Load Management with Demand-Side Management, an overview.

IEA Demand Side Management Task XVI Competitive Energy Services (Energy-Contracting, ESCo Services) & Task XVII Integration of Demand Side Management, Distributed Generation, Renewable Energy Sources and Energy Storages

Rob Kool

Chair IA DSM/EGRD, Manager NL Agency

This presentation

- Technology Implementing Agreements
- “World” of IA Demand Side Management & Strategy
- The simple problem
- The more complex reality
- Load Management: Present work & some results
  - Esco’s
  - Integration of DSM
- Summary
- Q&A

IEA & Electricity: Technology Implementing Agreements

- Energy End-Use party
  - Electricity Workinggroup “coordinates”
    - Enard (Electricity Networks Analysis, Research & Development)
    - ISGAN (International Smart Grid Action Network)
    - DSM (Demand Side Management)
      - Load Shape Cluster
      - Load Level Cluster
    - Wind
    - Hydrogen
    - High-Temperature Superconductivity (HTS) on the Electric Power Sector
    - Hybrid and Electric Vehicles

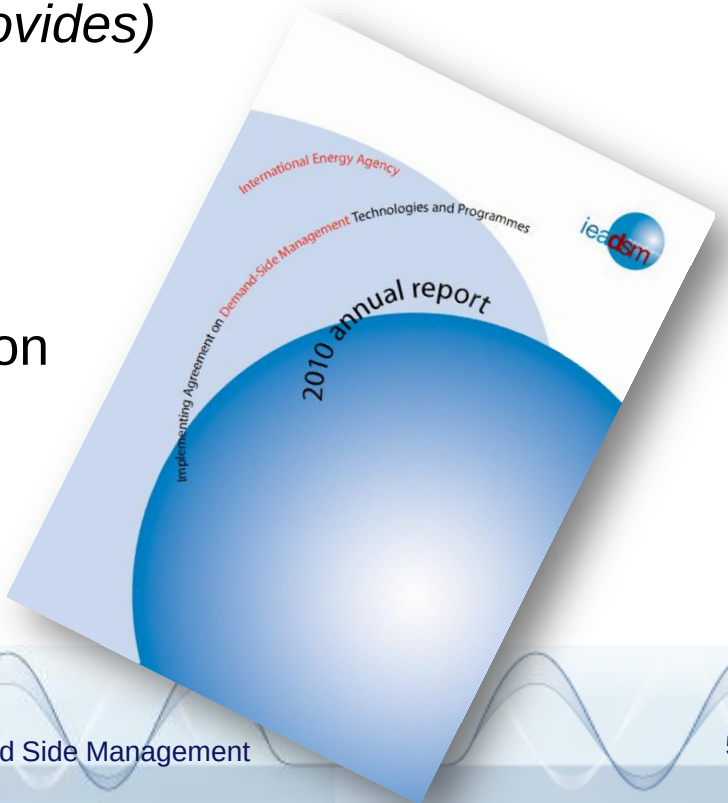
The strategy of the IEA DSM Programme

- Vision: Demand side activities should be the first choice in all energy policy decisions designed to create more reliable and more sustainable energy systems.

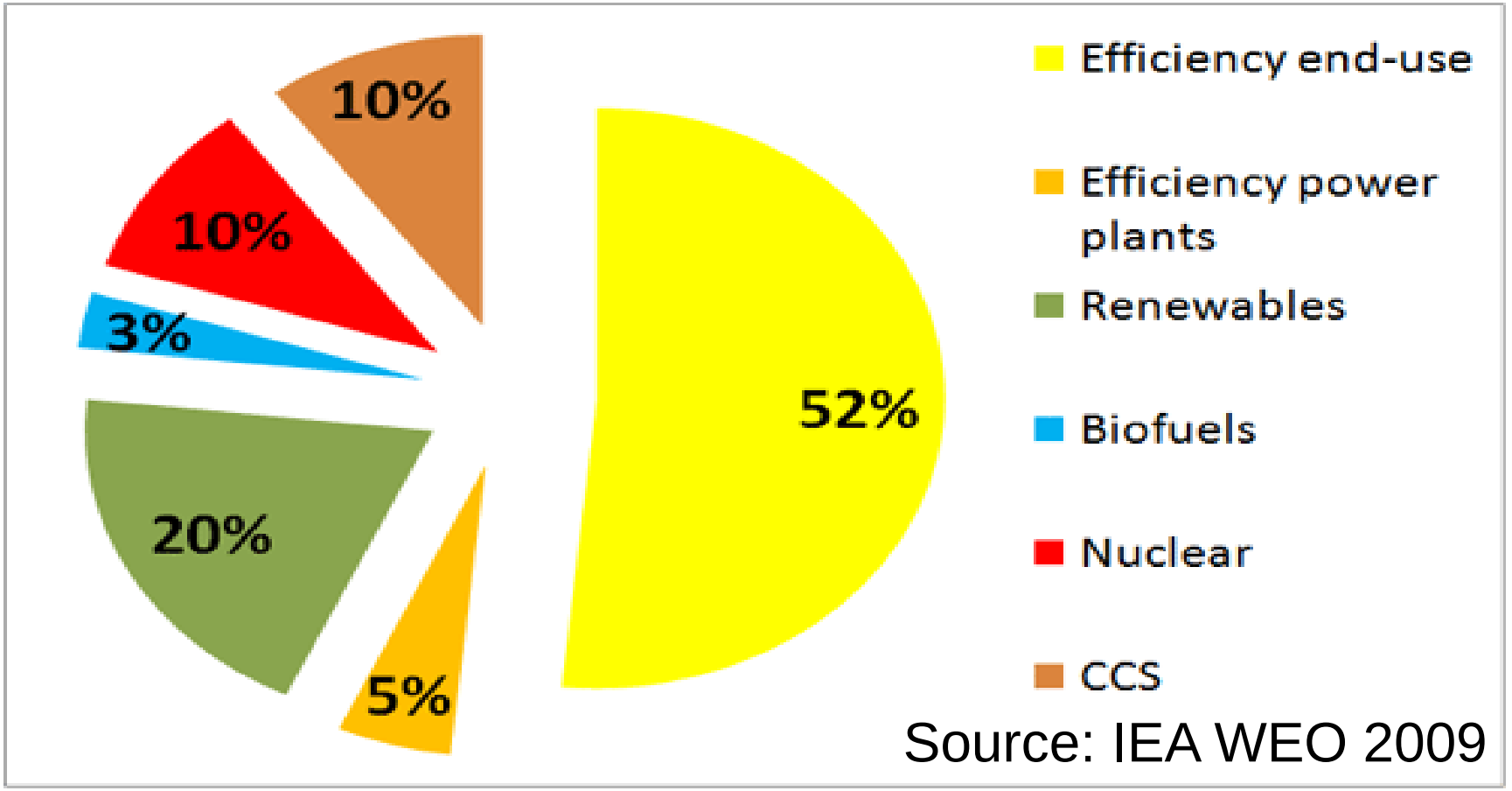
- Mission: To deliver to our stakeholders useful information and effective guidance for crafting and implementing DSM policies and measures, along with the necessary technologies and applications, which together can transform markets and facilitate energy system operations.

