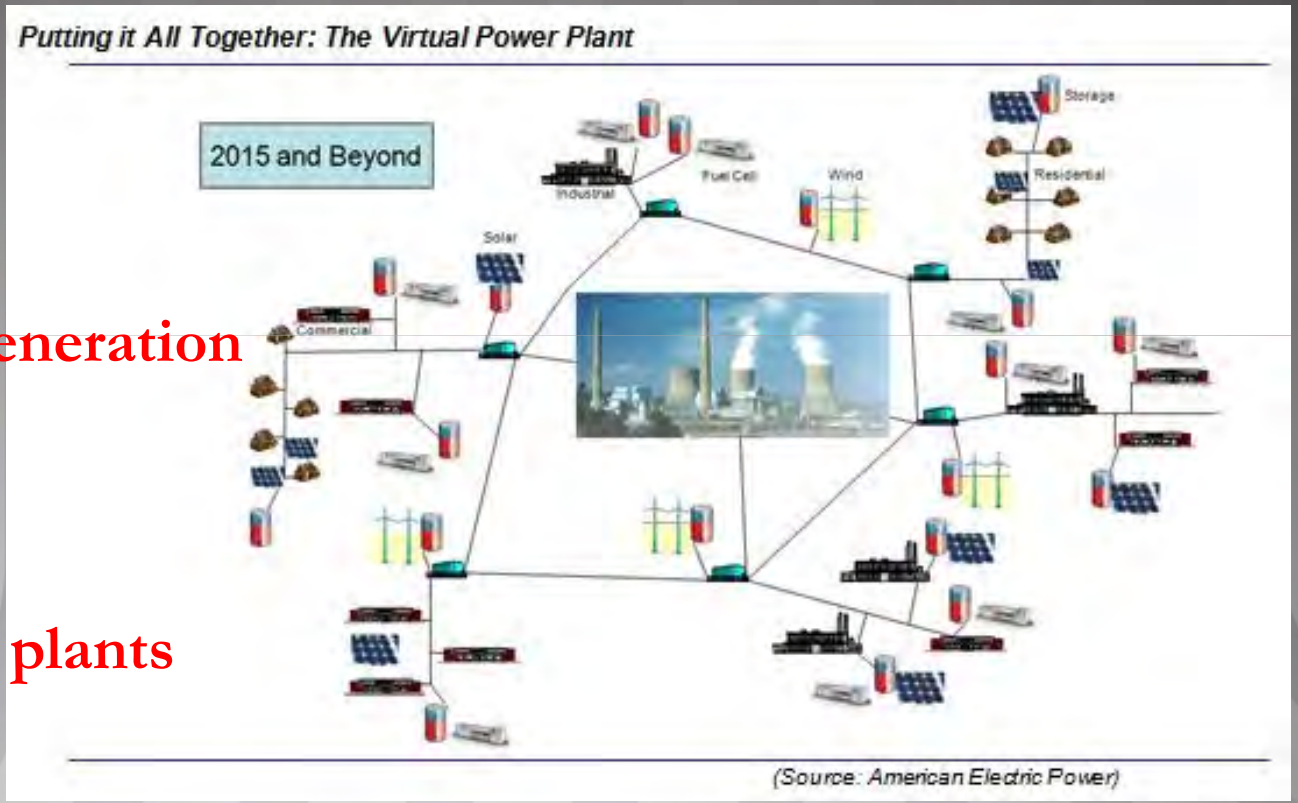

Consumer Devices
These devices are typically behind the meter and receive price signals to make "smart" decisions regarding energy use. Ultimately, their decisions are communicated back to the grid.
Energy Providers
Network Operations
The grid operator
price signals, back to all participants.
Grid Network
Consumer Devices
Energy Providers
Transmission
Grid Community
Energy Users
From a simple single-home meter to an aggrega
tion of multiple buildings and developments, loa
is aggregated and controlled based on informati
received and provided.
Transmission

Smart Grid

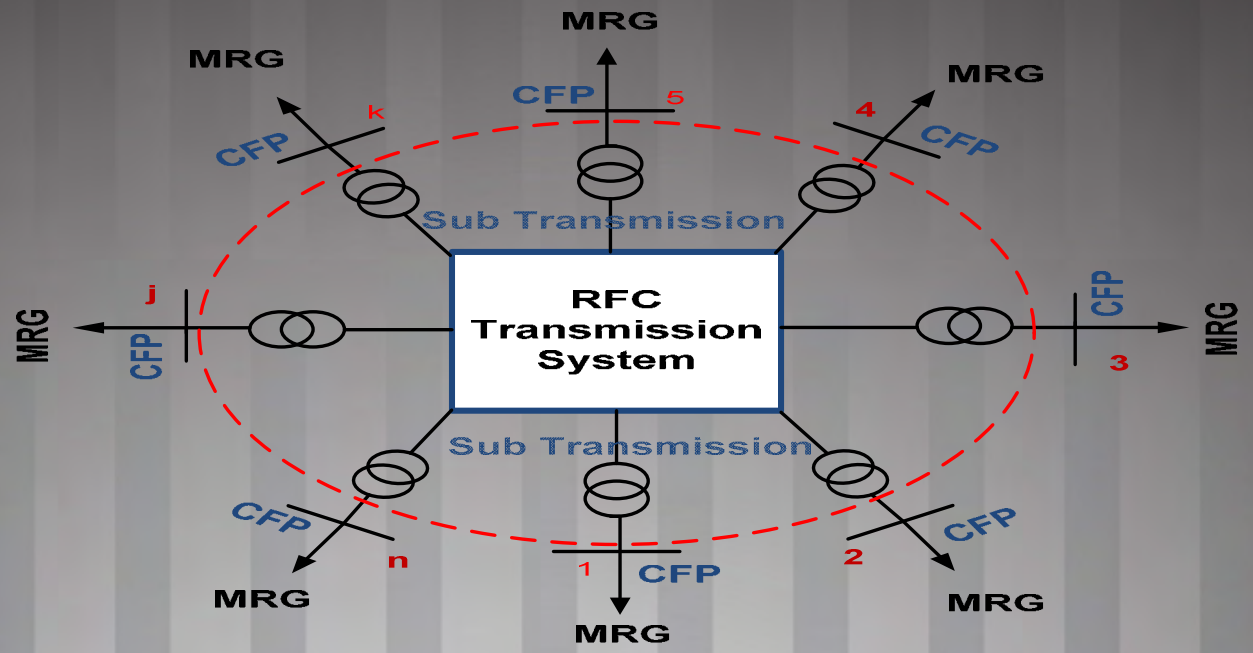
Prosumers = producers/consumers

Distributed generation

Virtual power plants



Smart Grid



CFP: Cyber Fusion Point

MRG: Micro-grid Renewable Green Energy System

Cyber-Controlled Smart Grid

http://www.ece.osu.edu/~keyhani/

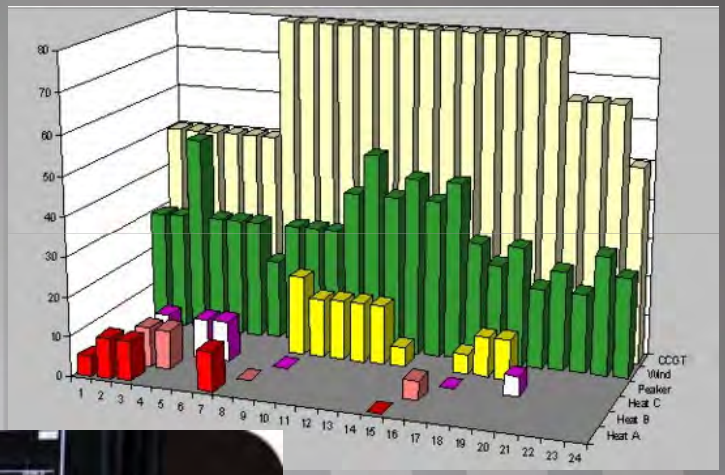
Smart Grid

Demand response

Reliability & Effectiveness

Integration of large/small RE

Network control, DMS, SCADA, EVs, ….



