

# Bridging to the future - presentations

- The Pathway project – short introduction
- The energy infrastructure
- Bridging to the future – UK pathways
- Towards sustainable development
- Public attitudes
- Future energy networks
- District heating
- Fuel market – natural gas
- Co – firing as a bridging technology
- **Panel discussion**

# **Pathways to Sustainable European Energy Systems - a new project**

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Pathways to Sustainable European Energy Systems,  
The 1st Project Conference, October 18, 2006

- *How can pathways to a sustainable energy system be characterized and visualized and what are the consequences of these pathways?*
- *...with respect to the characteristics of the energy system as such and for society in general*

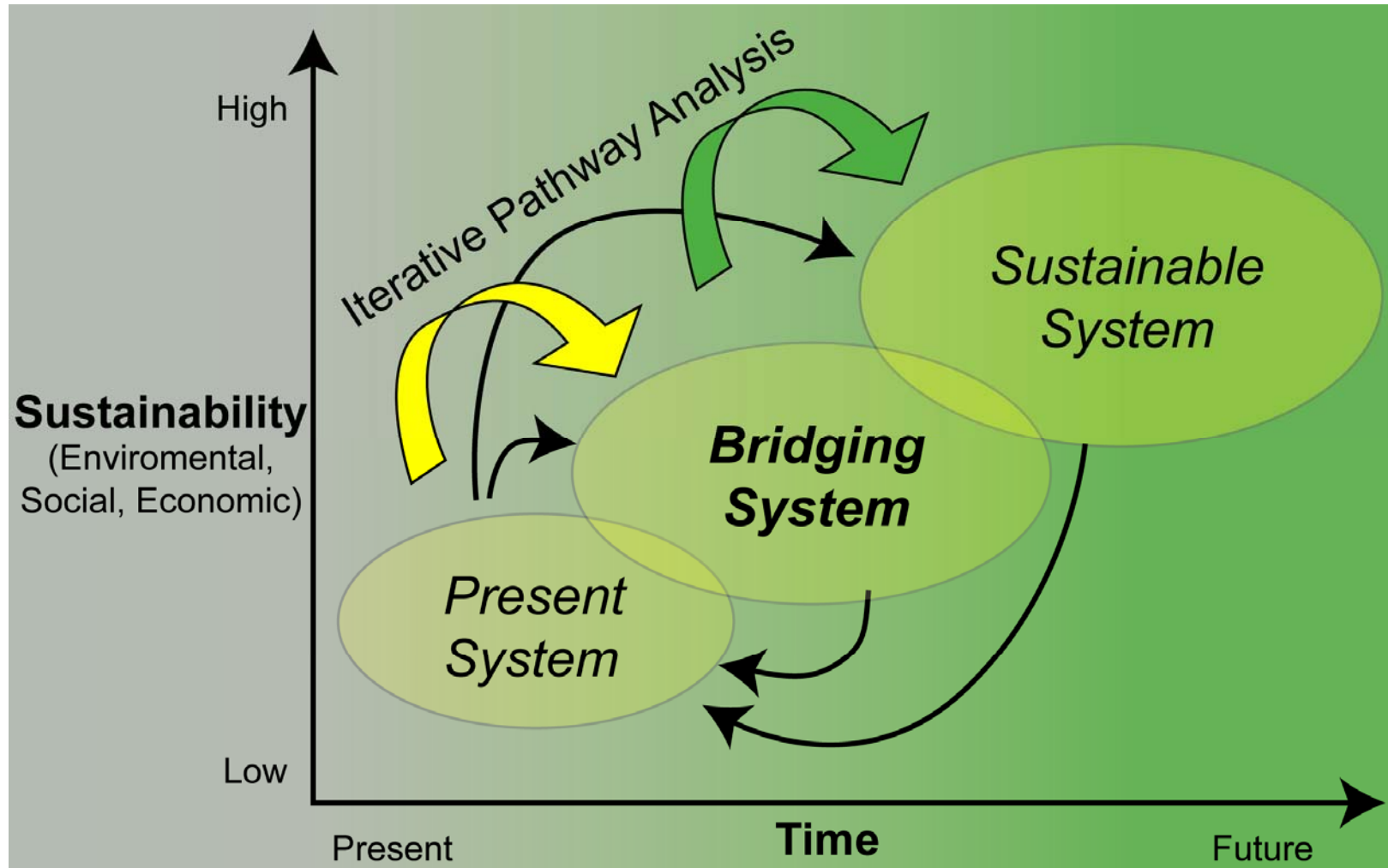
# The project – scope

- Stationary energy system (heat and power)
- Takes its basis in the existing energy system with this system described in a detailed way (*Energy Infrastructure – Chalmers databases*)
- European setting
- Pathway analysis for the next 50 years

## **..question divided into sub-questions such as**

- What is the critical timing for decisions to ensure that a pathway to a sustainable energy system can be followed?
- What are "key" technologies and systems for the identified "pathways" - including identification of uncertainties and risks for technology lock-in effects?
- What requirements and consequences are imposed on the energy system in case of a high penetration of renewables?
- What are the consequences of a strong increase in the use of natural gas?
- ...