The simple problem: The issues!

- Load level
  - a wasteful demand requires too much supply for the specific needs *(The customer do not need energy! They need the service that energy, combined with an installation, provides)*
- Load shape
  - high peaks,
  - little reserve capacity,
  - bottlenecks in transmission and distribution
- Market responsibilities
  - who is the owner of the problem?



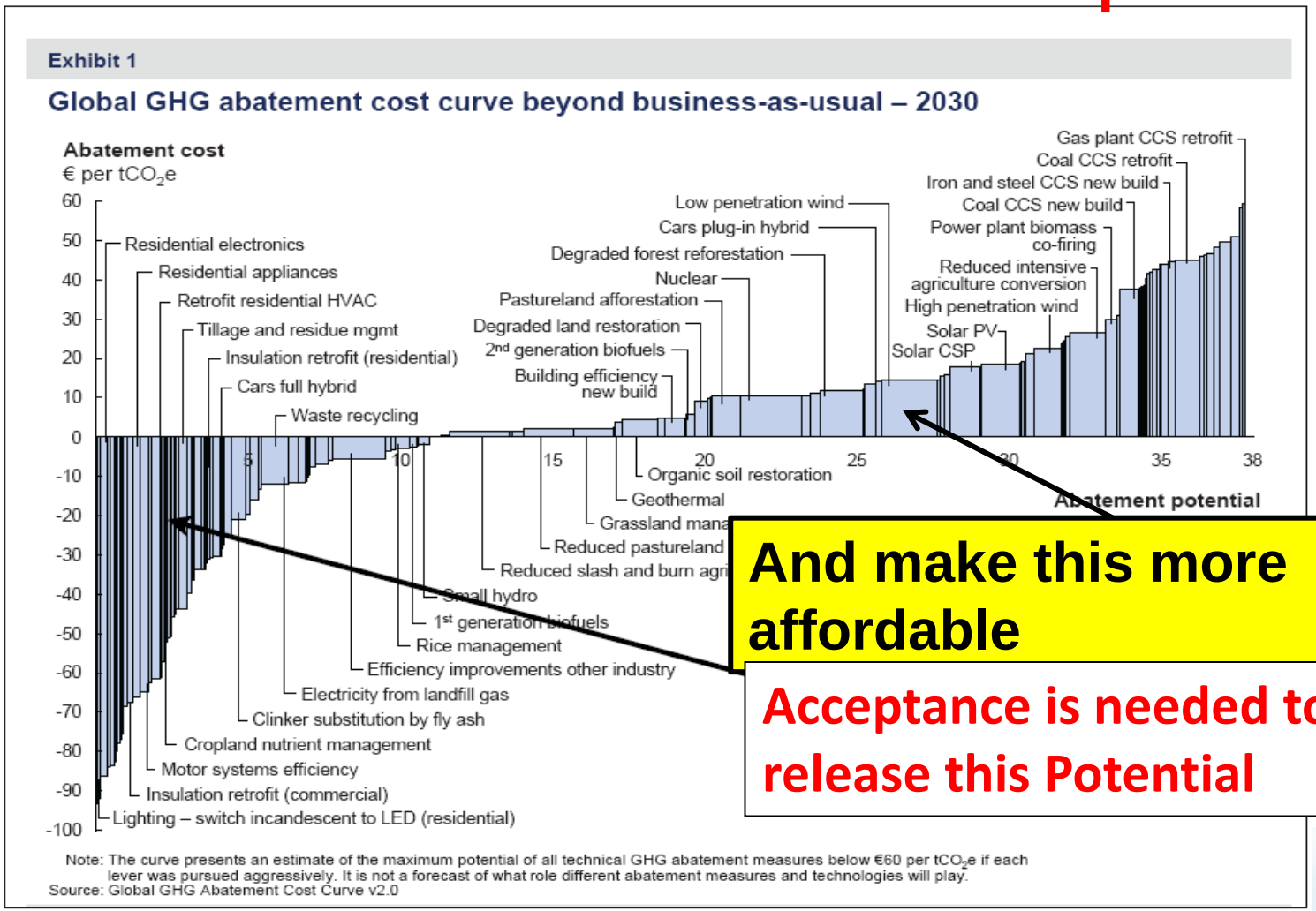
Source for GHG reductions till 2030



Source: IEA WEO 2009

Efficiency is under-utilized, since...

.... Result = Potential * Acceptance



And make this more affordable

Acceptance is needed to release this Potential

Load shape, simplified “Start of DSM”

Figure 1: Load Shape changes. (Adapted from Clark Gellings, speech made 1982)[5]

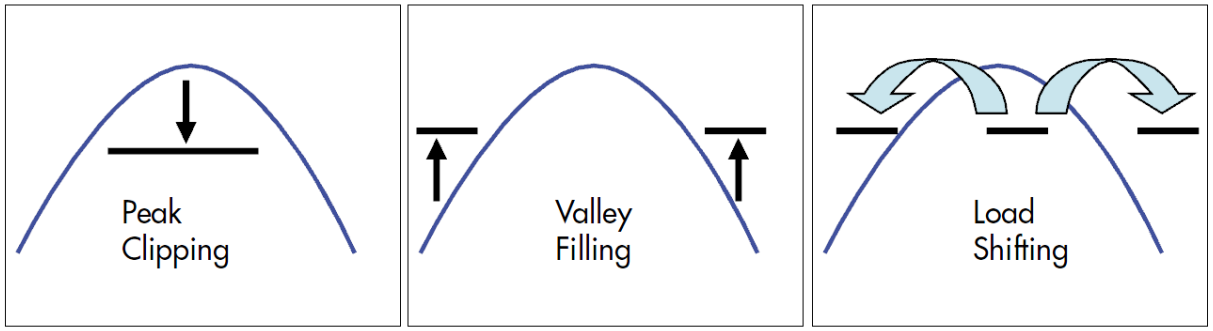


Table 1: Comparison between The IEA DSM-Programme tasks and the application “Load Management”[6]

VI	VII	VIII	IX	X	XI	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII
		■			■	■						■			■

	Current task
	Completed task
■	Most relevant for this application

Solution, over simplified

- Day – Night Tariff
- Real Time Pricing
- Shut down distribution

The more complex reality...

IEA DSM TASK XVII
Integration of Demand Side Management, Distributed Generation, Renewable Energy Sources and Energy Storages

Why Integration is Needed
When a country implements an energy policy to promote energy efficiency, distributed generation and renewable energy resources, the share of distributed energy will increase, including the intermittent energy sources such as wind, solar, small hydro and combined heat and power (small and micro-CHP). Due to the fact that intermittent types of electricity generation are difficult to predict, electrical networks and market are turning to integrated distributed energy resource as a solution. By combining distributed generation with energy storage and demand response, a country can decrease problems caused by distributed generation and increase the value of intermittent energy in the market.