Smart Grid

Source:

Wikinomics and the Future of Energy: Rise of the Energy Prosumer

Anthony D. Williams
Co-author of *Macrowikinomics*

Smart Grid

Data is accessible virtually everywhere

Source:

Wikinomics and the Future of Energy:
Rise of the Energy Prosumer

Anthony D. Williams
Co-author of *Macrowikinomics*

Smart Grid

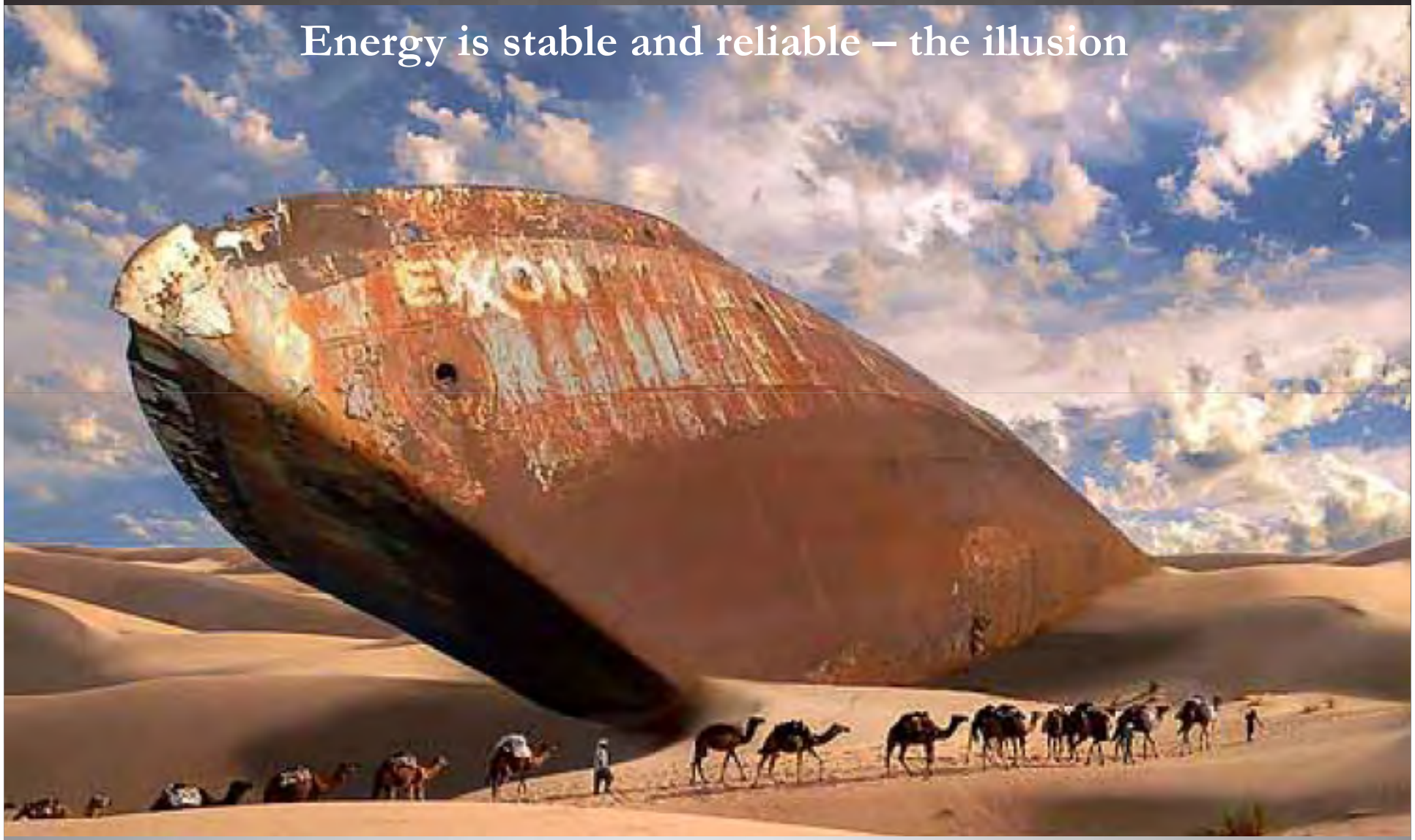
Why not energy / energy services app store?

Source:
Wikinomics and the Future of Energy: Rise of the Energy Prosumer

Anthony D. Williams
Co-author of *Macrowikinomics*

Security & confidentiality – the biggest challenge for the "smart grids"

Energy is stable and reliable – the illusion



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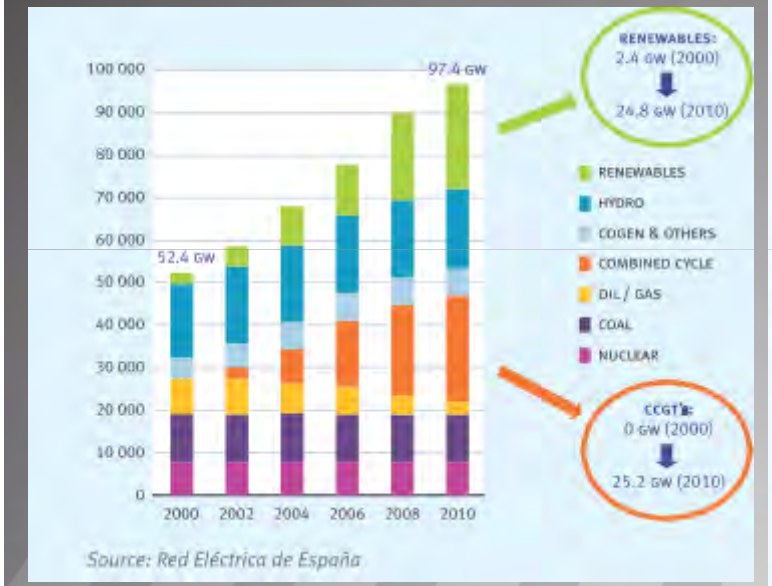
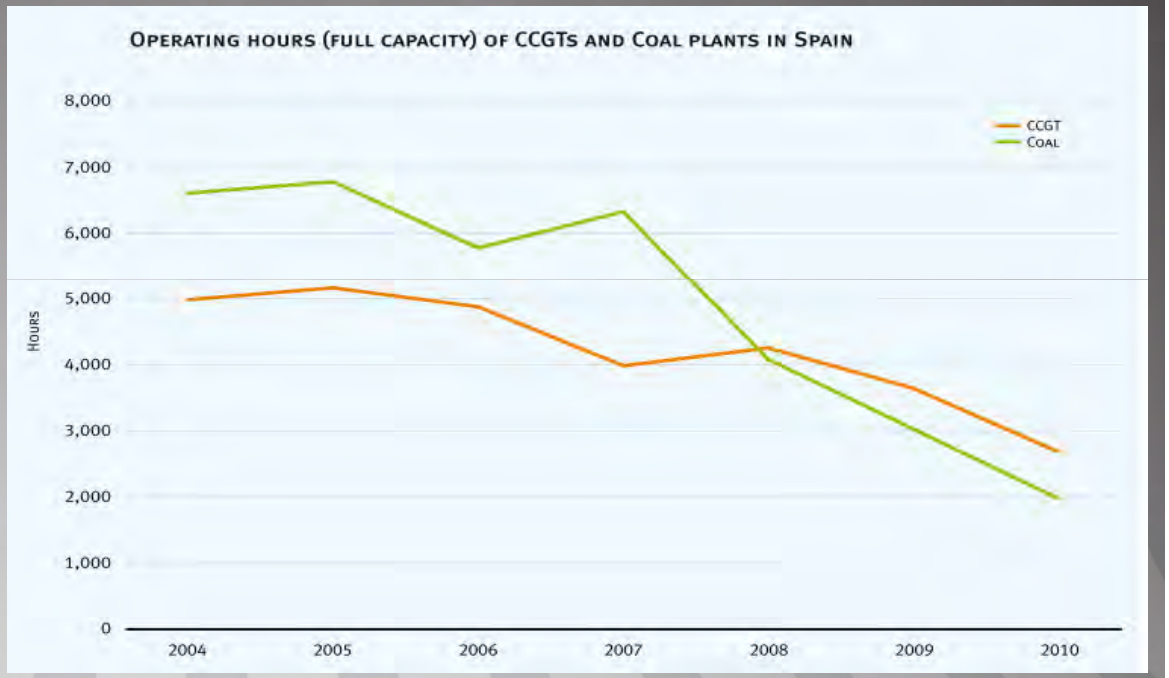
Balancing
New kind of management & operation

