



S M A R T G R I D S

# Overview of SmartGrids

## European Technology Platform

**Dr. Christian Sasse**

**Tavrída Electric North America**

**Managing Director**

**[chs@tavrida-na.com](mailto:chs@tavrida-na.com)**

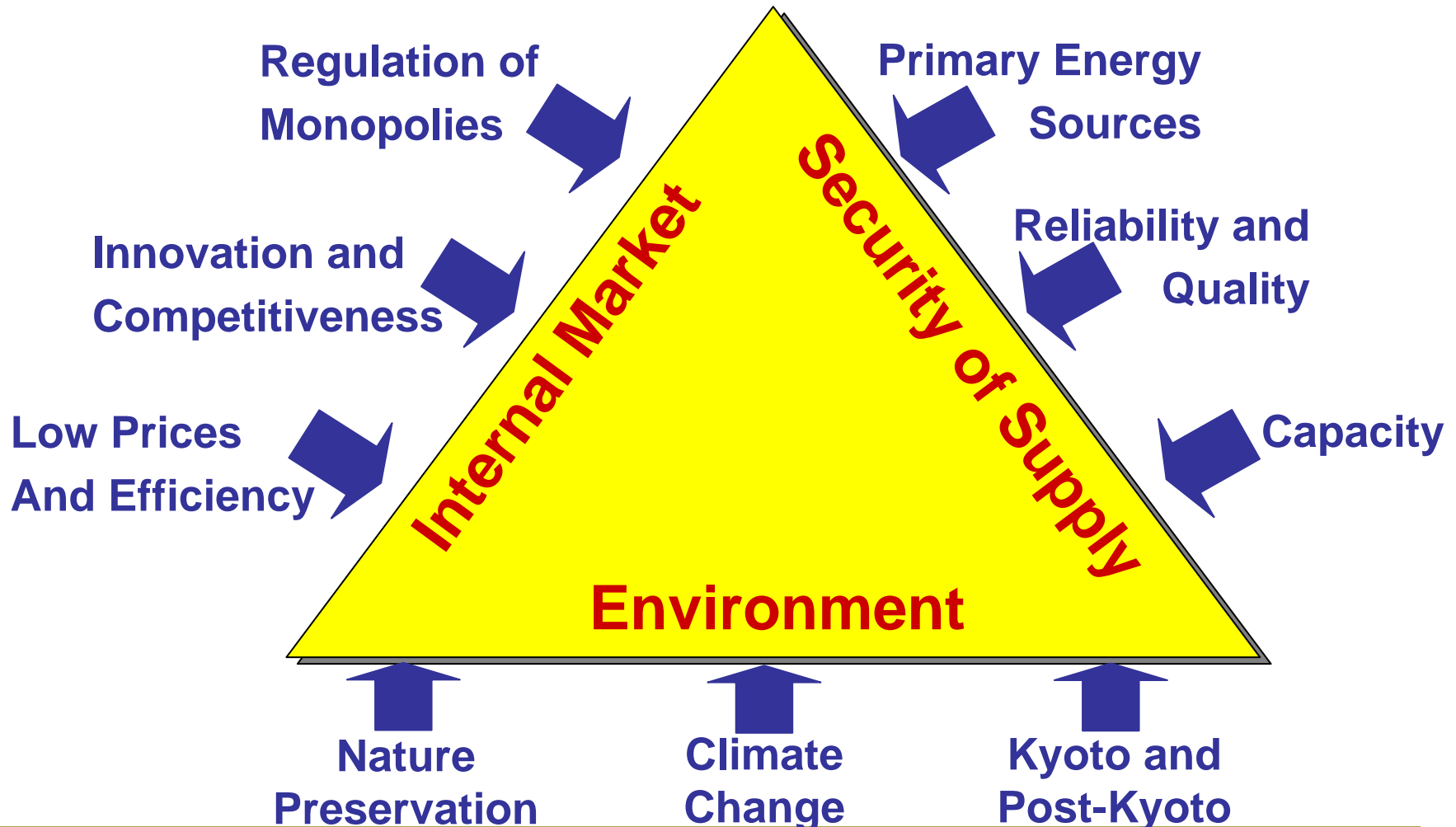
# SmartGrids

---

## Agenda for Today

- 1. Why SmartGrids?**
- 2. Networks today**
- 3. Networks tomorrow**
- 4. Model for SmartGrids**
- 5. Enabling technologies**
- 6. Some examples**

