Paul-Frederik Bach

# Smart Grid

## Research in Efficient Utilization of RES

Energiforsk 15

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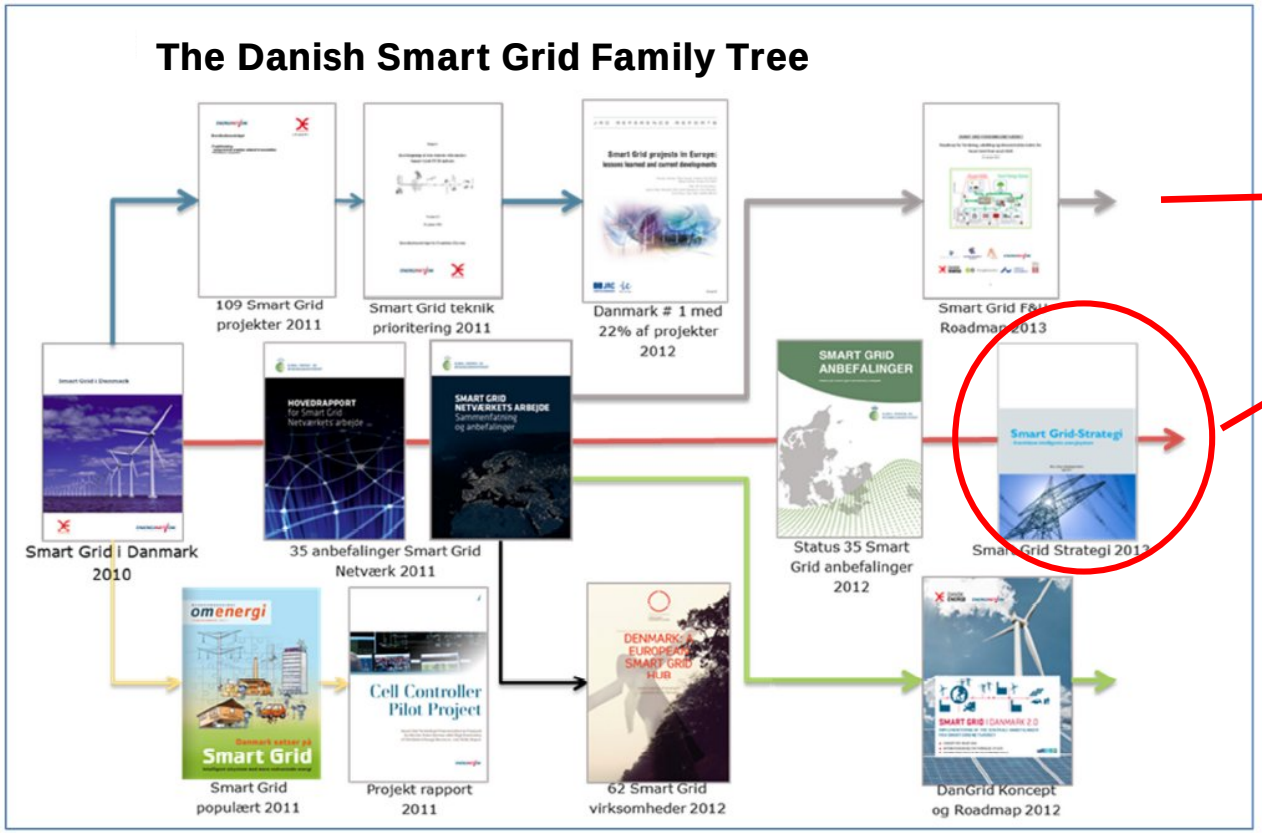
April 2013:

# A Smart Grid Strategy from the Danish Ministry of Climate

20 initiatives, including the request for at report on Smart Grid research






Requirements for the new report:

" – promote optimal use of resources with 50% wind electricity" (i.e. in 2020)