Balancing
New kind of management & operation





Source: RES Integration and Market Design Report, Euroelectric 2012

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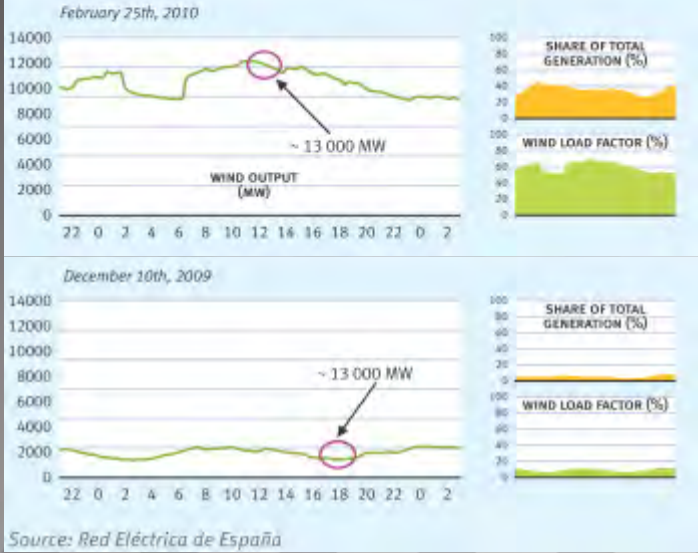
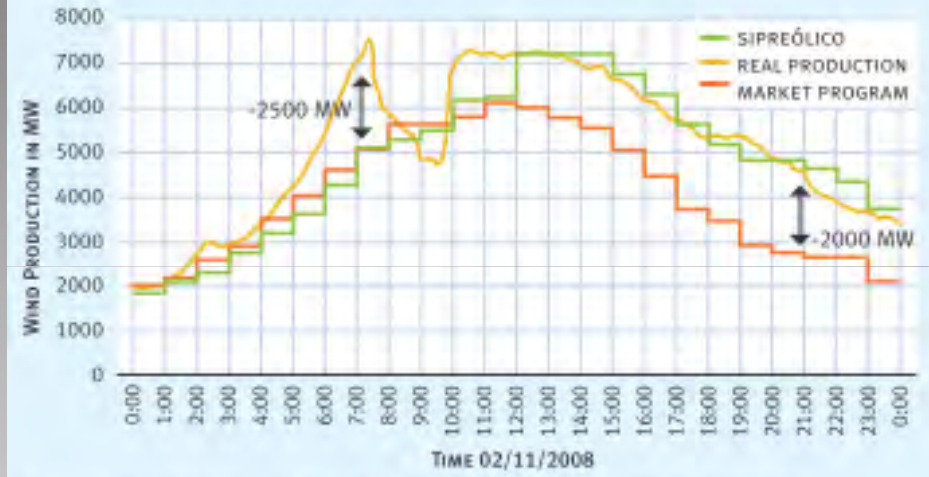
Balancing
New kind of management & operation

FIGURE 15: WIND OUTPUT AND CONTRIBUTION TO DEMAND COVERAGE IN SPAIN DURING TWO DAYS WITH COMPARABLE ELECTRICITY CONSUMPTION AND PEAK DEMAND



Source: Red Eléctrica de España

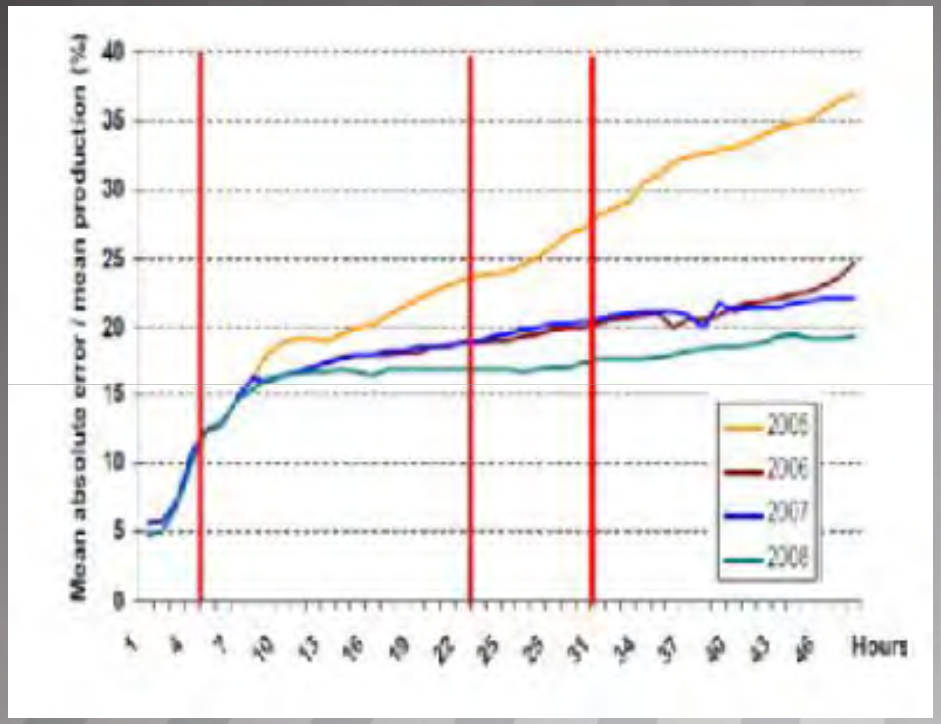
FIGURE 16: WIND FORECAST ERROR IN SPAIN

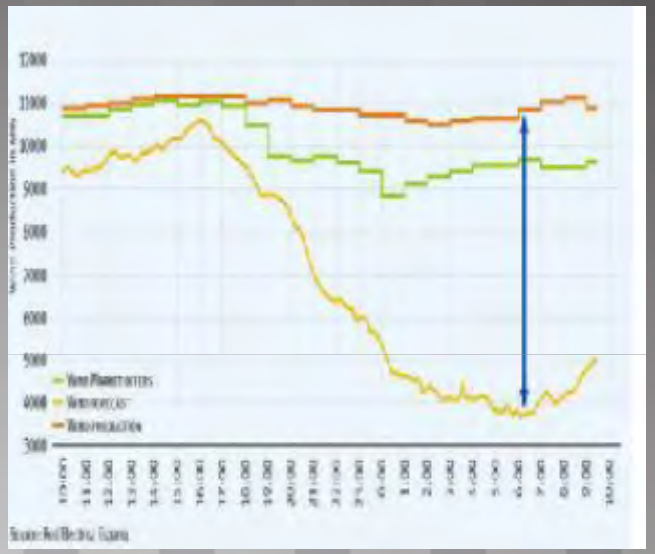


Source: Red Eléctrica de España, figure in EURELECTRIC, Integrating Intermittent Renewables, March 2010