# Drivers towards SmartGrids



# Why SmartGrids?

Interoperable European  
Electricity Networks

Networks  
renewal

**User-centric  
Stakeholder  
ownership**

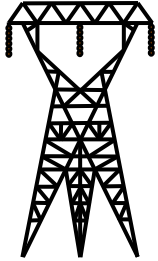
Liberalised  
markets

Distributed  
and central  
generation

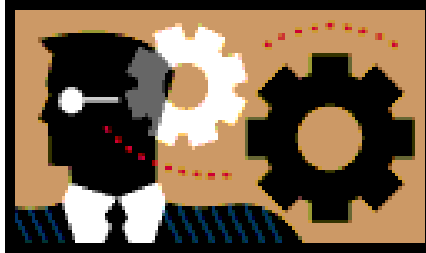
Demand  
response

Environmental  
policy

# The Stakeholders



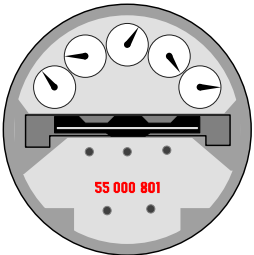
Network companies



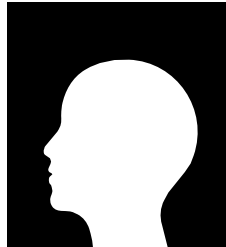
Technology providers



Researchers



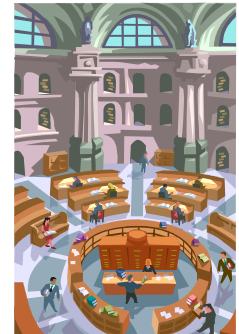
Energy service providers



Users



Regulators



Governmental agencies



Traders



Generators

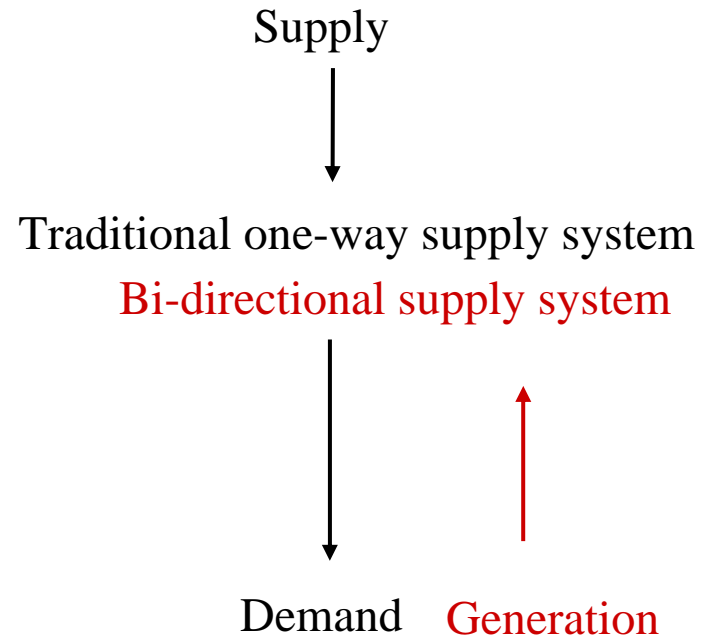
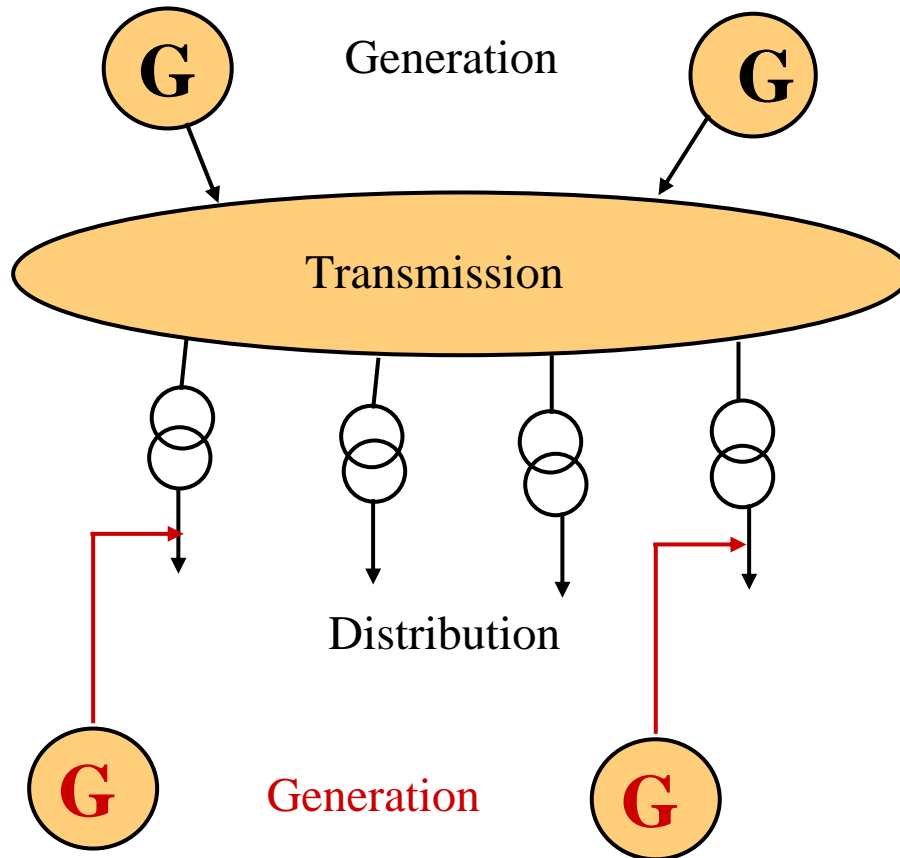
# SmartGrids

---

## Agenda for Today

- 1. Why SmartGrids?**
- 2. Networks today**
- 3. Networks tomorrow**
- 4. Model for SmartGrids**
- 5. Enabling technologies**
- 6. Some examples**