# Pathways to Sustainable European Energy Systems - priority on Bridging Technologies/Systems

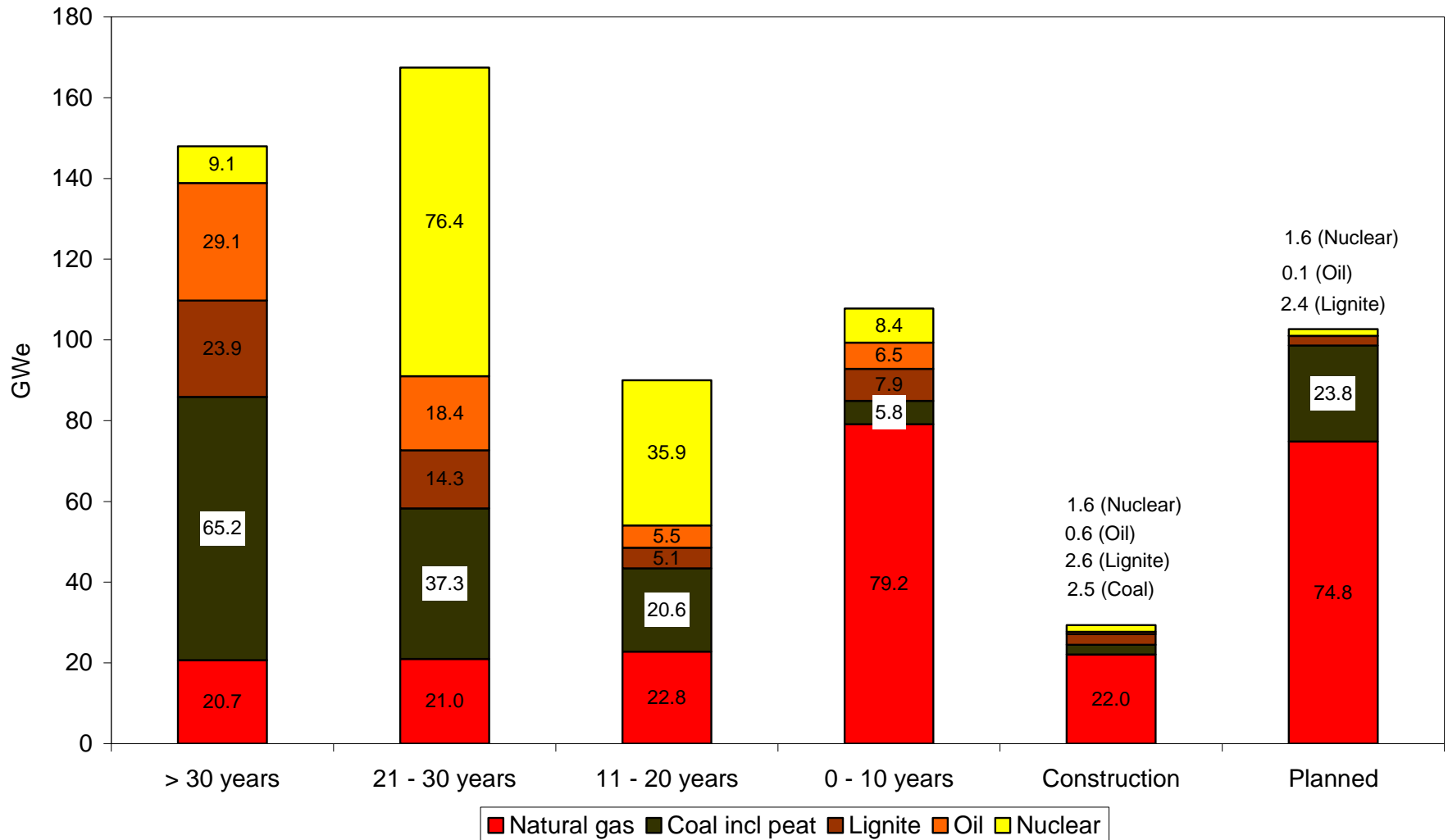


# **The Energy Infrastructure**

## **- what does it tell us?**

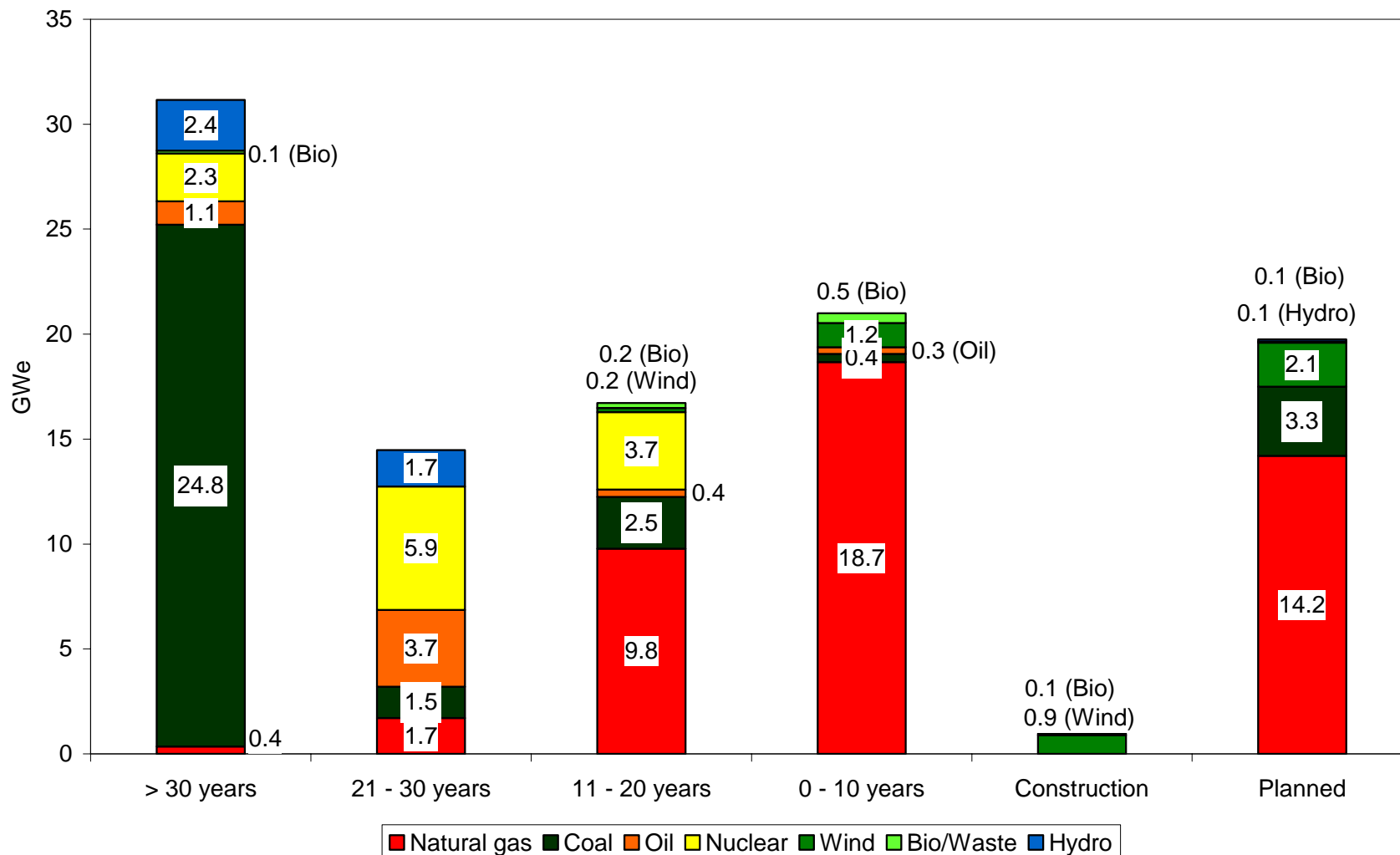
### **Supply and demand side examples**

# Net capacity of operating and planned thermal power plants in EU-25 distributed by fuel and age



Kjärstad, J., Johnsson, F., *Energy Policy*, submitted