Source: RES Integration and Market Design Report, Euroelectric 2012

Balancing
New kind of management & operation

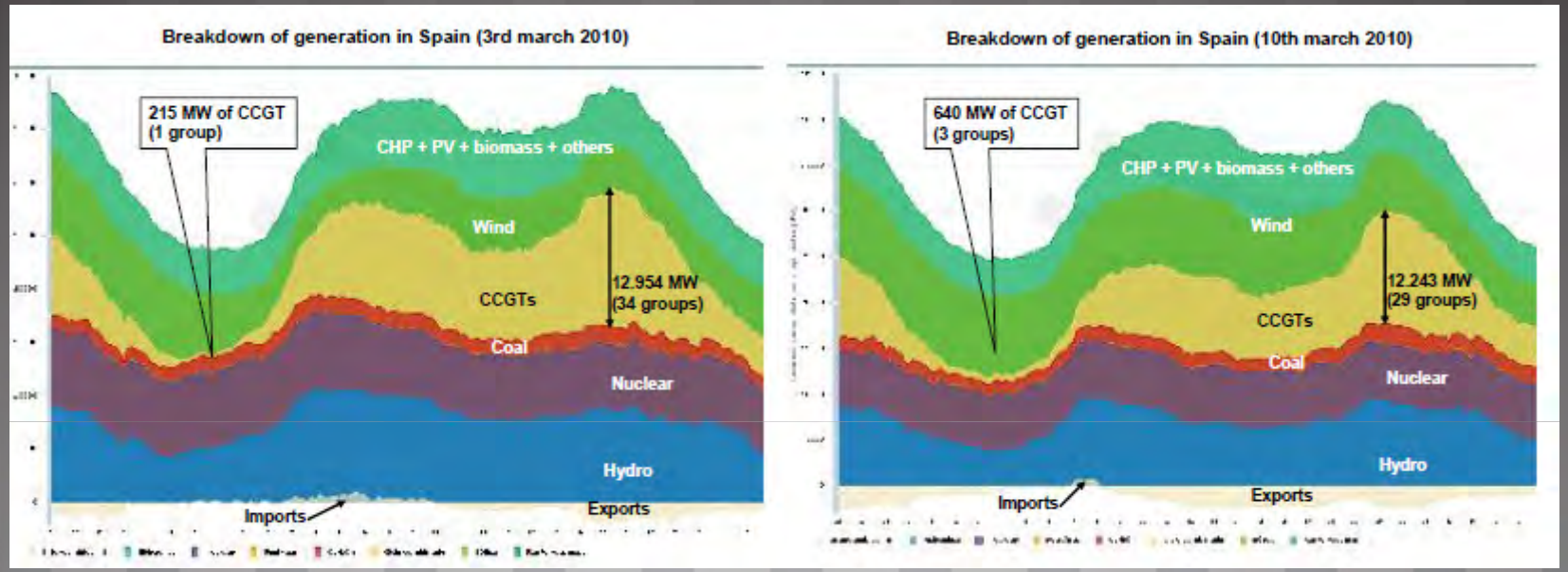




Differences b/n forecasts and real production of wind power plants in Spain

Source: Eurelectric workshop on electricity storage, 2012

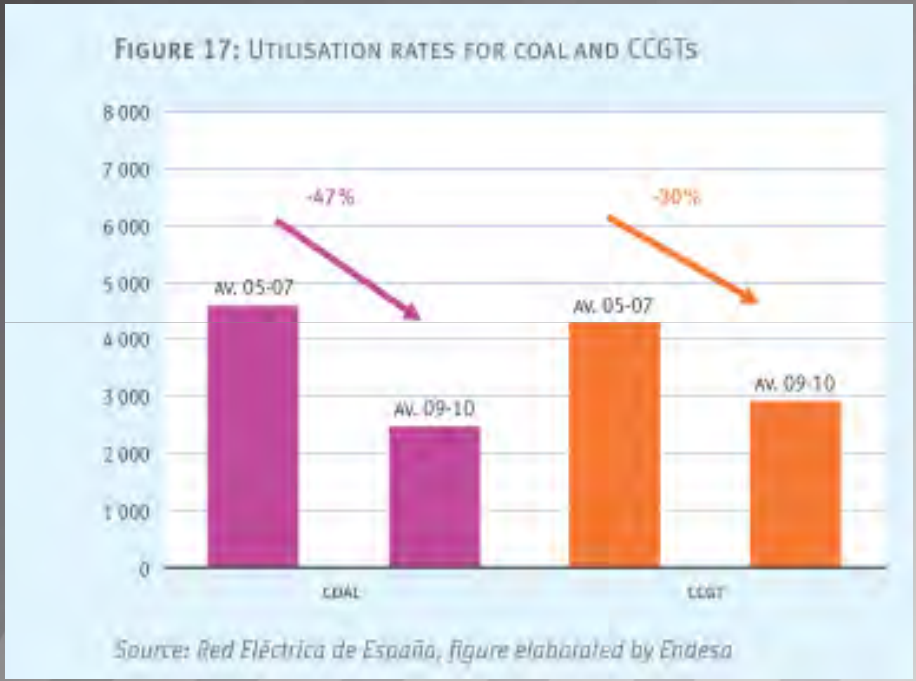
Балансиране
Преминаване към нов тип управление на централите