Structure based on report from the Smart Grid Research Network

Energy scenarios towards 2020, 2035 and 2050 should be considered

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# The Working Group

- The energy research programmes turned over the task to a working group of evaluators:
  - Paul-Frederik Bach /ForskEL
  - Jørgen Bjørndalen /ForskEL
  - Lennart Söder /Innovationsfonden
  - Per Holmgård /EUDP
  - Pernille Skjershede /ELFORSK
- Project period from the middle og May to 1st October 2014
- The working group referred to a steering committee:
  - Klaus Rosenfeldt Jakobsen, Danmarks Innovationsfond
  - Hanne Thomassen, EUDP
  - Jørn Borup Jensen, ELFORSK
  - Jeannette Møller Jørgensen, ForskEL

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# From the Terms of Reference:

- Survey and evaluation:
  - Present situation
  - Expectation for 2020
  - Expectation for 2030
  - Prospects towards 2050
- Structure based on report from the Smart Grid Research Network:
  - The electricity system
  - Energy Markets
  - Components
  - Consumers
  - Information and communication technology (ICT)
- ”- recommendations for the future Danish Smart Grid efforts regarding both research, development and demonstration”

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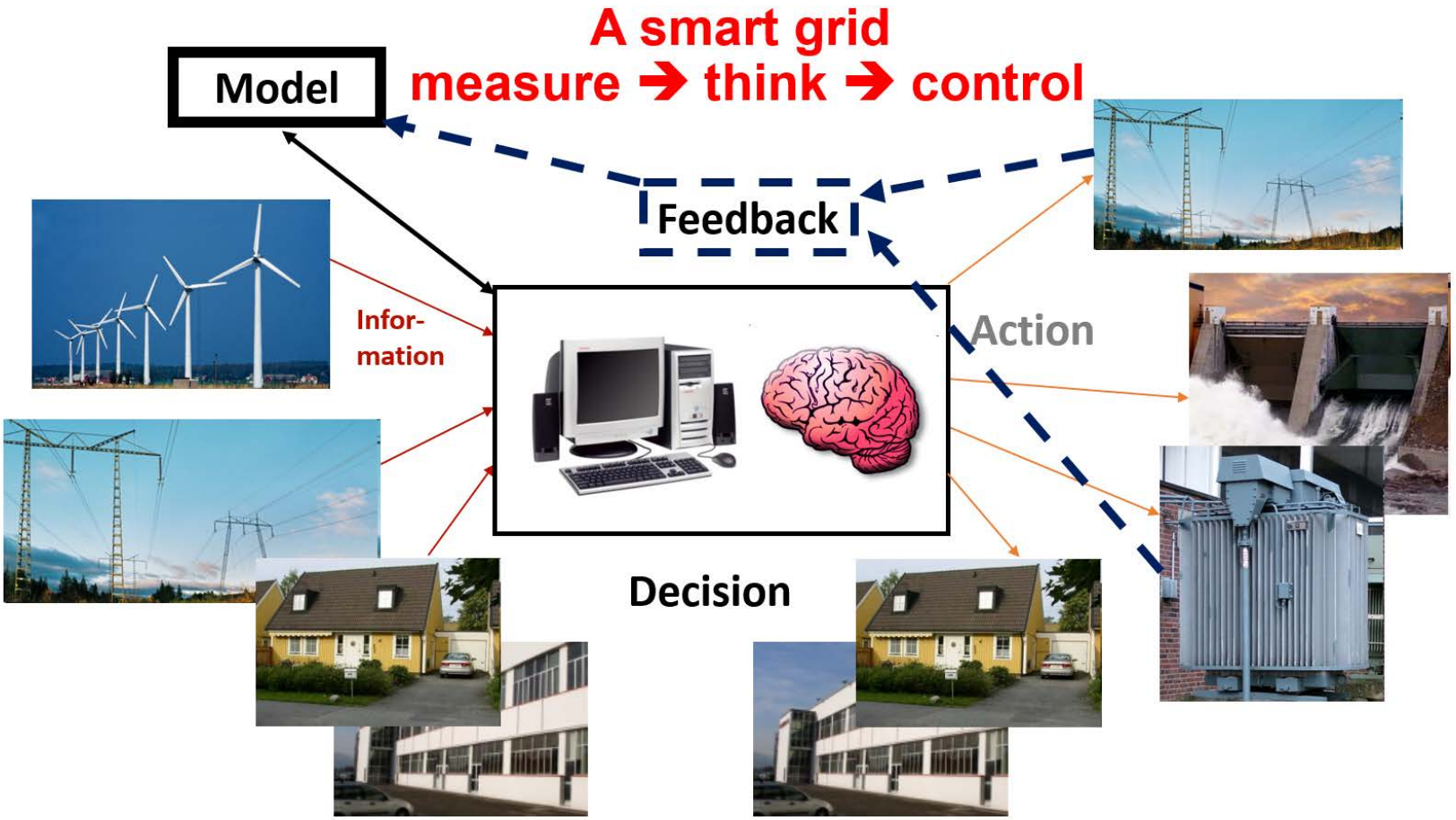
# Smart Grid – More evolution than revolution