# Networks Today

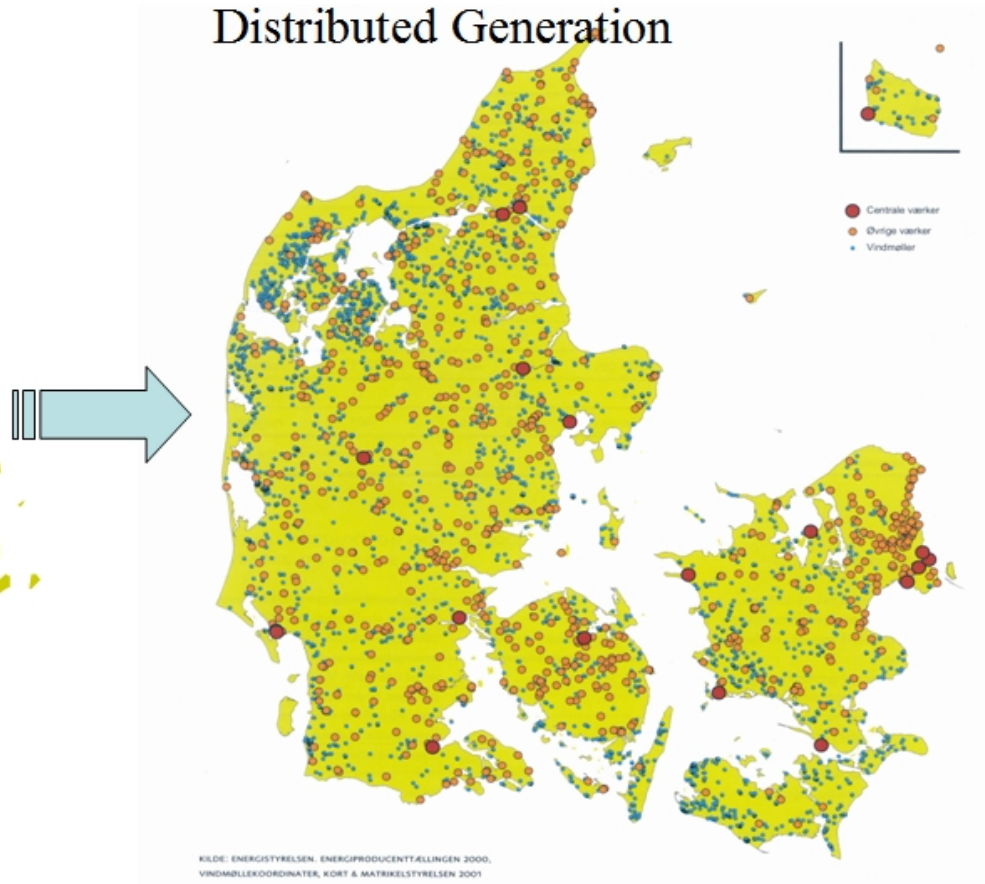


# Wind Generation: Denmark

Centralised Generation

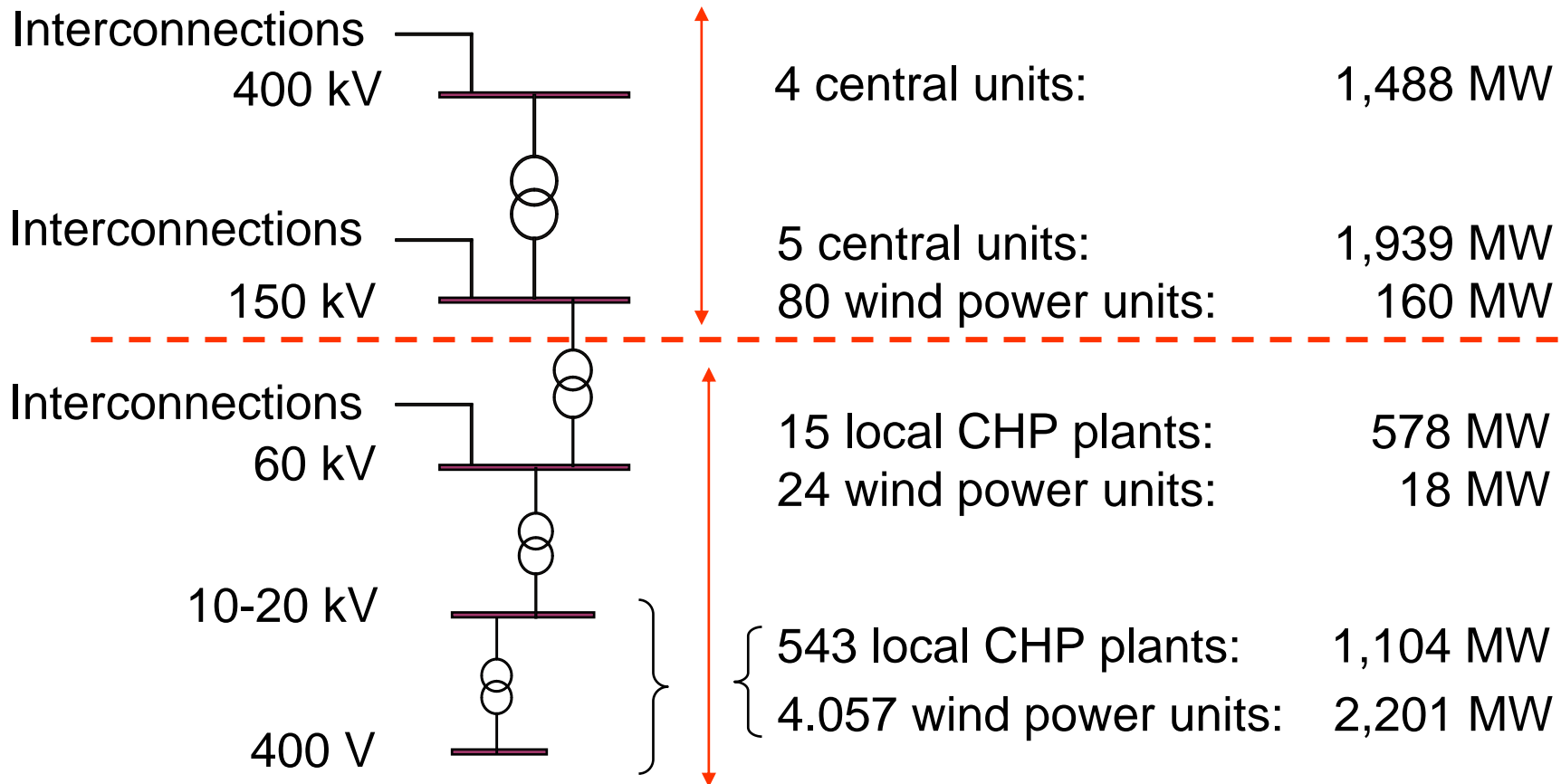


Distributed Generation



# Example: Danish Grid (West)

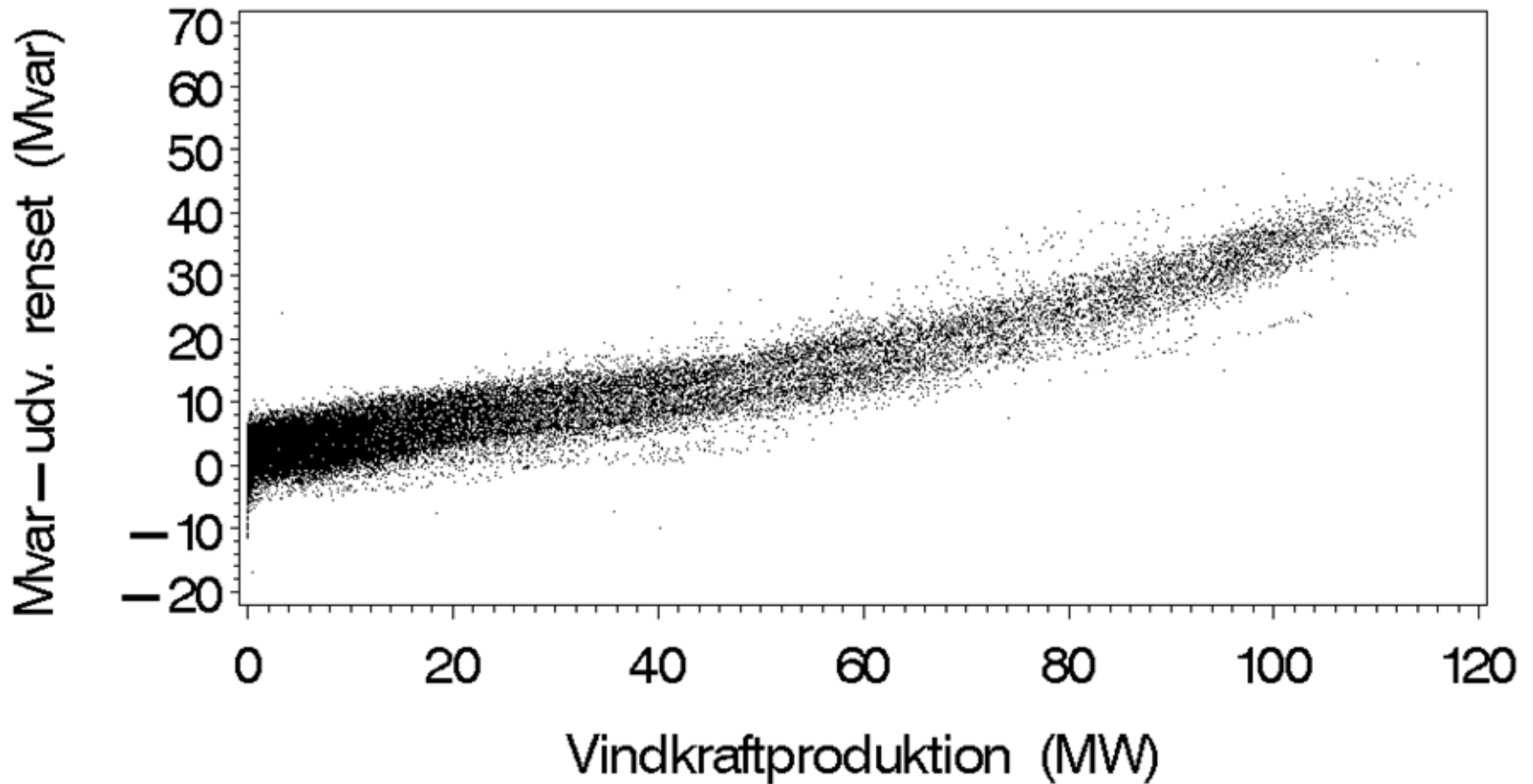
## Range of central control



## Non-dispatchable and beyond central control

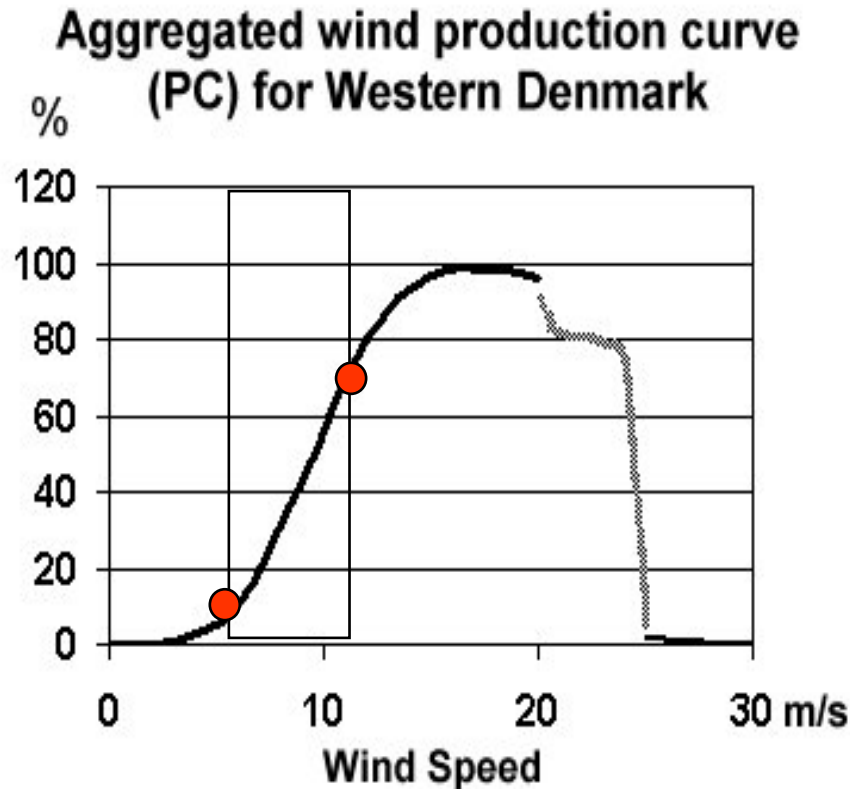
# Example: Danish Grid

## Reactive Power Demand



DEFU, 2004-06-07