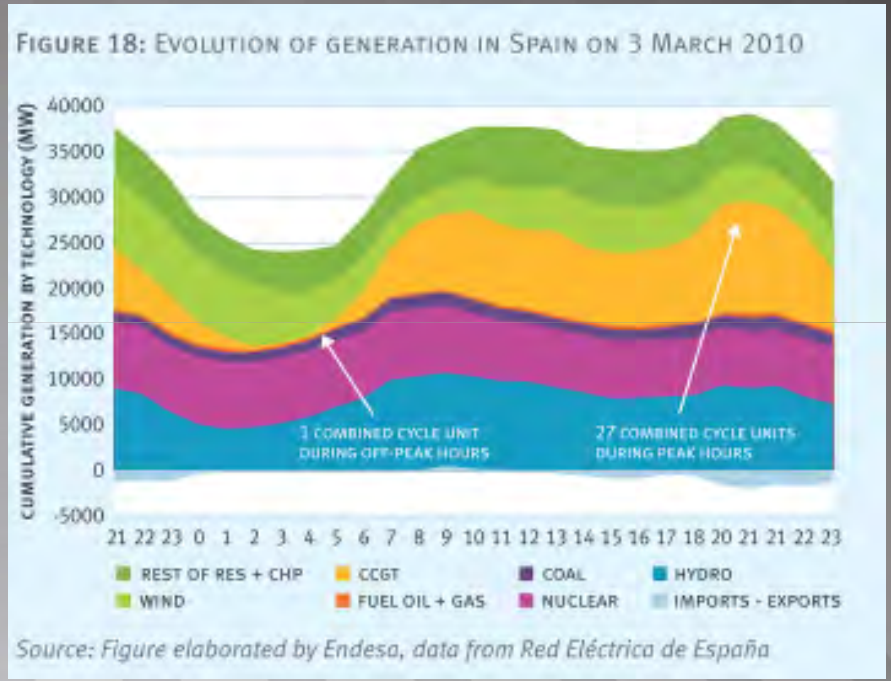


Power reserve – above 120 %, the flexibility is primarily from WPP and TPP

Source: Eurelectric workshop on electricity storage, 2012

Балансиране
Преминаване към нов тип управление на централите





Source: RES Integration and Market Design Report, Euroelectric 2012

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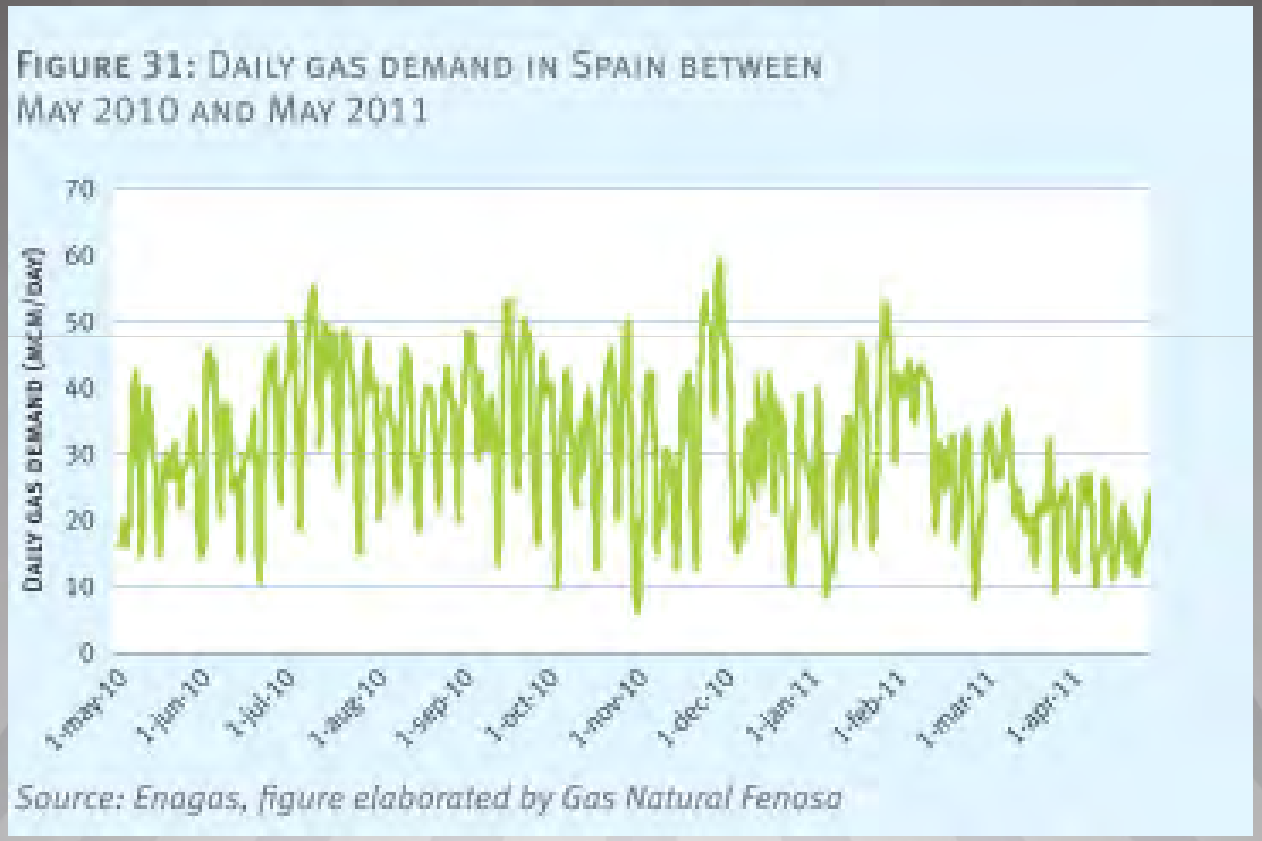
Balancing

The integration & interaction of electricity transmission and gas transmission / operators