How to integrate these components, however, is not an easy task. To begin to analyze how best to integrate distributed generation with energy storage and demand response, this new IEA DSM Task will undertake several activities.

Main Activities
The main objective of this Task is to study how to optimally integrate flexible demand (Demand Response, Demand Side Management) with Distributed Generation, Energy Storages and Smart Grids, thereby increasing the value of Demand Response, Demand Side Management and Distributed Generation and decreasing the problems caused by intermittent distributed generation. The Task will look at integration issues both at the local (distribution network and customer) level and at the transmission system level, for example where large wind farms are connected.

Subtasks
To conduct the work, Task XVII is divided into four Subtasks.

Subtask 1
This Subtask will analyze information on the characteristics of different types of Distributed Energy Resources (DER) in integrated solutions. The analysis will focus on integrated solutions where energy efficiency and demand response are combined (or seen possible to combine) with at least one of the following technologies—distributed generation, energy storage or smart grid technology aspects.

Subtask 2
This Subtask will prepare a synthesis report with preliminary conclusions. It will include the state-of-the-art on integration of DER at customer, network, system and market level; pilot and research projects and actual applications, technical and market impacts, and needed improvements to enhance integration.

Subtask 3
This Subtask will hold a workshop for stakeholders to collect additional information and feedback on the preliminary conclusions. Proceedings will be prepared from this workshop.

Subtask 4
This Subtask will focus on finalizing the synthesis report with integration-based solutions and examples of best practices and preparing a detailed work plan for any additional work needed.

Participants
Finland
Korea
Netherlands
Spain
United States

Other countries are welcome to join this Task.

Operating Agent
Seppo Kärkkäinen
VTT Technical Research Centre of Finland
Telephone: +358 20 722 6406
E-mail: seppo.karkkainen@vtt.fi