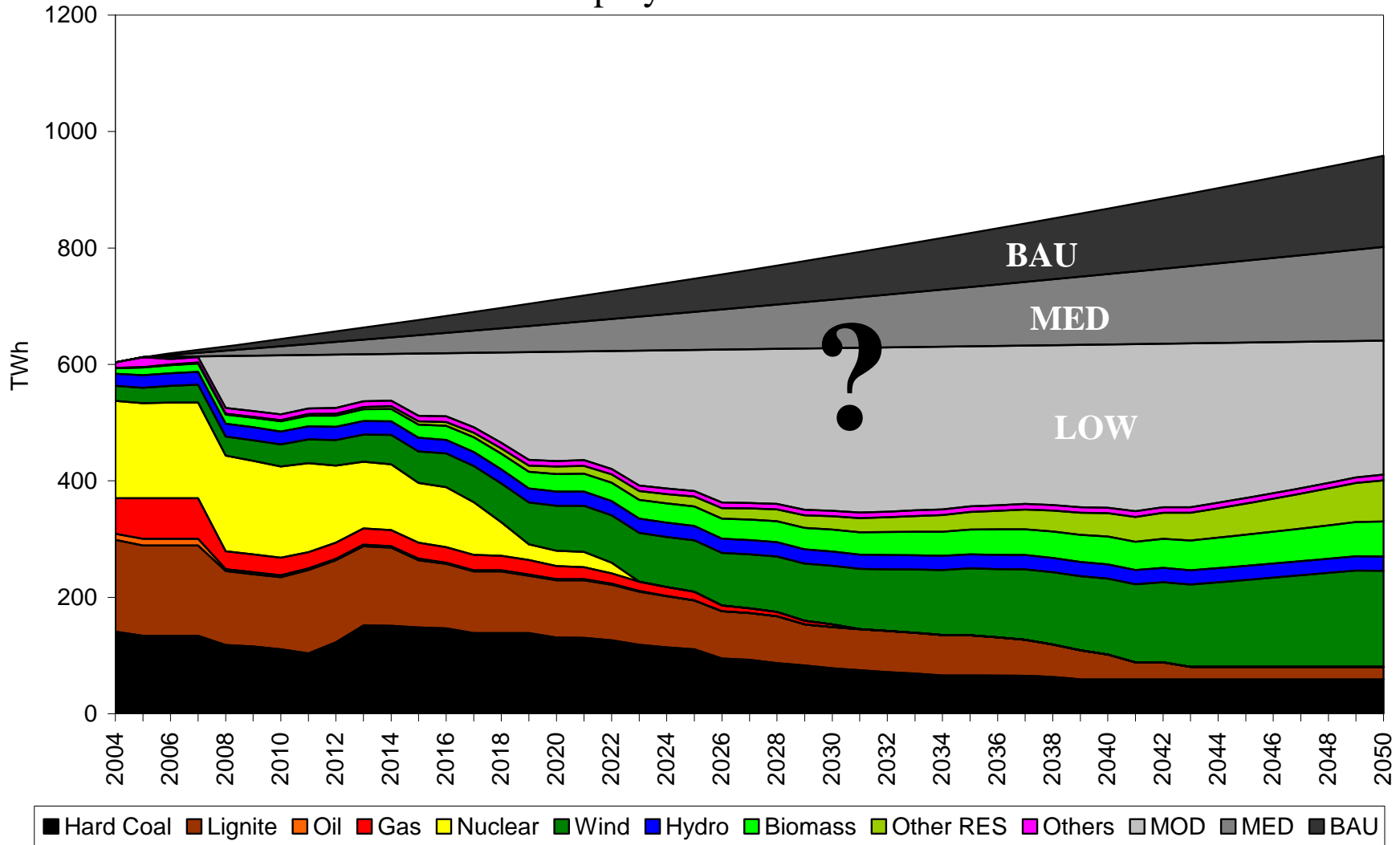
# Net capacity of operating and planned power plants in UK distributed by fuel and age



Kjärstad, J., Johnsson, F., *Energy Policy*, submitted

# The challenge – Example **Germany**

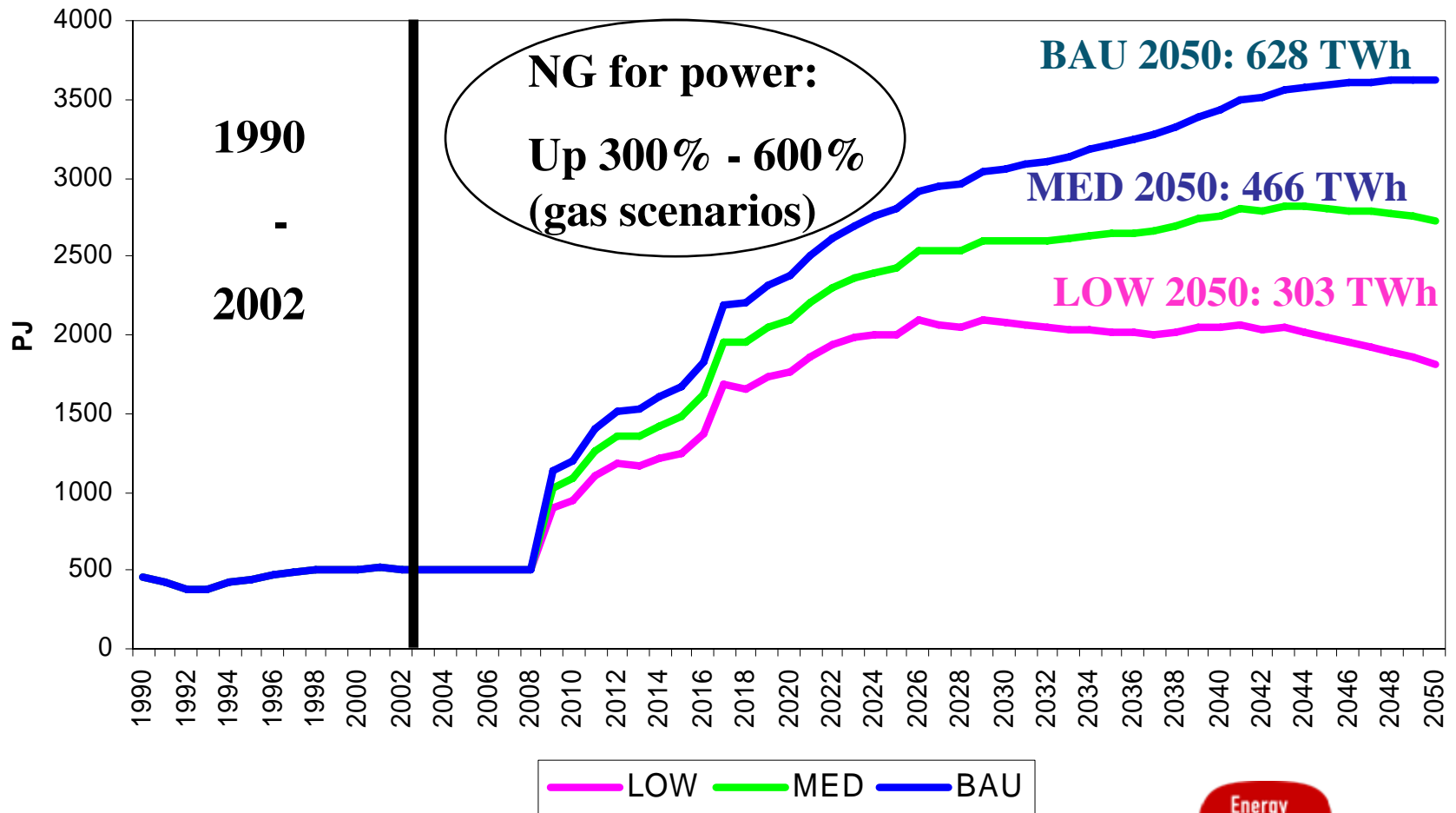
Phase out of fossil and nuclear generation in Germany together with estimated “maximum realistic deployment” of renewables 2004-2050