# Big Errors in Wind Power Forecasting



***“Fresh breeze”  
means somewhere  
between 200  
and 1,600 MW***

- ▶ A deviation of just  $\pm 1$  m/s may have an impact of  $\pm 320$  MW (With a 2,374 MW installed base).

▶ [EltraVKort\EltraVKort.html](#)

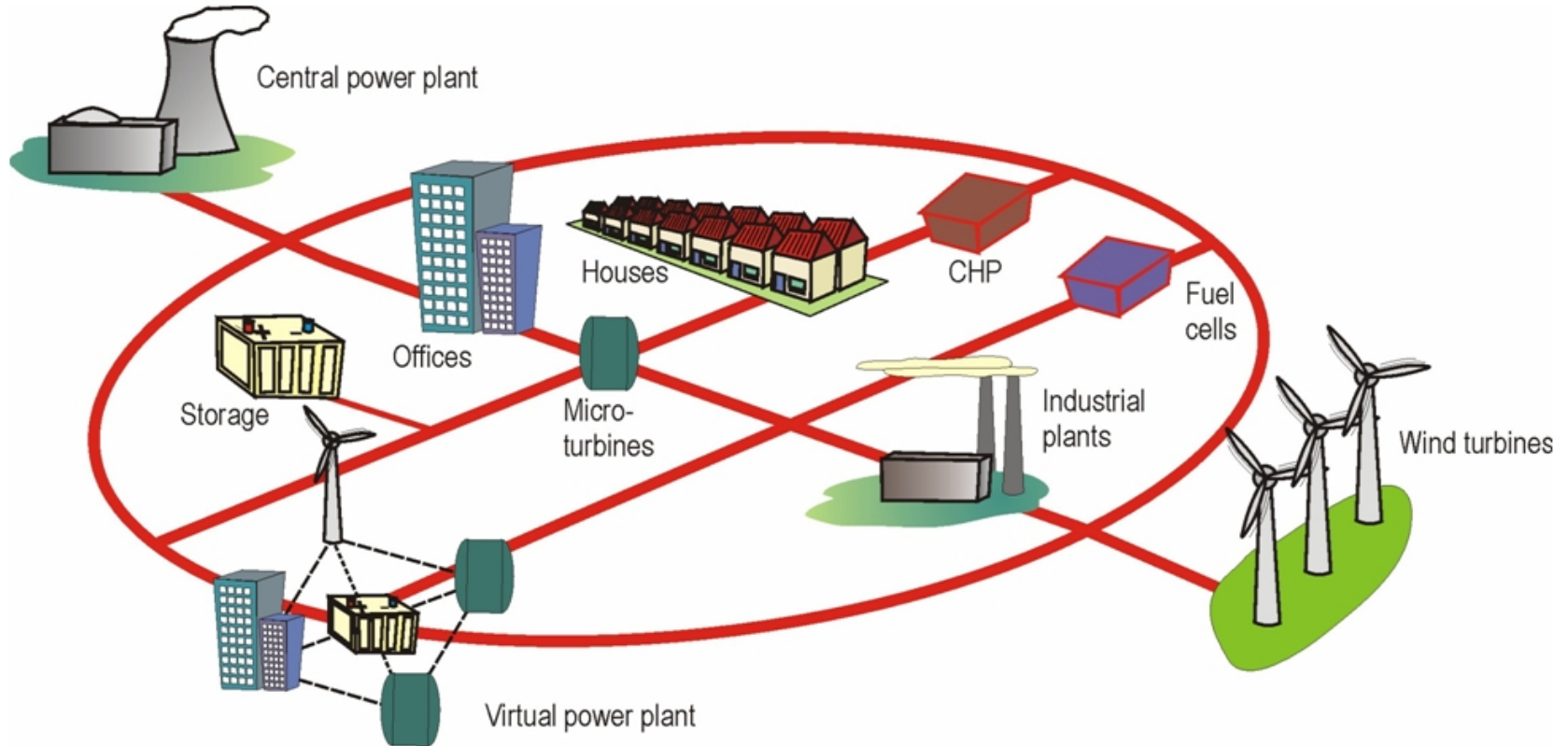
# SmartGrids

---

## Agenda for Today

1. Why SmartGrids?
2. Networks today
3. Networks tomorrow
4. Model for SmartGrids
5. Enabling technologies
6. Some examples