Task XVII Web Site
http://dsm-tcp.org/ViewTask.aspx?IDc=16&Task=17&Sort=0

The more complex reality: Load shape on national level

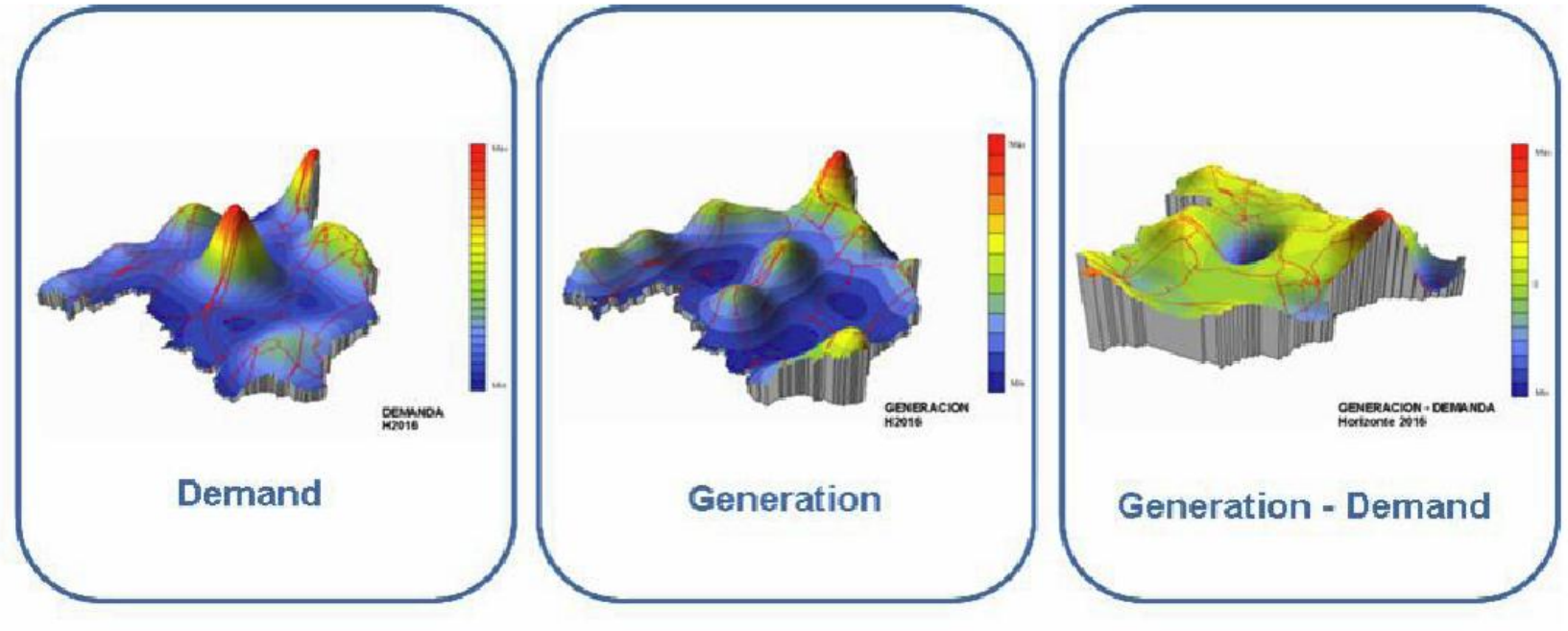


Figure : Demand and generation geographical distribution in Spain

The more complex reality: Load shape in Time

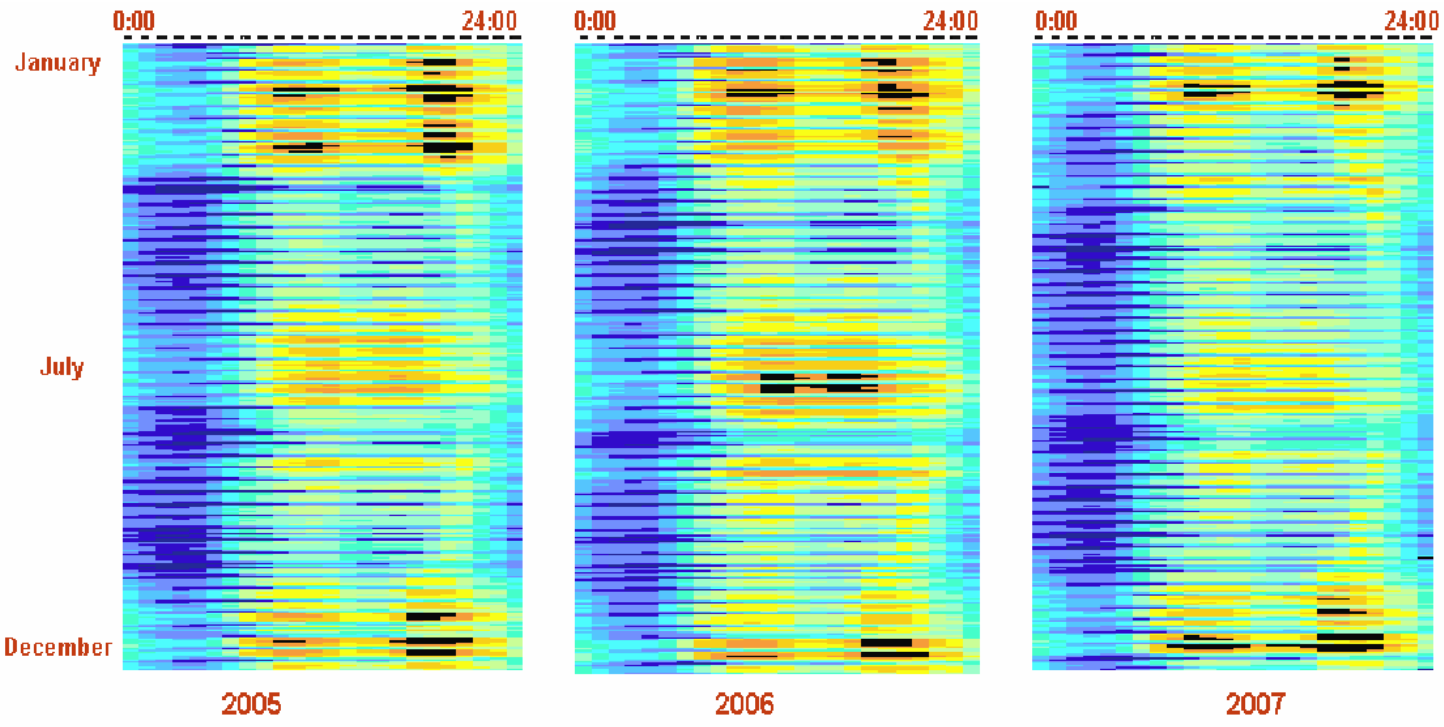
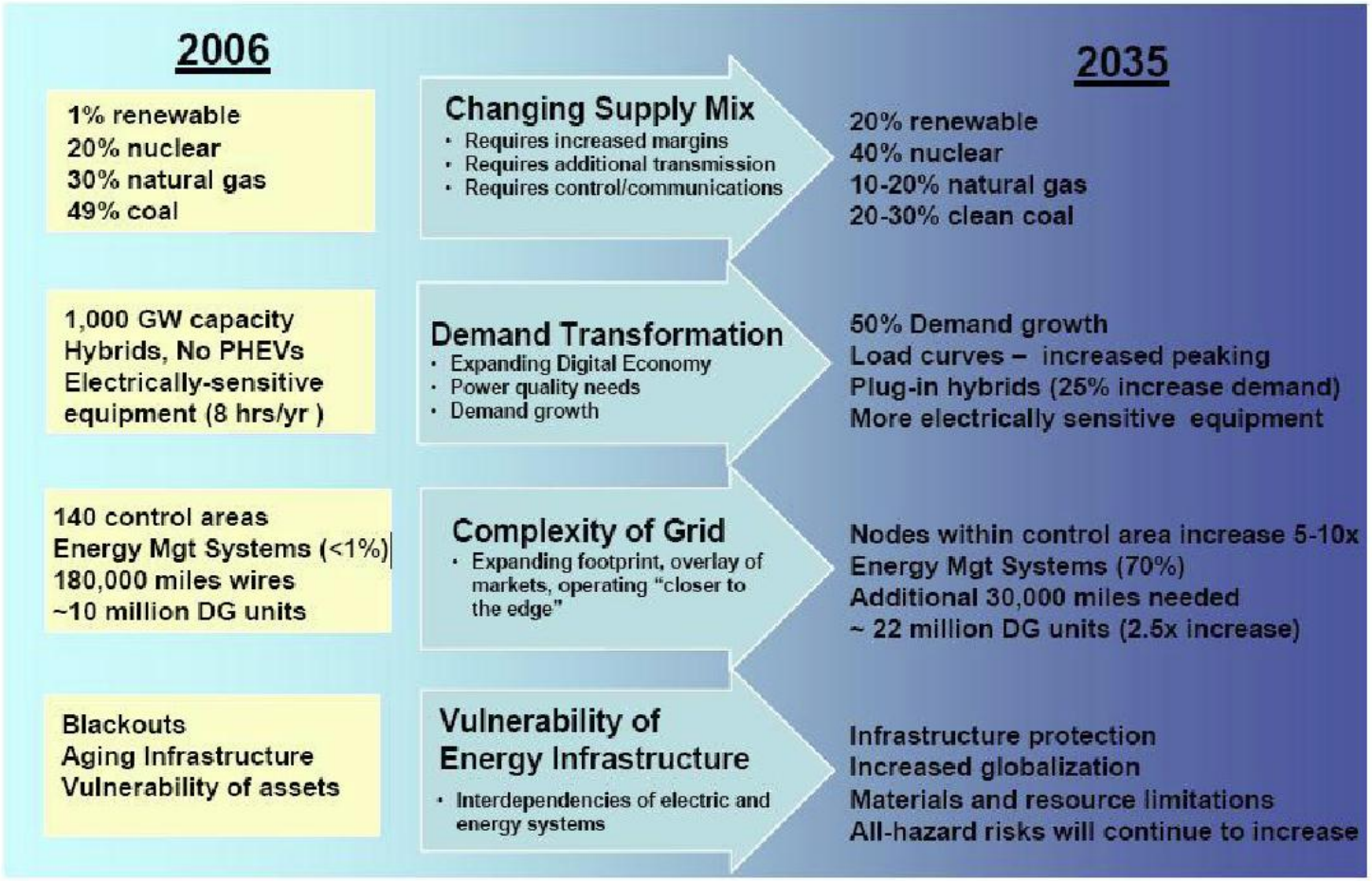