Kjärstad, J., Johnsson, F., *Energy Policy*, submitted

# German Natural Gas (NG) consumption for power generation 2000-2050

Note: High use of renewables



## Conclusions – supply side example

- We must use *bridging technologies/systems* (NG, CCS, Co-firing etc) *but avoid lock-in effects* and *maintain security of supply*
- *Energy efficiency* measures must be implemented!
- Possibilities and limitations from the *Energy Infrastructure* (regional variations)
  - Important to have detailed information on the energy system
  - Turnover in capital stock

# **Demand side example - buildings**

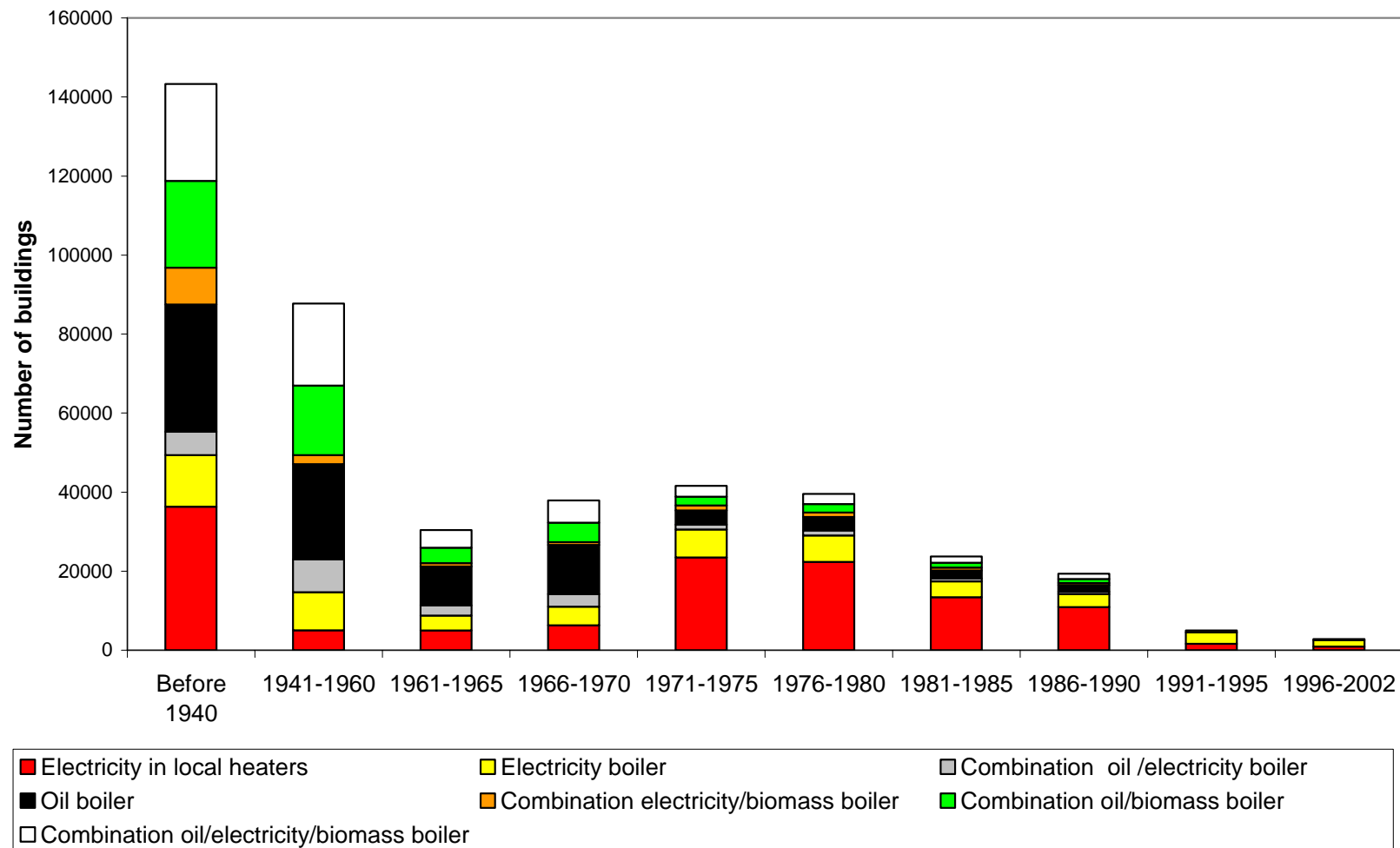
## **Building sector – CO2 reduction strategies**