# Networks Tomorrow



# EU investment until 2030: One trillion €

---

## □ Demand

- Growth 2%/year = +1250 TWh by 2030

## □ Generation

- Replacement & expansion 900 GW needed by 2030
- RES 500 GWpeak needed by 2030

## □ Transmission & Distribution

- Ageing assets, expansion and RES+DG integration
- 500 billion € until 2030 needed

## □ Markets & Regulation

- Data + information need > 20 billion € investment  
(conservative figure based on 100€ per connection)

# We are not the only ones

## China

### 2006

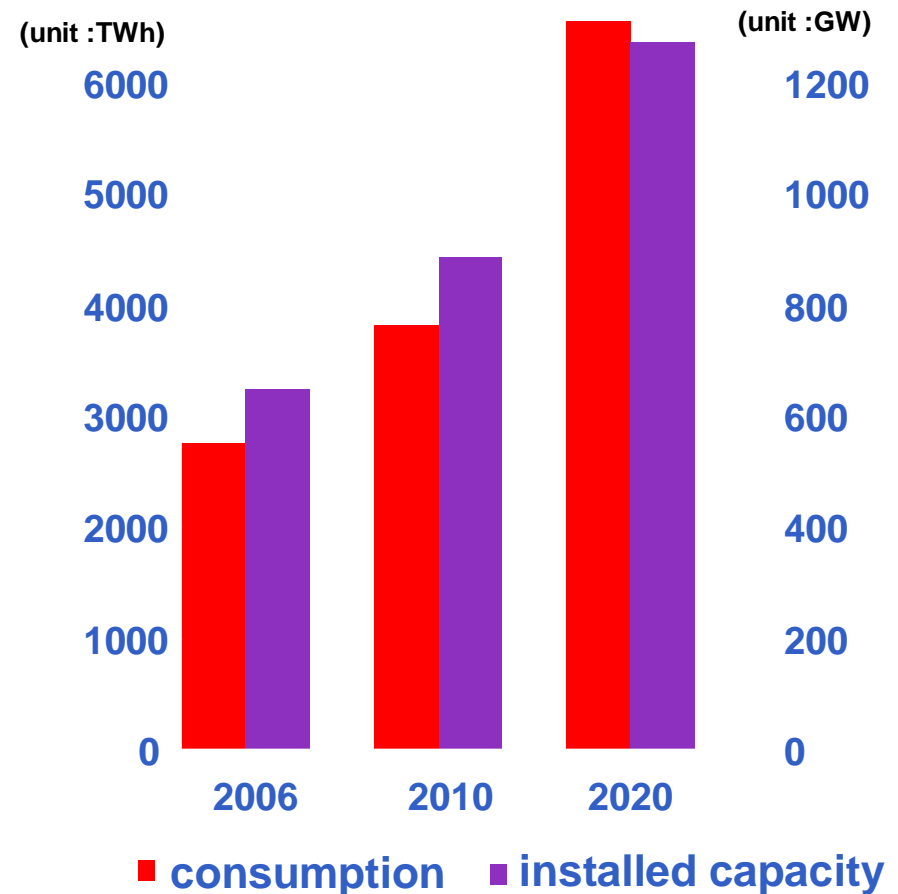
622 GW Installed capacity  
2820 TWh Consumption

### 2010

860 GW Installed capacity  
3810 TWh Consumption

### 2020

1320 GW Installed capacity  
6580 TWh Consumption



# Future Network Vision



# SmartGrids

---

## Agenda for Today

1. Why SmartGrids?
2. Networks today
3. Networks tomorrow
4. Model for SmartGrids
5. Enabling technologies
6. Some examples



# A Model for SmartGrids

- There are real technical challenges
- They are solved or solvable
- But technology alone is not enough

Technology

- Market frameworks may not facilitate innovative solutions
- Attention to intellectual property
- Export opportunities

Commercial

- Regulatory frameworks may have unintended barriers to innovation
- New thinking takes time to implement

Regulation

- Innovation needs wide deployment
- But supply chains have limited capacity
- Manufacturing, raw material, services and skills

Supply Chain

- Standards and protocols underpin open systems
- A Plug & Play approach is needed
- But there are no quick changes here

Standards

**SmartGrids**  
Making  
Smart Connections  
Enabling  
Smart Choices

Demonstration

- Demonstration/pilot projects are key
- Operational proving is a critical step
- Beware the Valley of Death.....



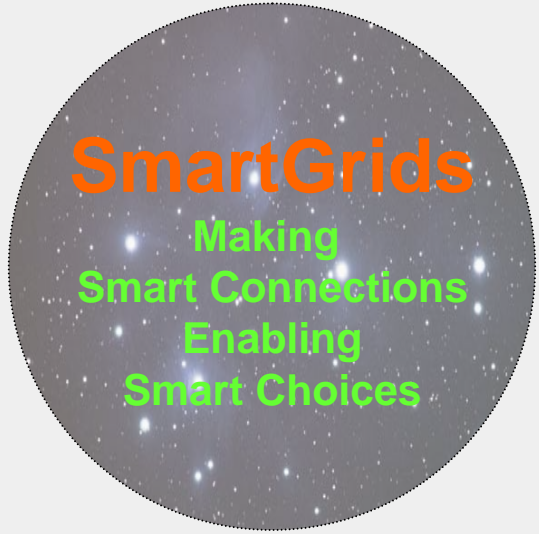
# A Model for SmartGrids

- There are real technical challenges
- They are solvable by good research
- But technology alone is not enough

Technology

- Market frameworks may not facilitate innovative solutions
- Attention to intellectual property
- Export opportunities

Commercial



Regulation

- Regulatory frameworks may have unintended barriers to innovation
- New thinking takes time to implement