Figure 11: Demand peaks in Spain in 2005-2007

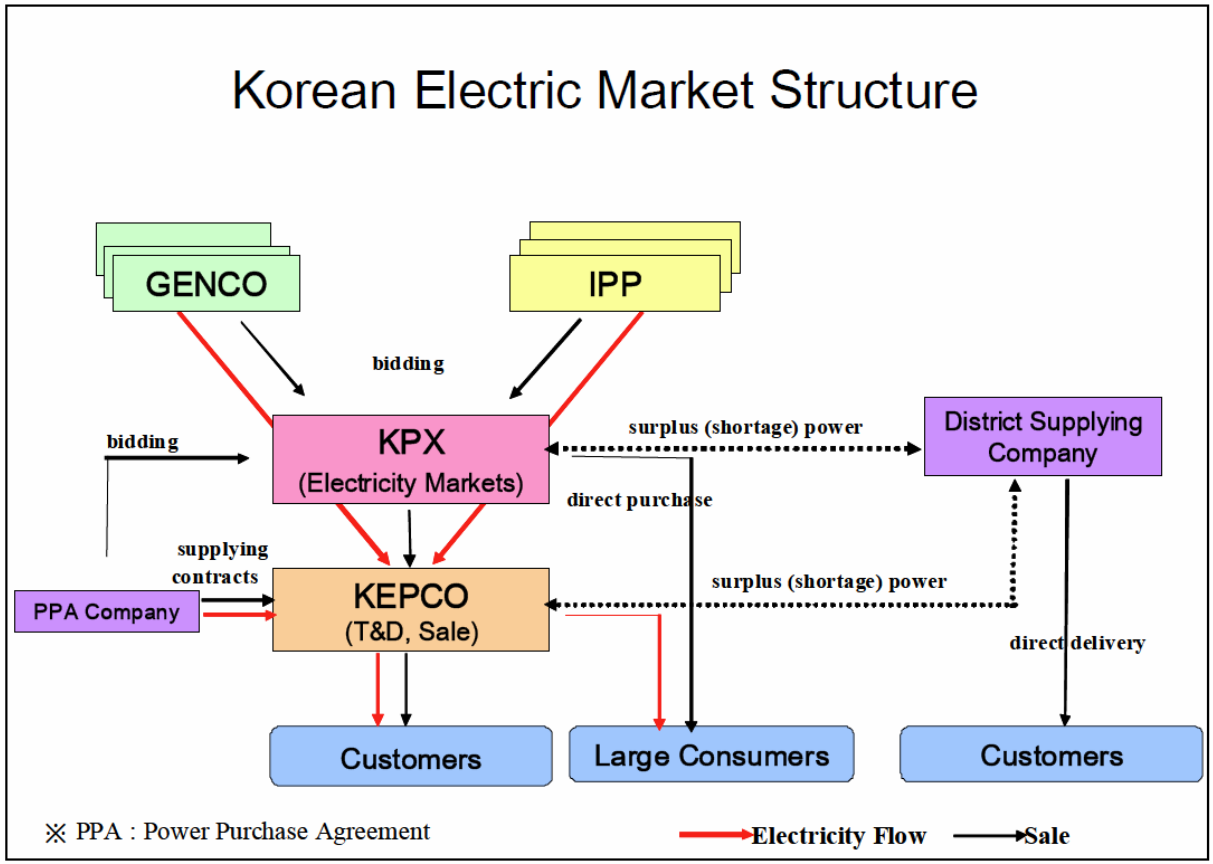
All these challenges create opportunities for the development of DG, RES and DR/DSM.