- Well-known principles – The news:
  - Better and cheaper components pave the way for more intensive use
  - Particularly in the distribution grids – all the way to the end users

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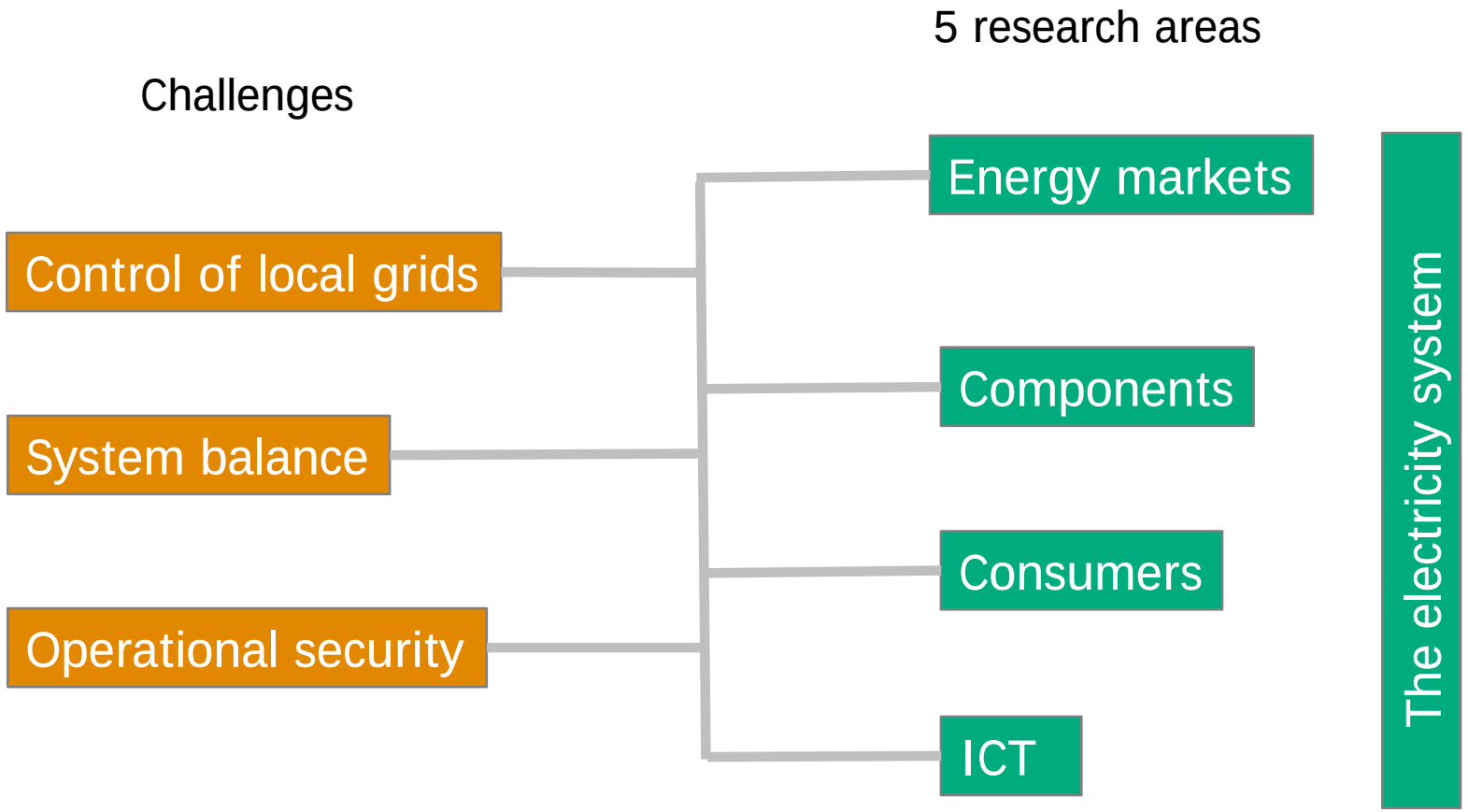
# Smart Grid Research Includes Almost Everything