- increase energy efficiency
- substitute fuels
- reduce demand

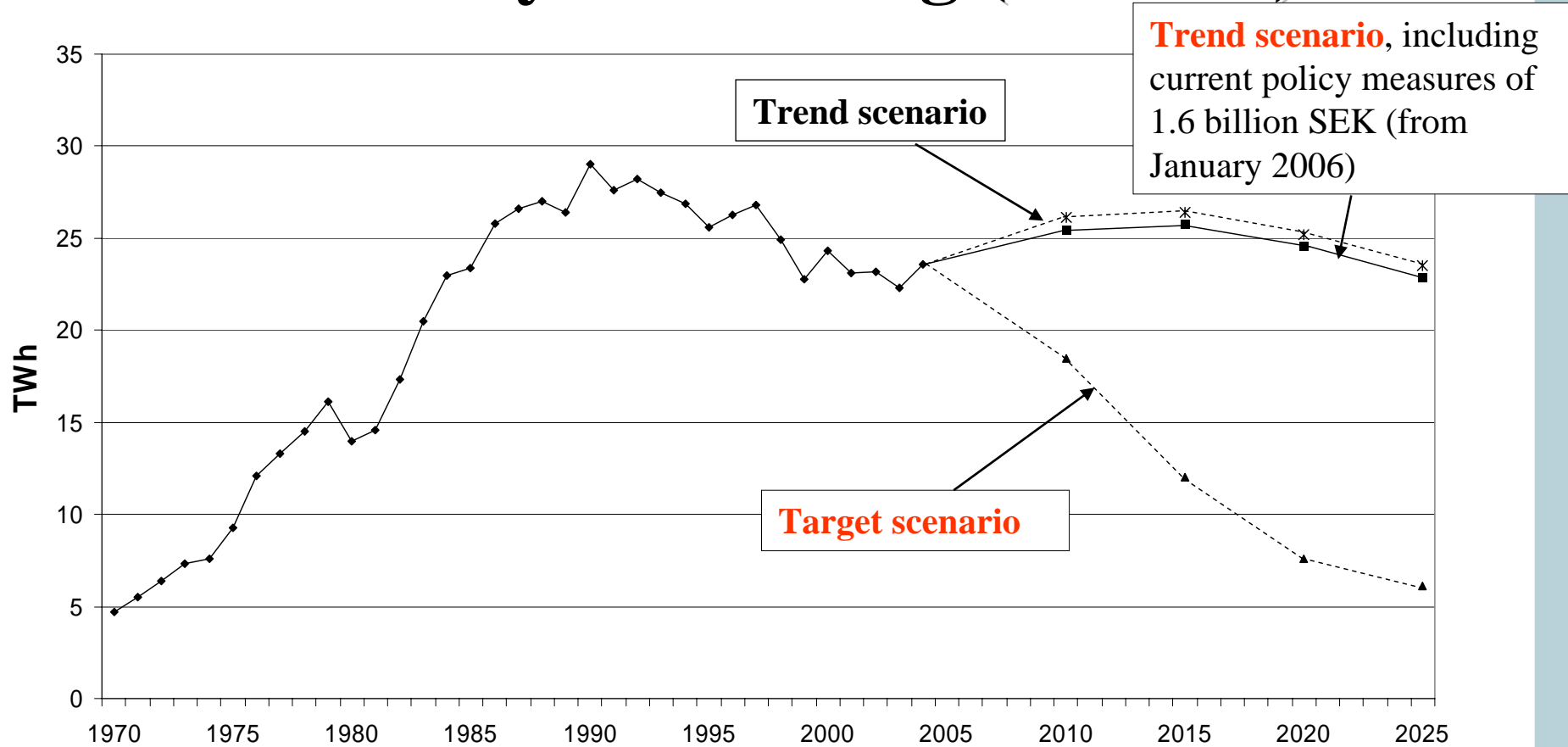
# Turnover in capital stock

- Possibilities to reduce dependency of electricity and oil for heating in the Swedish building sector – as in line with governmental policy
- Compare a pathway in line with current policy (“Target scenario”) with current trends on the heating market (“Trend scenario”)

**Age structure of one- and two family houses with each age period divided with respect to heating system. Only buildings with heating systems which will be replaced (from detailed database of Southern Sweden)**



# Electricity for heating (Sweden)



# Conclusions – Swedish demand side example

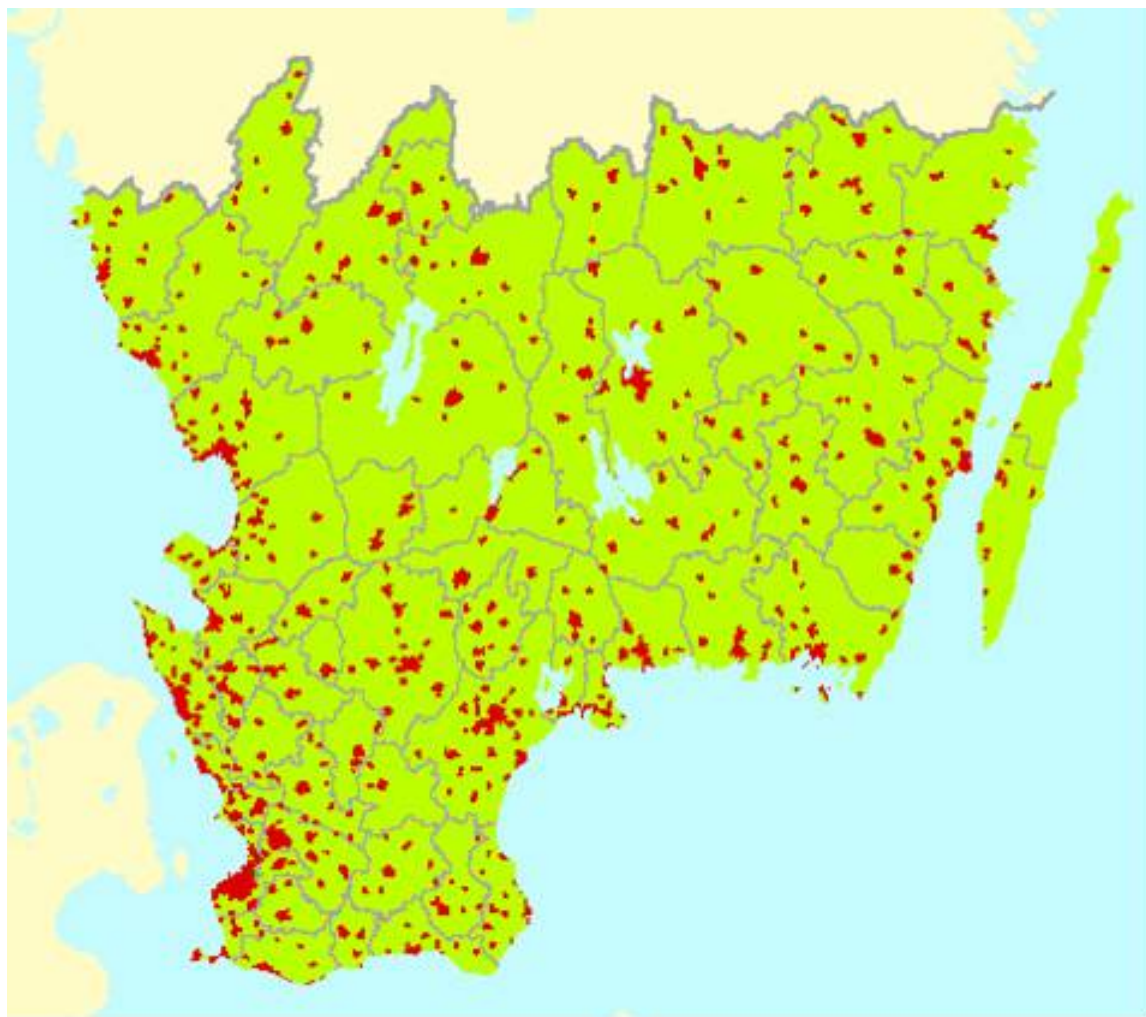
- Current development only gives little reduction – if any – in electricity used for heating.
- Analysis of energy pathways: Important to consider the energy infrastructure – turnover in **capital stock**
- Implement **long-term policy** for development of the energy system
- **Local conditions**
  - Policies and strategies must be developed based on local conditions
  - Require municipalities to develop “best strategies” on development of heating market for various house types
  - Strengthen the role of “municipal energy advisers”