- Innovation needs wide deployment
- But supply chains have limited capacity
- Manufacturing, raw material, services and skills

Supply Chain

Standards

- Standards and protocols underpin open systems
- A Plug & Play approach is needed
- But there are no quick changes here

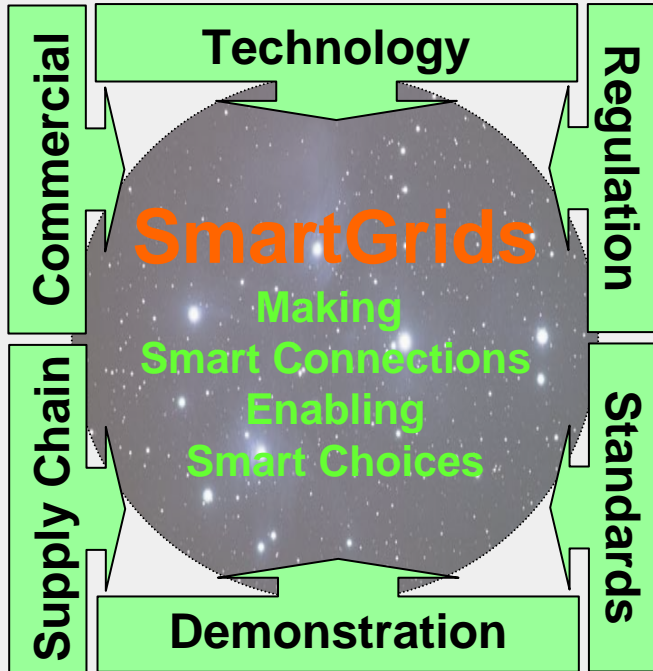
Demonstration

- Demonstration/pilot projects are key
- Operational proving is a critical step
- Beware the Valley of Death.....



# Shared Vision

Societal Legitimacy



Gov't & Regulators Support of

# Collaboration

- Consents for development will be needed; also
- *Permission to Operate* in the wisest sense
- Trust & social impact requires special attention

- Multiple parties must form a common view of success
- A shared and living Vision is a must for 'joined up thinking'

- Collaborative working underpins integration & efficiency
- It is the way a market handles complexity

- Major change requires shared priorities and co-operation
- Especially for framework changes and between different sectors

# Example of past group activities

---

## The Strategic Research Agenda 2006

**Network Assets**



**Input please!**

**Demand and metering**

**Networks Operations**

**Generation and Storage**

# EU Technology Platform: SmartGrids

- The Technology Platform brings together key stakeholders across Europe
- The Vision document has been published
- Also the Strategic Research Agenda
- The Strategic Deployment Document is close to publication

## Some SDD key messages are:

- Demonstration projects are key to progress
- Governments & Regulators must address the framework issues
- Smart Grids are critical to sustainability targets and security of supply policy goals.



**The SDD**  
Strategic  
Deployment  
Document

# Funding options for SmartGrids

---

## EC Research & Development funding

- Seventh Framework Programme
- ERA-NET

## National Funding opportunities

- Vary according to each MS (numerous)

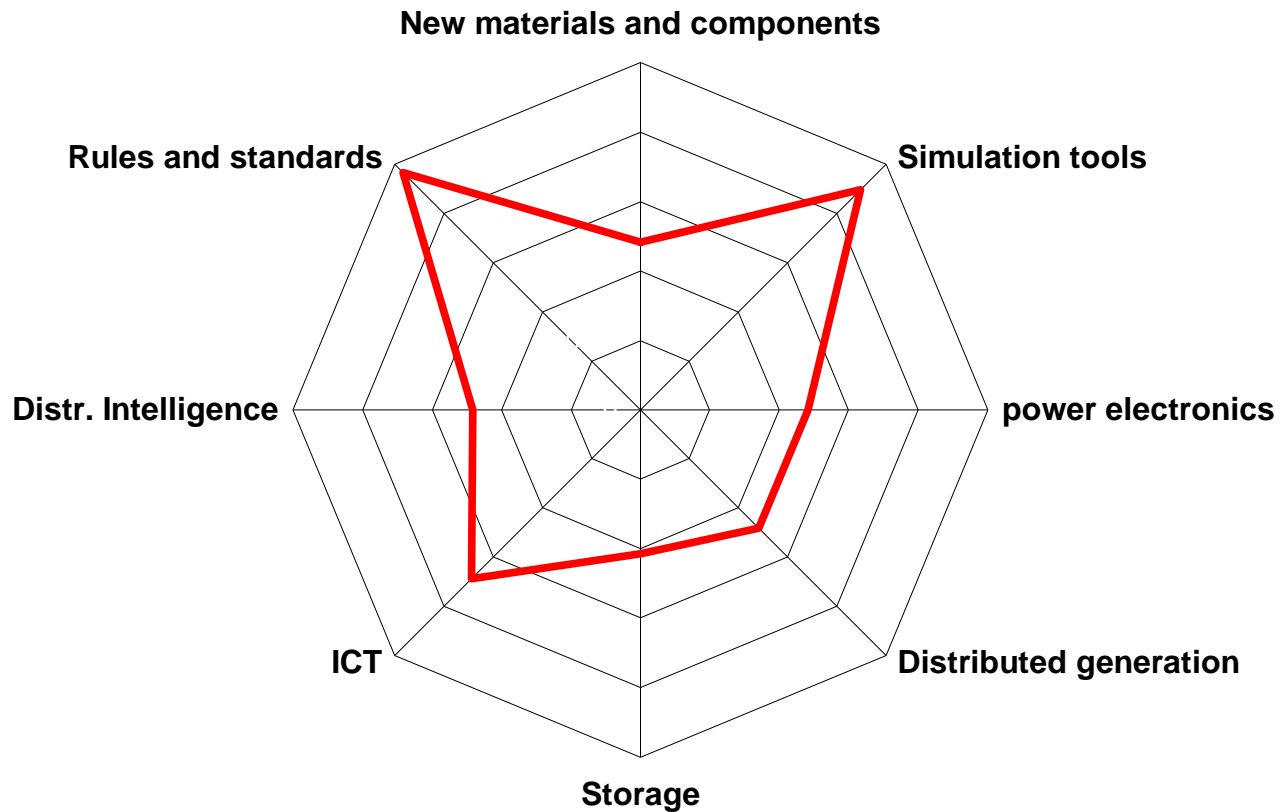
## Regulator allowances for innovation

- UK; the IFI (innovation funding initiative) and RPZ (registered power zone)

## Private Funding options

- industry

**RTD PRIORITIES FOR T&D AS DERIVED FROM THE EU TECHNOLOGICAL PLATFORM "SmartGrids" S.R.A**



# SmartGrids

---

## Agenda for Today

1. Why SmartGrids?
2. Networks today
3. Networks tomorrow
4. Model for SmartGrids
5. Enabling technologies
6. Some examples

# Enabling Technologies

---

- Active Distribution Networks
- Improved power flow: FACTS, WAMS, WAPS
- Power electronic technologies
- Smart Metering
- Communication for DSM, on-line services, energy management
- Stationary energy storage

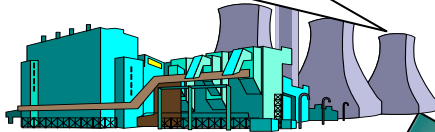
# The interactive Grid

Present and forecast: capacity, availability, price, contract terms



Present and forecast: capacity, availability, price, contract terms. Managing balance, losses, voltage, frequency, reserve.