The more complex reality

Annex 7: Country report of USA



The more complex reality: Stakeholders

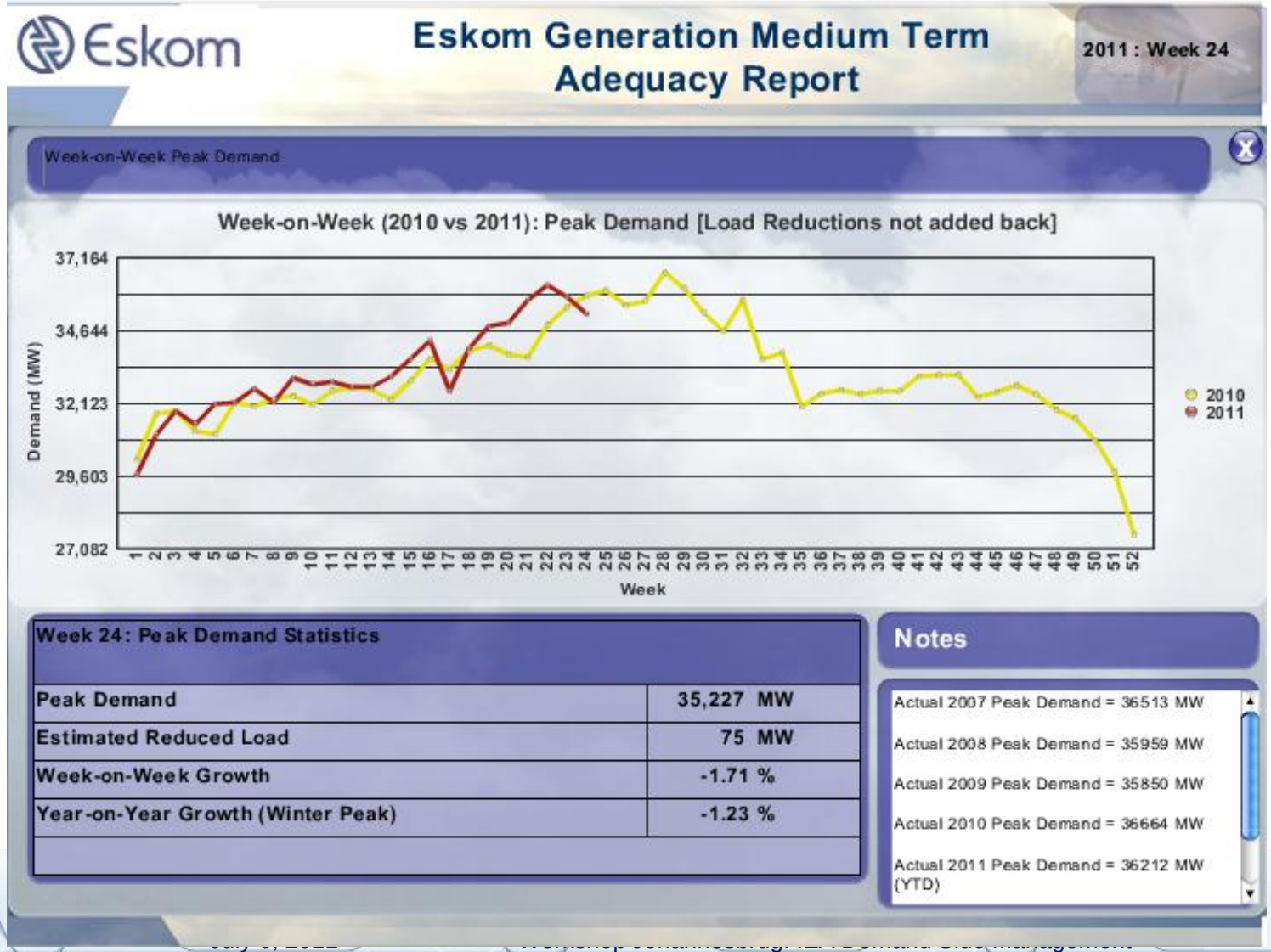


So demand side management is complex

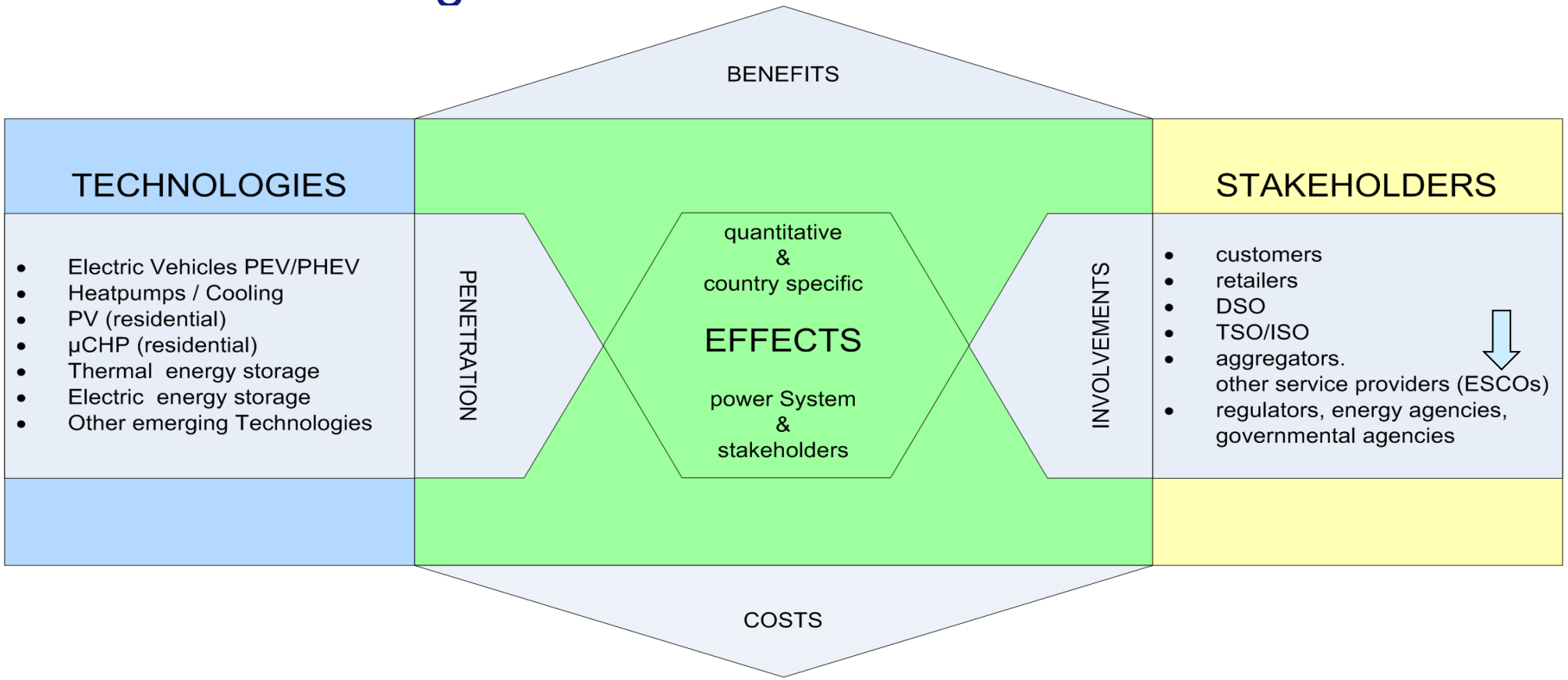
- Energy mix
- Design / age net
- Demand in time (sec. Min. Hour. Day etc...)
- Development of / Stakeholders in the energy market

- .....Every country is unique

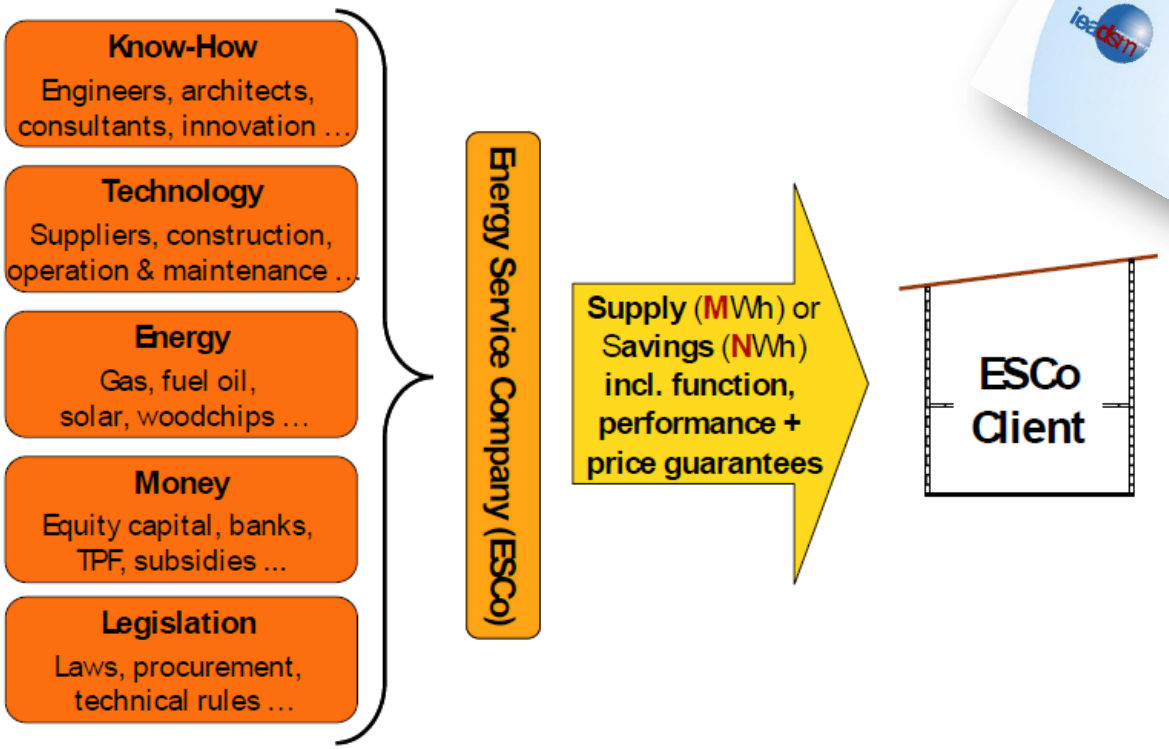
So demand side management is complex



Load Management: Present work & some results



Esco's (1/3)



Energy-Contracting: Components of service package and outsourcing of interfaces and guarantees to an ESCo

Esco's (2/3): Lessons learned

- Successful market development was demand side driven, meaning ESCo customers defined their needs and goals for energy service packages and put out request for proposals on the market.
- To foster market development, the role of independent market facilitators as mediators between ESCos and their (potential) clients has proved to be of great value.!
- Financing is not necessarily the core business of ESCos. Their core competence lies in technical, economic, and organizational matters. ESCos should serve as finance vehicle, not necessarily as financiers.