- Extras

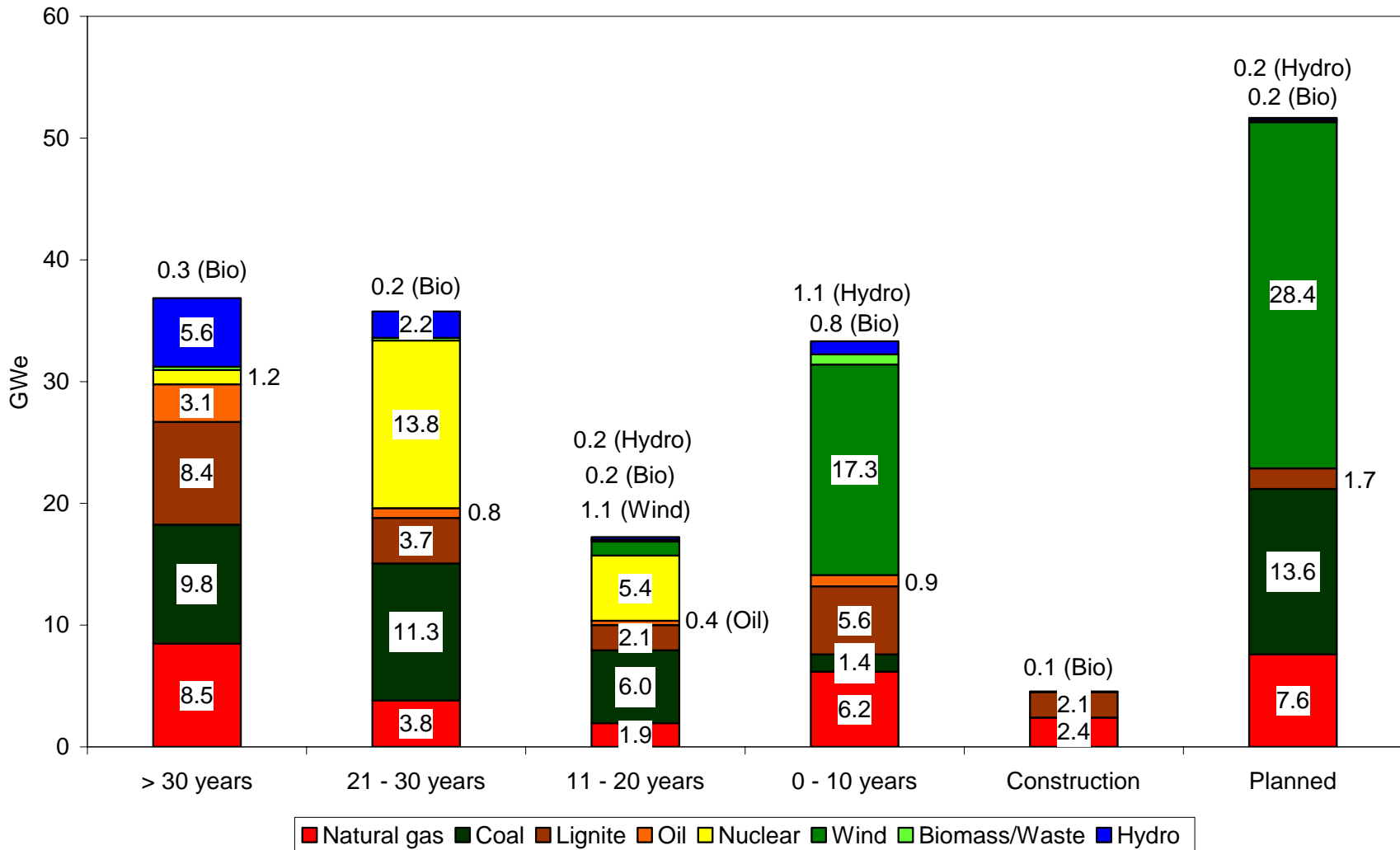
# Methodology

- Description of *Energy Infrastructure*
  - Supply side
    - The Chalmers Power Plant Database (EU25)
    - The Chalmers Fuel database
    - The Chalmers CO<sub>2</sub> Storage Databases (EU25)
  - Member State Database (EU25)
  - Demand side
    - Databases on regional as well as on MS level with main characteristics of energy use – to be developed based on existing databases (e.g. Odyssee)
- Modeling and analysis
- 10 work packages address key questions