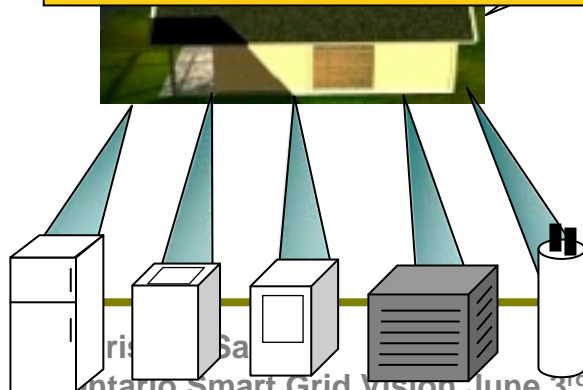
Grid operator



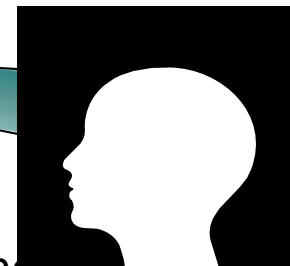
**Intelligent Metering is the gateway**



and  
ce  
eets  
nts



Appliances, Equipment



User

# SmartGrids

---

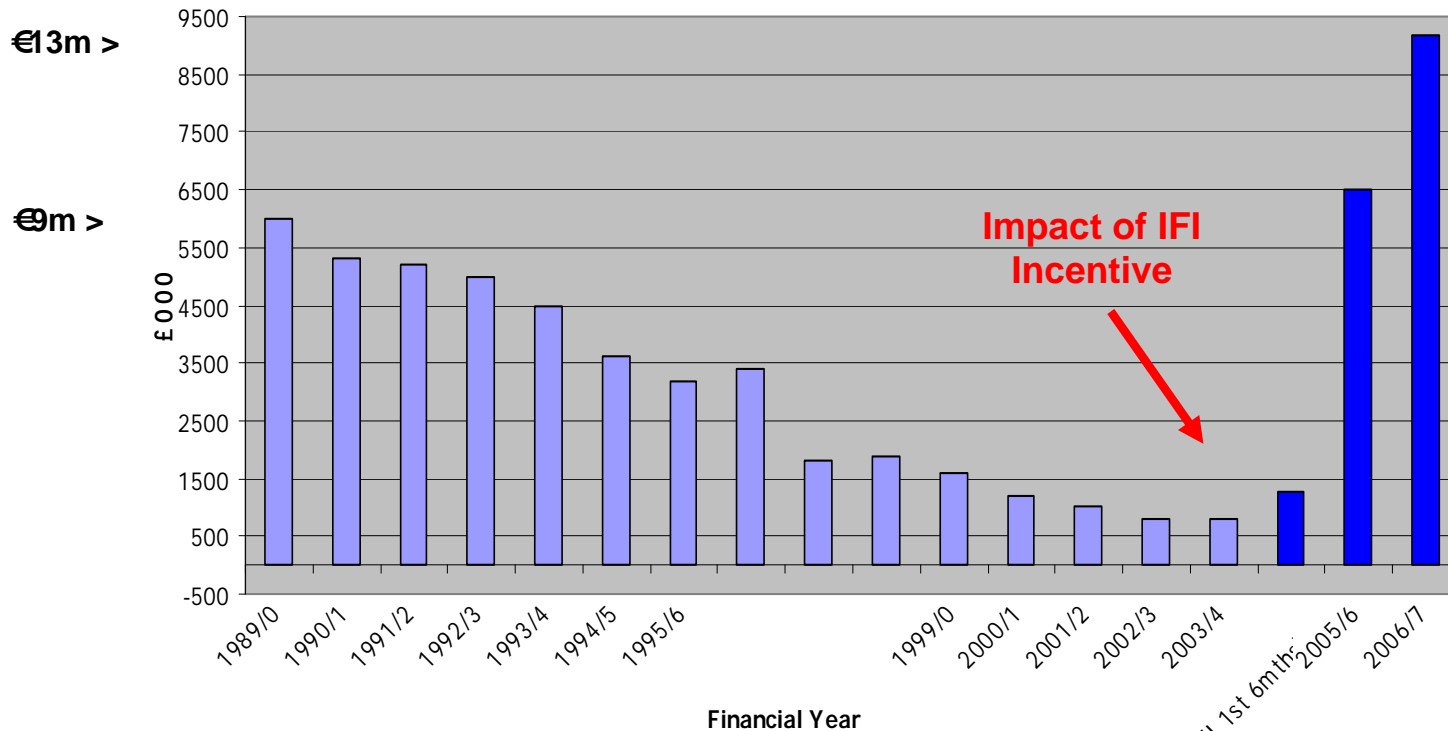
## Agenda for Today

- 1. Why SmartGrids?**
- 2. Networks today**
- 3. Networks tomorrow**
- 4. Model for SmartGrids**
- 5. Enabling technologies**
- 6. Some examples**