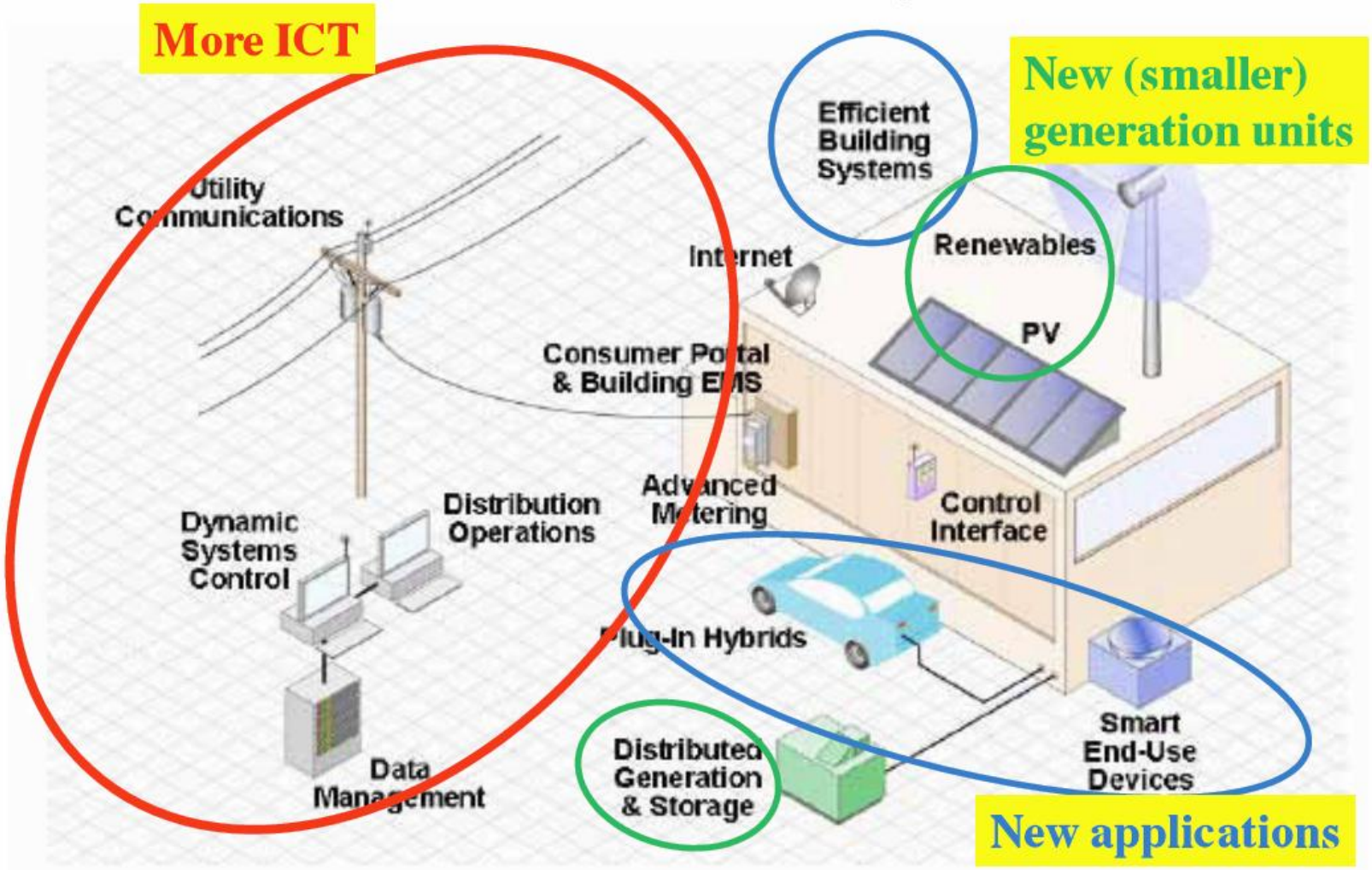
Esco’s (3/3): Lessons learned

- Energy-Contracting is a flexible and modular energy service package. This also implies the ESCo customer may define – depending on his or her own resources – what components of the energy service will be outsourced and which components he carries out himself.
- Energy efficiency improvements are not the driving force for many of the projects but rather a (beneficial) side effect.
- It is important to optimize investment decisions according to project (or better life) cycle cost and to ensure the results of the energy efficiency measures on a long-term basis.

Change Agents (companies, intermediaries, catalysts)

DSM-concept		Change agent role	Example
Classic (addressing utilities as they are)	Monopolised markets	Deliver products and services	Paradip Port (India)
	Customer aggregation	Fundraising	Public Benefit Charges (USA)
	Liberalised markets	Mandate utilities to achieve a set level of energy efficiency	White Certificates (Italy and some Australian states) and EE Commitment (UK)
Incentivising utilities to deliver energy efficiency		Decouple profit from sales volume	California Investor-owned Utilities
Energy Efficiency Power Station		Aggregate energy efficiency projects to the scale of a virtual power plant	Jiangsu, Shanghai and Guangdong (China) Efficiency Vermont
Government Deployment schemes		Aggregation of purchasing power	FEMP (USA), Technology procurement (Sweden)