# Southern Sweden



# Germany



# *Thermal Power Plants in EU25*

*Red = gas*

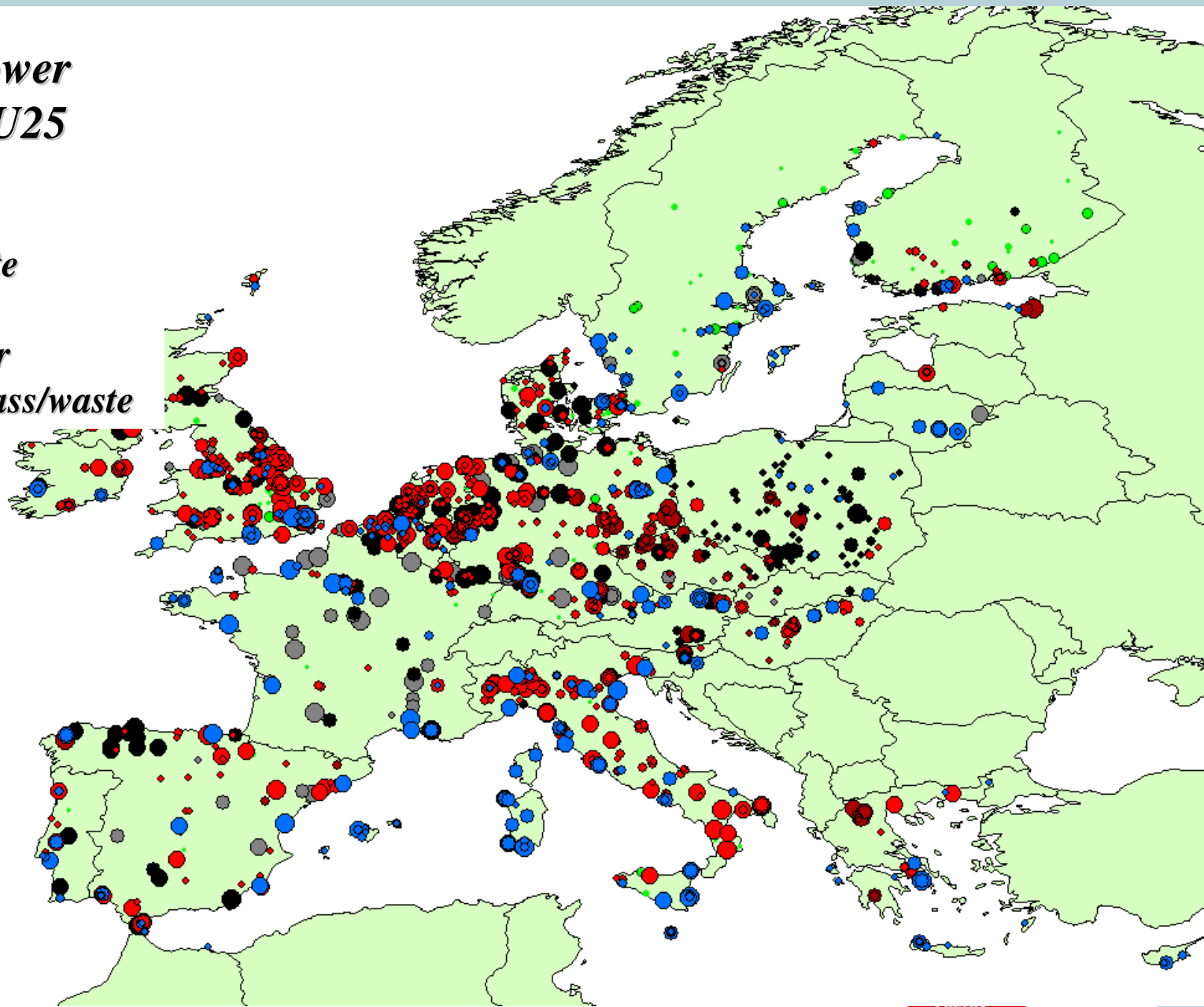
*Black = coal*

*Brown = lignite*

*Blue = oil*

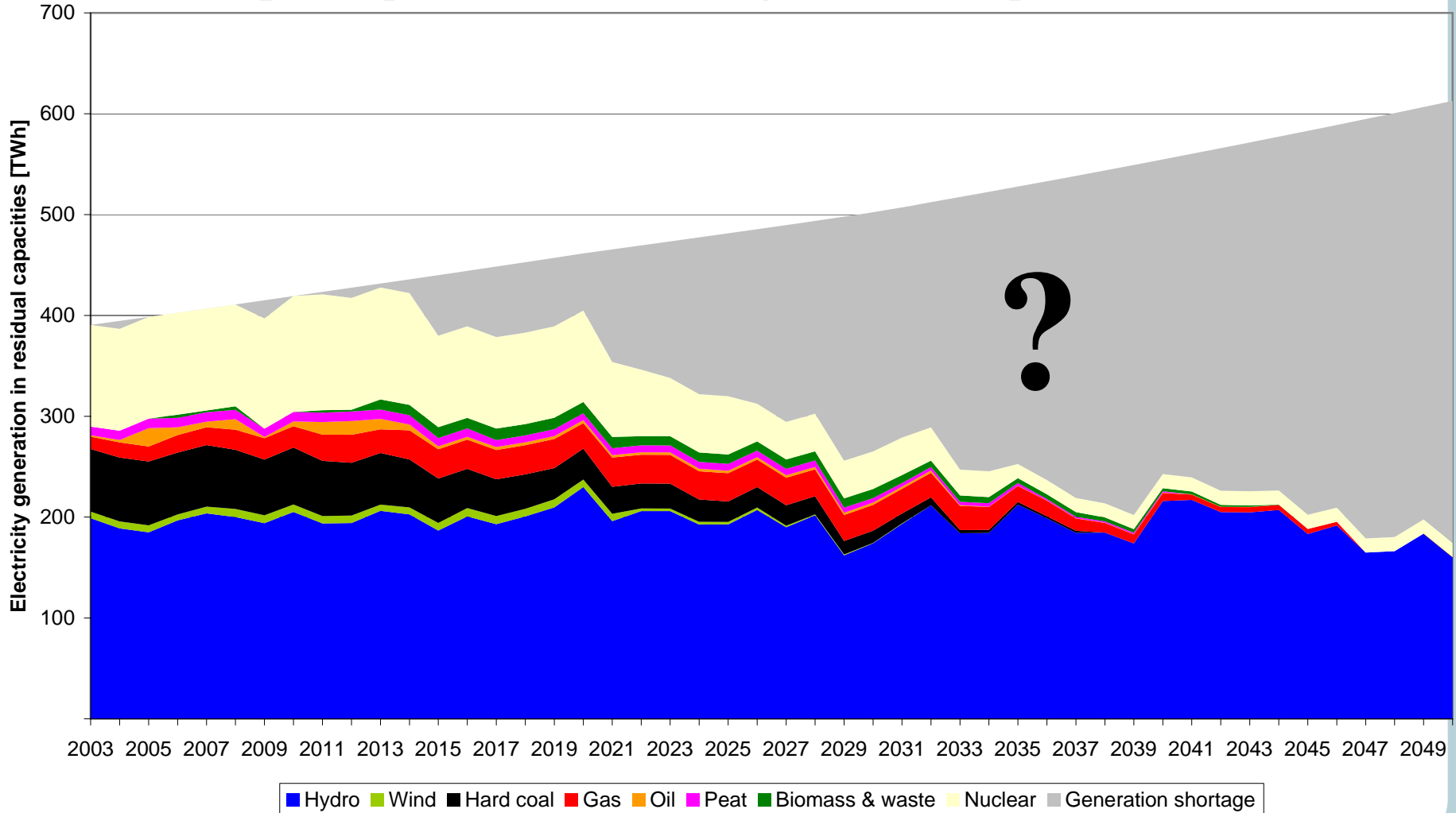
*Grey = nuclear*

*Green = biomass/waste*

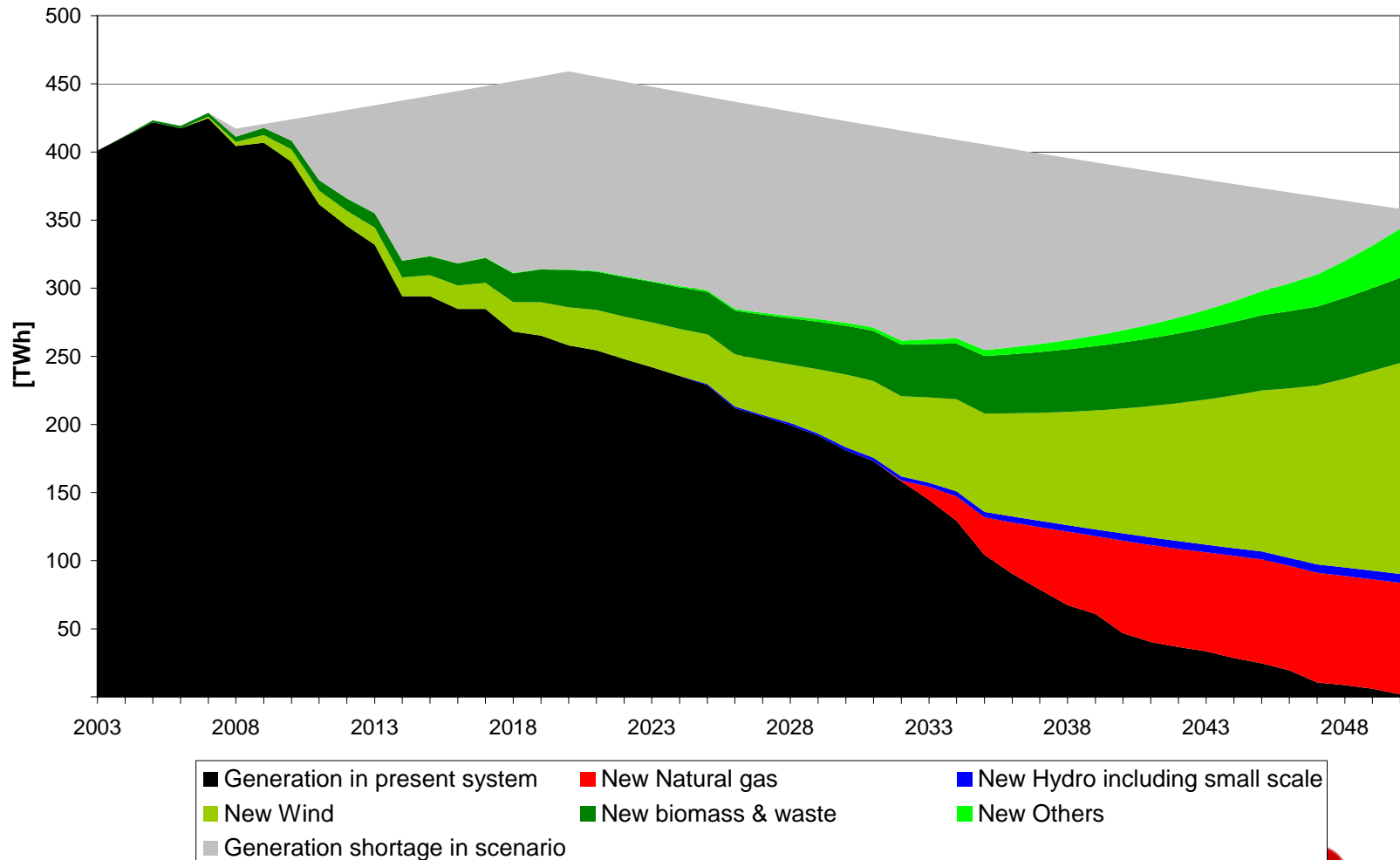