# UK Distribution Company R&D trend

## Impact of new incentives

Privatisation



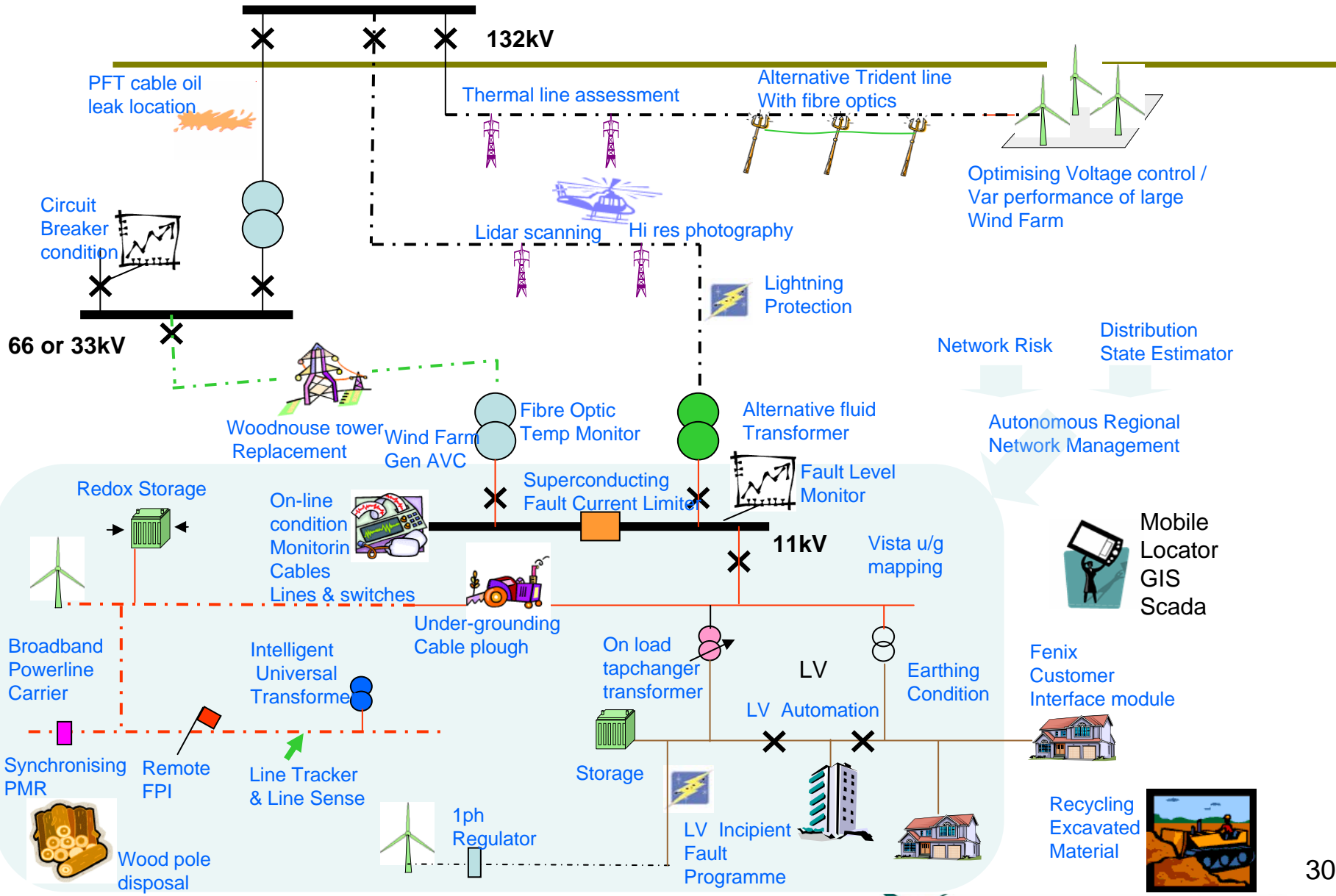
- c.180 projects
- Projects are initiated by the companies
- Ofgem does not 'approve' each project
- Spend up to 0.5% of annual turnover (use it or lose it)
- Av. intensity is 0.27%
- Forecast benefits total €70m (NPV)

Oct 04 - Apr 05 (IFI 1st 6mths)

\* Data from 1989/1990 to 2003/2004 is the collaborative spending on R&D amongst the DNOs through a single provider.

\*\* Data from Oct 2004 - April 2005 and the last financial year (2005/2006) shows reported total IFI spend.

# Examples of IFI projects



# Example: Distribution Network Protection Co-ordination

## High Tech for what?



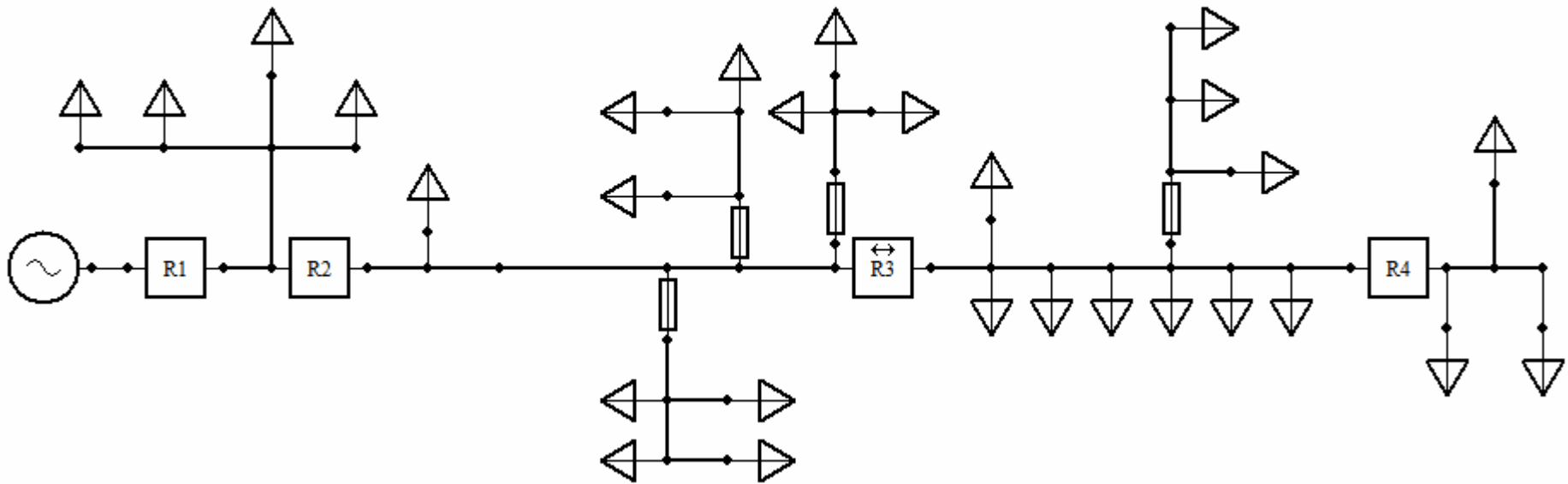
Advanced relay function	Percentage of utilities using advanced function
Distance protection	4%
Directional protection	2%
Negative sequence protection	8%
Automatic back feed restoration	8%

*IEEE PSRC Report "Distribution line protection practises - Industry survey results", December 2002*

# Solution: Auto-coordination

Network Software that:

- ❖ Automatically calculates optimized recloser settings resulting in correct coordination



---

**The best way to predict your  
future is to create it**

**(Peter Drucker)**

---

# Thank you for your attention!

**Christian Sasse**  
**chs@tavrida-na.com**

***Acknowledgment: Thank you to the Chairman of the  
European Technology Platform SmartGrids Pier Nabuurs  
and Vice-Chairman Ronnie Belmans for their kind support***