Source: RES Integration and Market Design Report, Euroelectric 2012

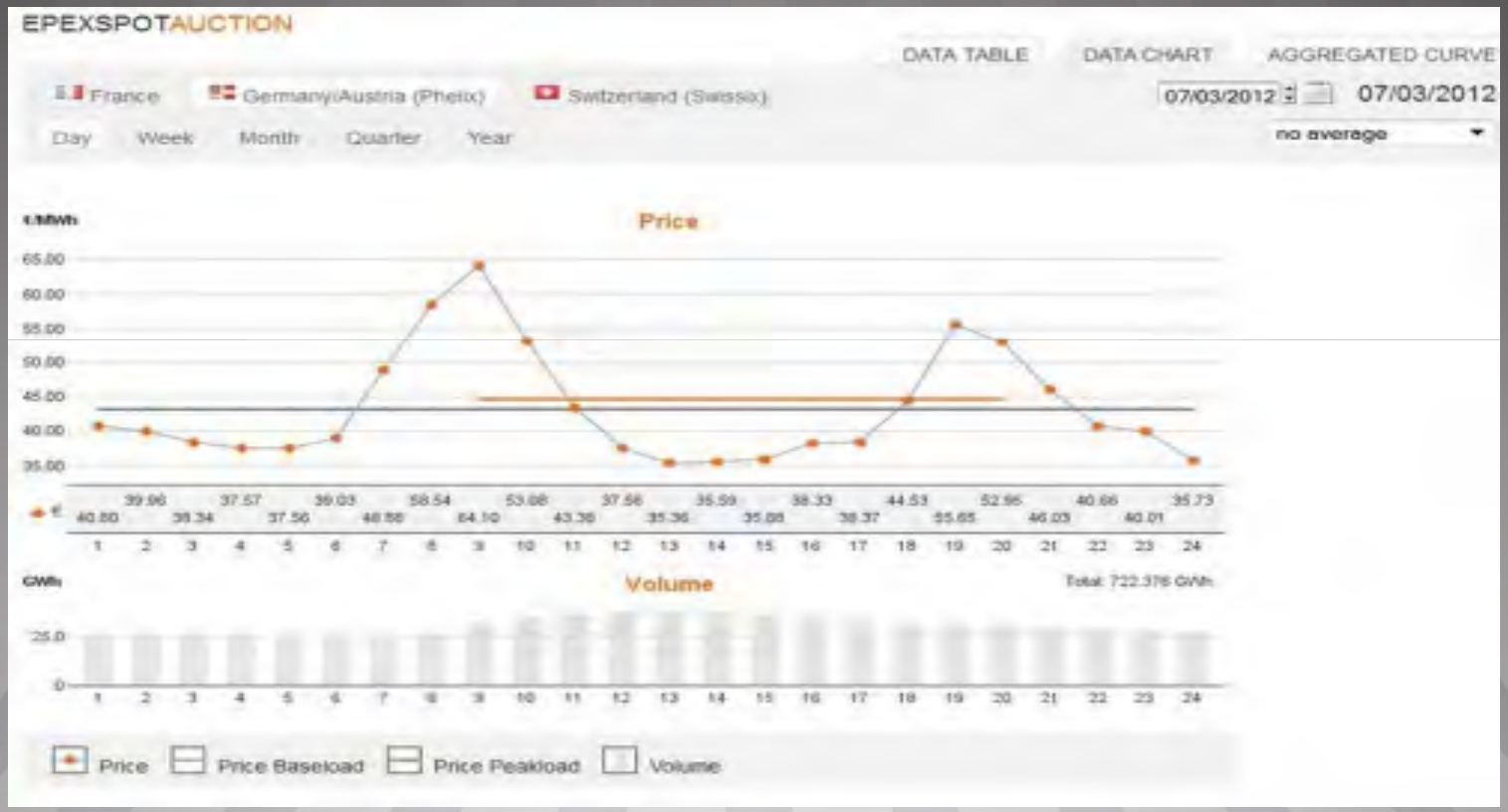
Operation

How solar energy is reducing the electricity price in Germany… and increases the export

цената и консумацията на електроенергия в Германия през март 2008 г.

Operation

How solar energy is reducing the electricity price in Germany… and increases the export



цената и консумацията на електроенергия в Германия през март 2012 г.

Operation

How solar energy is reducing the electricity price in Germany… and increases the export

Institute for Future Energy Systems (IZES):

✓ Electricity prices in Germany drops with 10 % due to the PV production

✓ Electricity prices in Germany drops 40 % avera due to the PV production in the afternoon hours (peak load).

This phenomena is know as „merit order effect“.

http://cleantechnica.com/2012/02/09/solar-pv-reducing-price-of-electricity-in-germany/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+IM-cleantechnica+%28CleanTechnica%29

Operation

How solar energy is reducing the electricity price in Germany… and increases the export