Overlaps between descriptions of research areas are unavoidable

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# Time Horizons and Challenges

- The situation in 2014
  - No longer Danish reserve capacity for all constingences
  - Surplus of electricity from wind and CHP during winter
- Perspectives for 2020
  - Balancing the power system will be influenced by decreasing Danish dispatchable capacity
  - Security of operation will be affected by decreasing short circuit capacity
  - Planning of local grids:
    - Uncertain addition of electric vehicles (EV) and photovoltaics (PV)
- Development from 2020 to 2035
  - Local grids will be charges by
    - Replacement of oil-fired heating by heat pumps
    - High consumption of electricity for EV
  - Reserve capacity for calm periods
- Views towards 2050
  - The four non-fossil scenarios are very different
  - ”Wind” and ”hydrogen” will imply special challenges for maintaining system balance

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# Main Views from the Working Group 1

1. Insufficient dissemination of research results
   - It is very difficult to create an overview
     - Energiforskning.dk mentions 2,258 projects
   - Brief end evaluations could help identifying promising results
2. Projects in progress can give usable results before 2020 within:
   - Operation of the transmission system (e.g. SOSPO)
   - Planning of the distribution systems (e.g. Pronet)
3. On the other hand, important recommendations from 2011* seem to have been ignored for:
   - Market design
   - Communication
4. Several measures are based on fluctuating electricity prices
   - Paradox: Efficient measures can smooth away price variations
   - The combined effect of potential measures should be analysed
5. The challenges will be different in the overall grid and in the local grids
   - There may be conflicts of interest in power system control
   - New, intelligent market arrangements will be required

* The Coordination Committee for the power system of the future

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# Main Views from the Working Group 2

6. In 2020 the flexibility of traditional electricity consumption is expected to have limited effect
   - The ”wholesale model” will not be ready until the end of 2015
   - The adaptation to price sensitive consumption is supposed to be slow
   - In 2020 CHP systems will be the most important sources of domestic flexibility
7. Essential assumptions are very uncertain, even for 2020

| GWh in 2020 | Smart Grid in Denmark | Energinet.dk: Assumptions |
|---|---|---|
| | 2010 | for analyses 2015 |
| Consumption EV | 720 | 140 |
| Production PV | 110 | 840 |

8. It is questionable, if the cost-benefit analyses from 2010 are still valid
   - Regular cost-benefit analyses of the Smart Grid plans are recommended
   - Preferably with individual updates of the most important measures
9. The energy research should still be broad-spectrum
   - On the other hand more targeted work is needed for the implementation
   - Should the work be organized in two tracks?
10. The energy research programmes need more than a technological focus
    - The social sciences (economics, political science, sociology) should have essential roles


Thank You