New Technologies



Source: An EPRI Initiative to Advance the Efficient and Effective Use of Energy

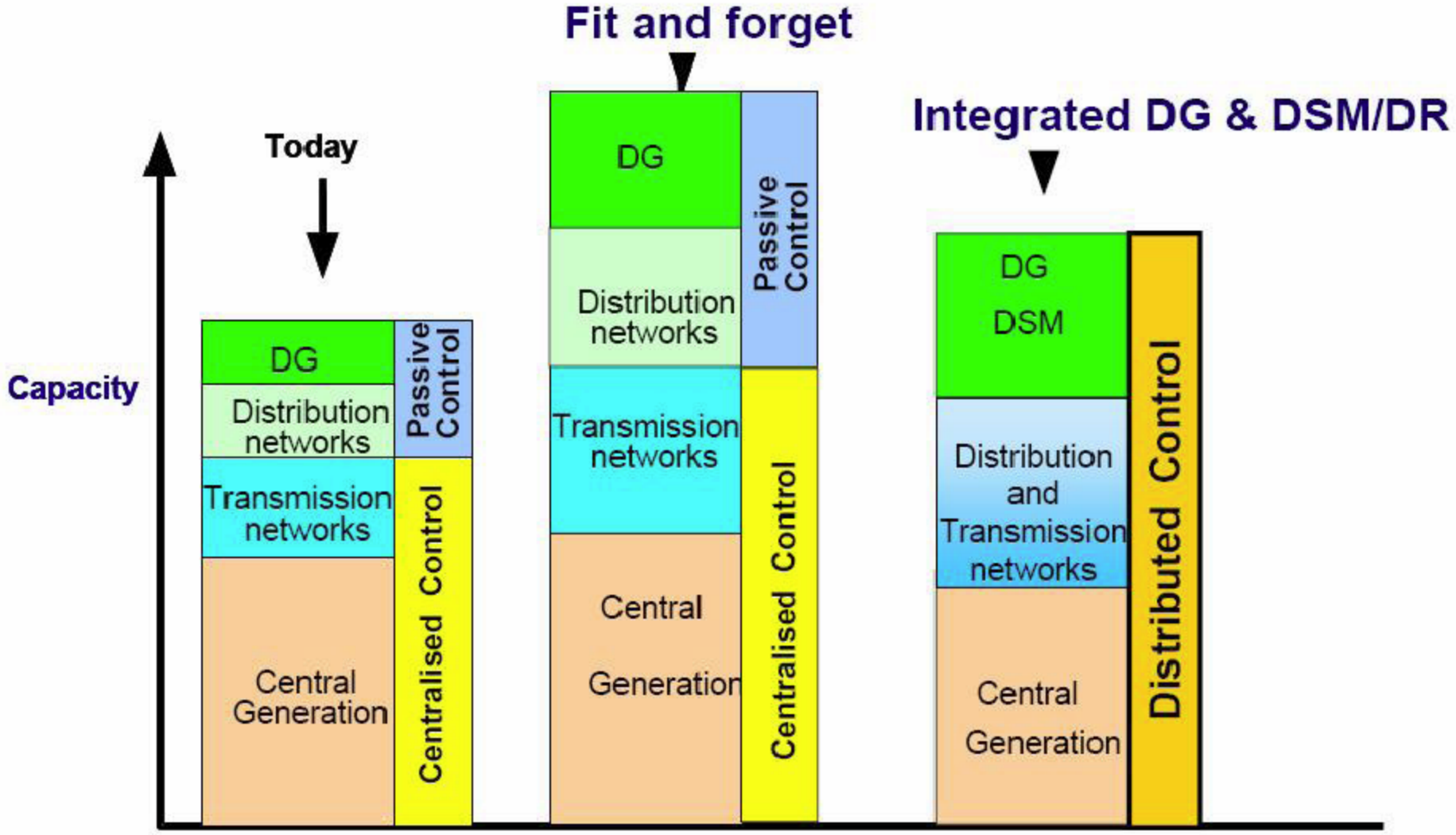
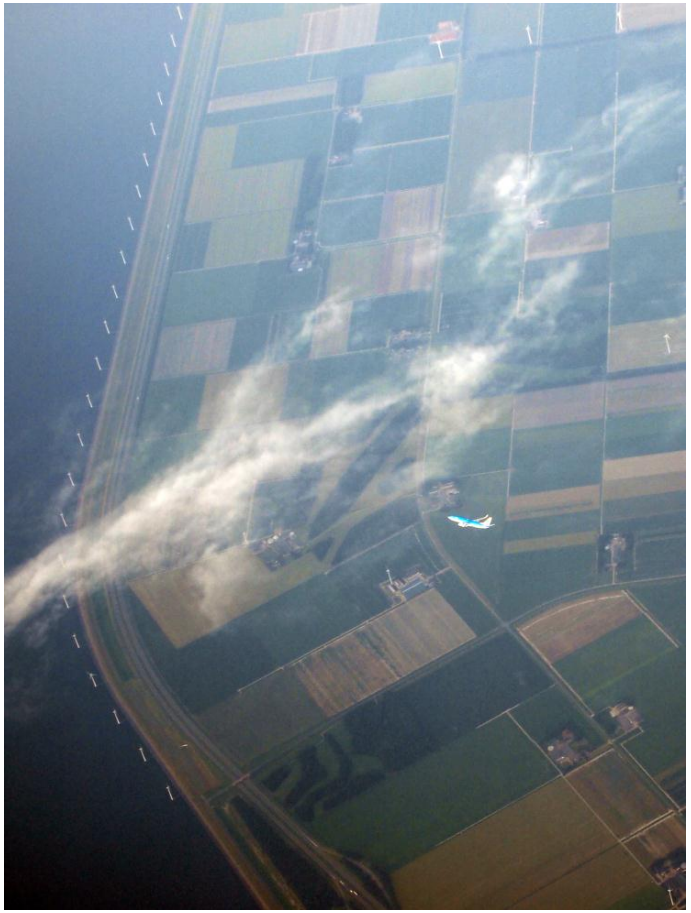


Figure 3. Impact of a smart grid on the need for energy system capacity. Two basic alternatives for the future electric systems: "Fit and forget" and "Integrated DG&DSM/DR" (Distributed Generation, Demand Side Managment/Demand Response

Links:

- Comprehensive overview on South Africa energy policy: http://www.erc.uct.ac.za/Research/publications/06Winkler-Energy%20policies%20for%20SD.pdf
- www.ieadsm.org

Thank you!



Q&A?

Past, Present and Future Tasks

		Business interest in DSM	
Status of Task		**Peak Load**	**Load Level**
Past, Present and Future IEA DSM-Programme tasks Further information on the activities can be found at www.ieadsm.org .	Completed	**Task II:** Communications Technologies for Demand-Side Management **Task VIII:** Demand-Side Bidding in a Competitive Electricity Market **Task XI:** Time of Use Pricing and Energy Use for Demand Management Delivery **Task XIII:** Demand Response Resources **Task XV:** Network-driven DSM	**Task I:** Subtask 9 – Evaluation Guidebook on the impact of DSM and Energy Efficiency Programmes **Task III:** Technology procurement **Task V:** Marketing of Energy Efficiency **Task VI:** Mechanisms for Promoting DSM and Energy Efficiency in Changing Electricity Businesses **Task VII:** Market Transformation **Task IX:** The Role of Municipalities in a Liberalised System **Task X:** Performance Contracting **Task XIV:** Market Mechanisms for White Certificates Trading
	Current	**Task XVII:** Integration of Demand Side Management, Energy Efficiency, Distributed Generation and Renewable Energy Sources **Task XIX:** Micro Demand Response and Energy Saving **Task XXIII:** Role of the Demand Side in delivering effective smart grids	**Task XVI:** Competitive Energy Services **Task XVIII:** Demand Side Management and Climate Change **Task XX:** Branding of Energy Efficiency **Task XXI:** Standardisation of Energy Efficiency Calculations **Task XXII:** Energy Efficiency Portfolio Standards
	Proposed		- **DSM University** - **DSM from theory to practices**

Integration of Demand Side Management, Distributed Generation, Renewable Energy Sources and Energy Storages

- study how to achieve the optimal integration of flexible demand with Distributed Generation, energy storages and Smart Grids,
- increase the value of Demand Response, Demand Side Management and Distributed Generation
- decrease problems caused by intermittent distributed generation (mainly based on RES) in the physical electricity systems and at the electricity market
- provide integration based solutions and examples on successful best practices to the problems defined above.

Assessment the effects of the penetration of emerging DER technologies to different stakeholders and to the whole electricity system

The emerging DER technologies in Task XVII discussed include:

- plug-in electric and hybrid electric vehicles (PEV/PHEV)
- different types of heat pumps for heating and cooling
- photovoltaic at customer premises
- micro-CHP at customer premises
- energy storages (thermal/electricity) in the connection of previous technologies
- Other technologies seen feasible in 10 – 20 years period
  - Smart metering,
  - emerging ICT
  - (and perhaps wind power at customer premises).