Operation

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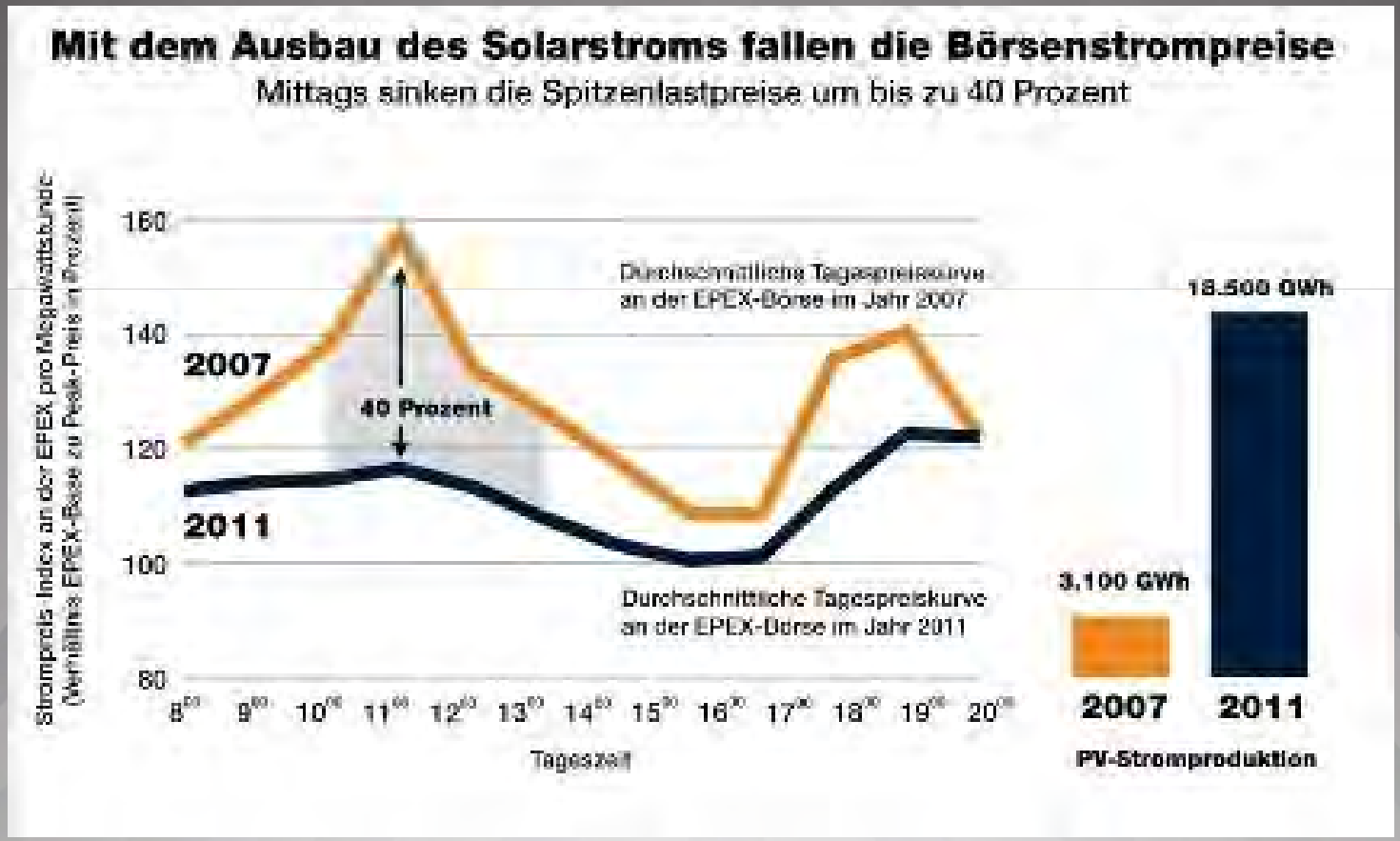
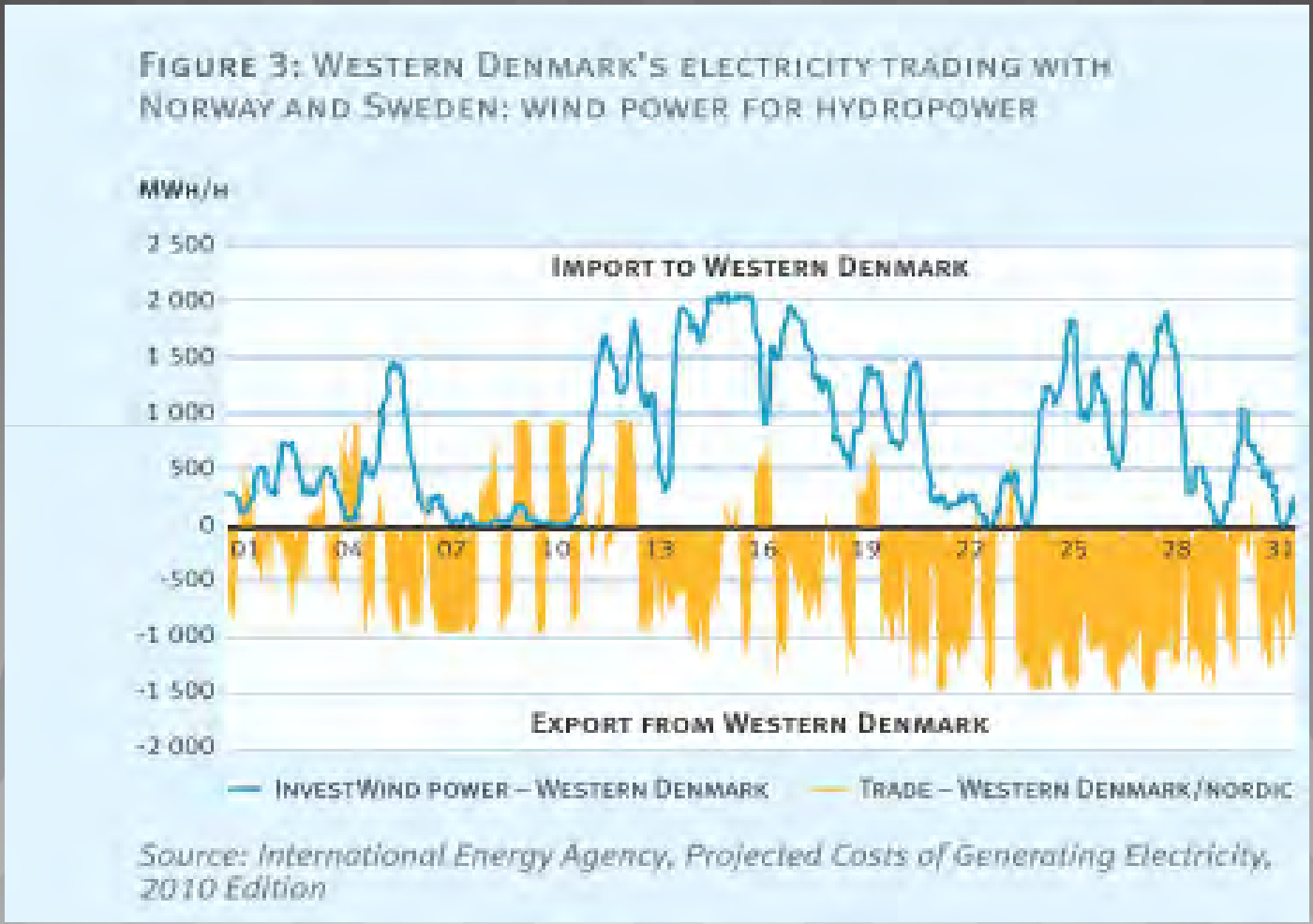
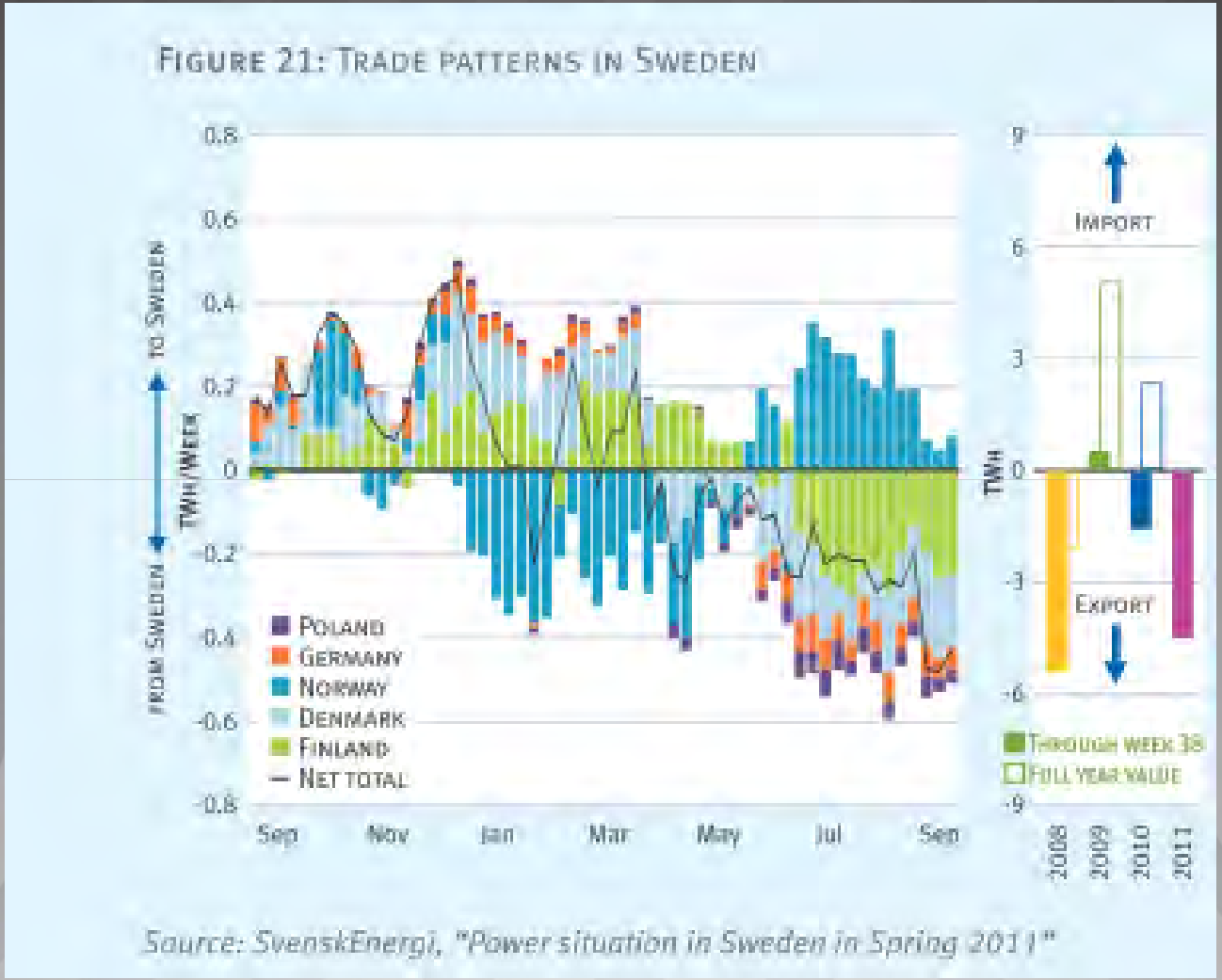


Operation



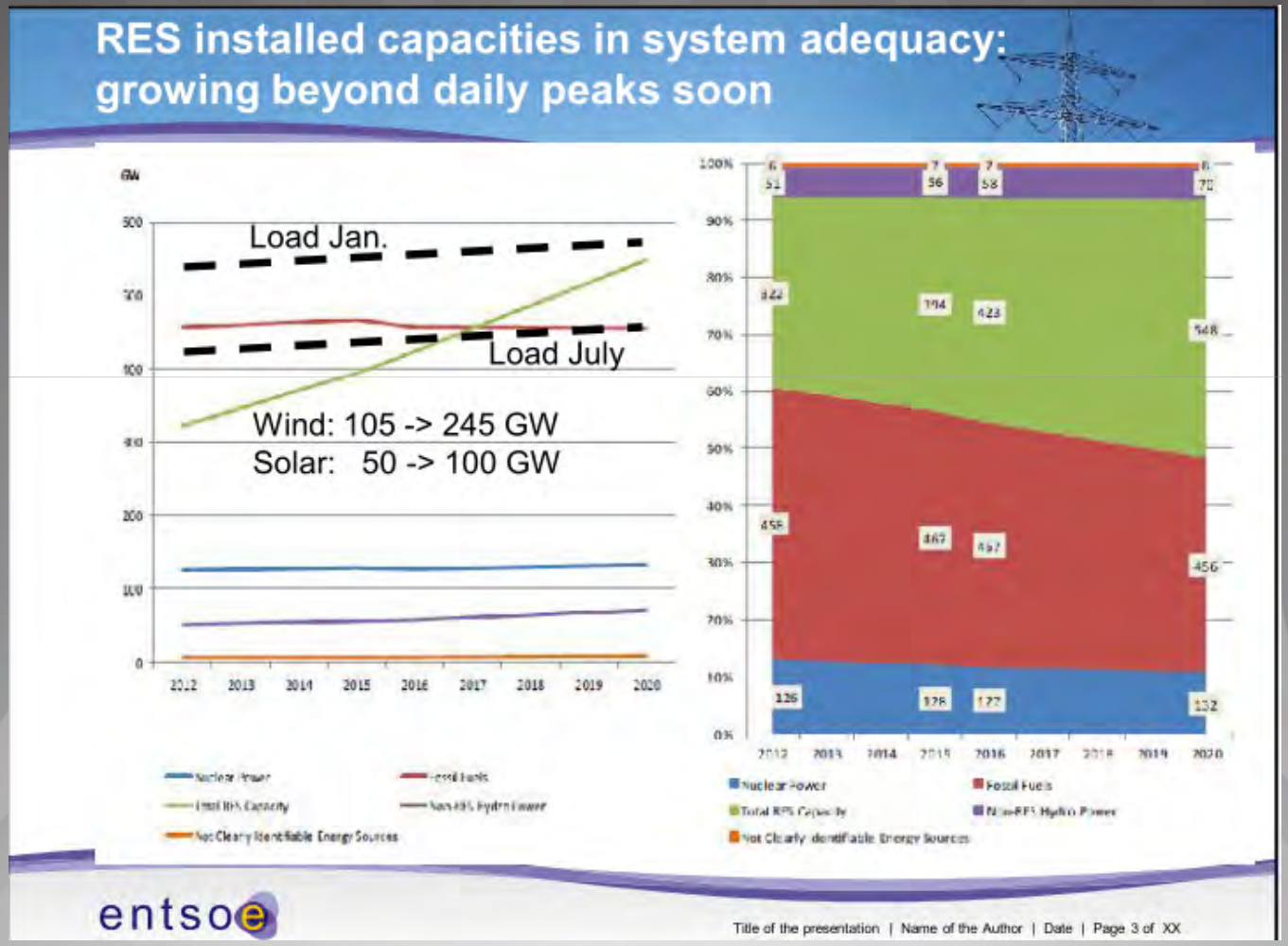
Source: Flexible Generation Report, Euroelectric 2012

Operation



Source: Flexible Generation Report, Euroelectric 2012

Operation


RES installed capacities in system adequacy:
growing beyond daily peaks soon
GW
Load Jan.
Load July
Wind: 105 -> 245 GW
Solar: 50 -> 100 GW
entsoe
Title of the presentation | Name of the Author | Date | Page 3 of XX

Operation

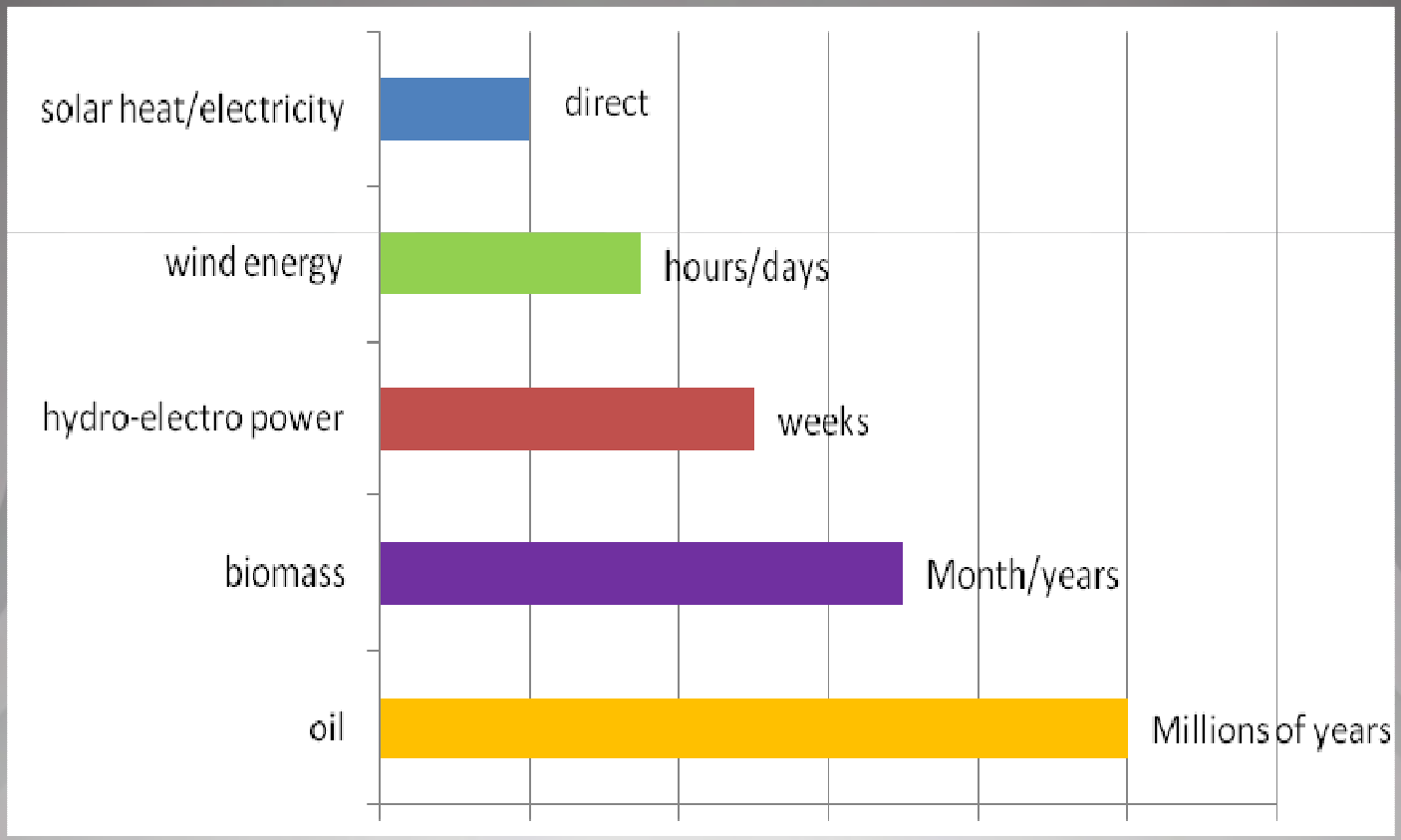
Appropriate renewable mix can almost make conventional base-load power plants needless.

The key is **flexibility**,

Which will allow the distribution/transmission companies to buy the cheapest energy, available at any particular moment.

Primary energy: Everything we us, comes from the Sun

Energy sustainability demands the use of the resources with the same speed as they are created by the nature…or far lower speed.



A few minutes for questions and comments

“The future has already arrived. It's just not evenly distributed yet.”

William Gibson (founder of the concept “cyberspace”)

Thank you for your attention!

Vassil Petev
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