# Nordic electricity generation by fuel

Power plants phased out according to life time/political decisions

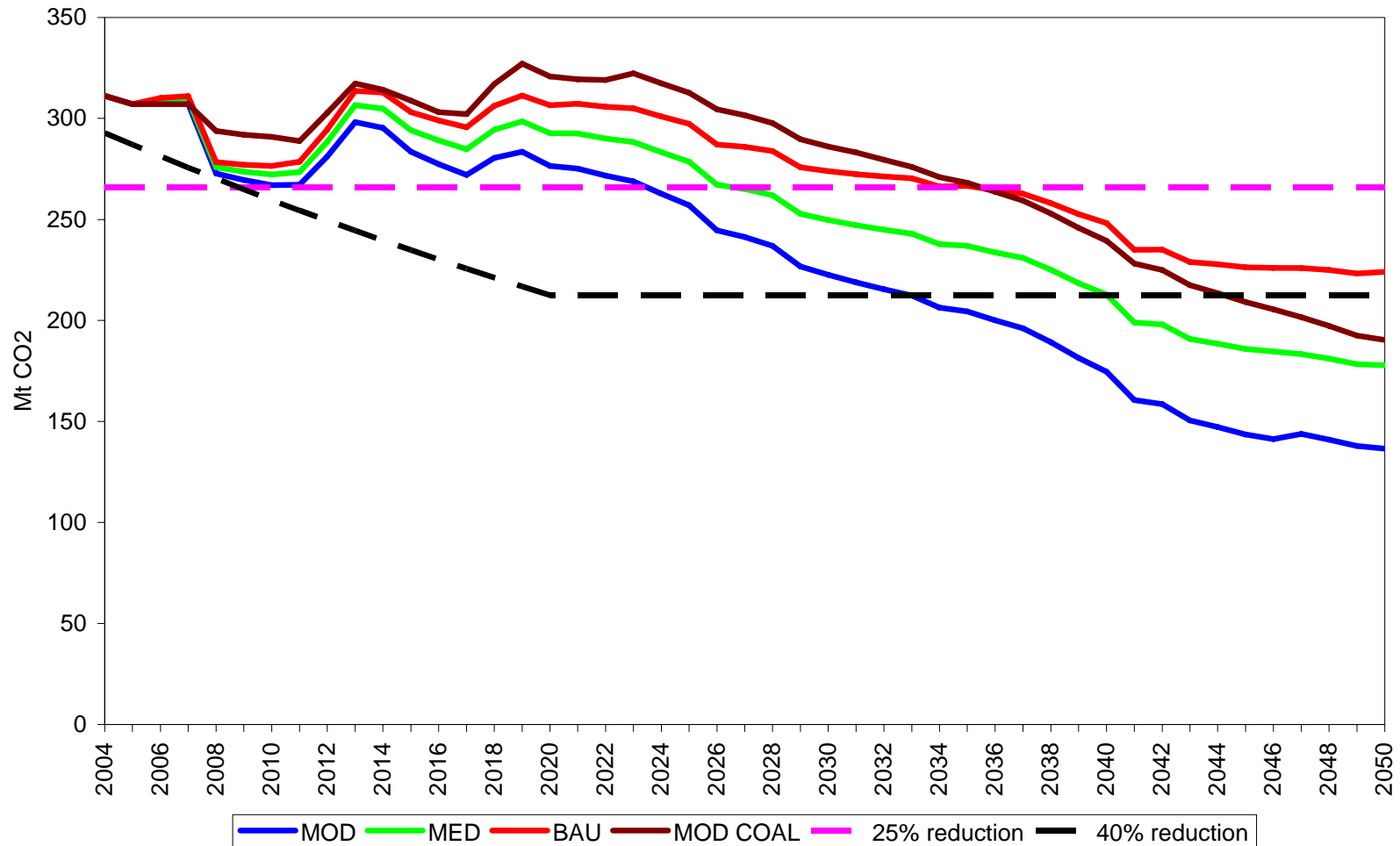


UK electricity generation in present system and contribution of set targets based on maximum realistic penetration of RES and prescribed targets for gas technologies used for backup and peak production.



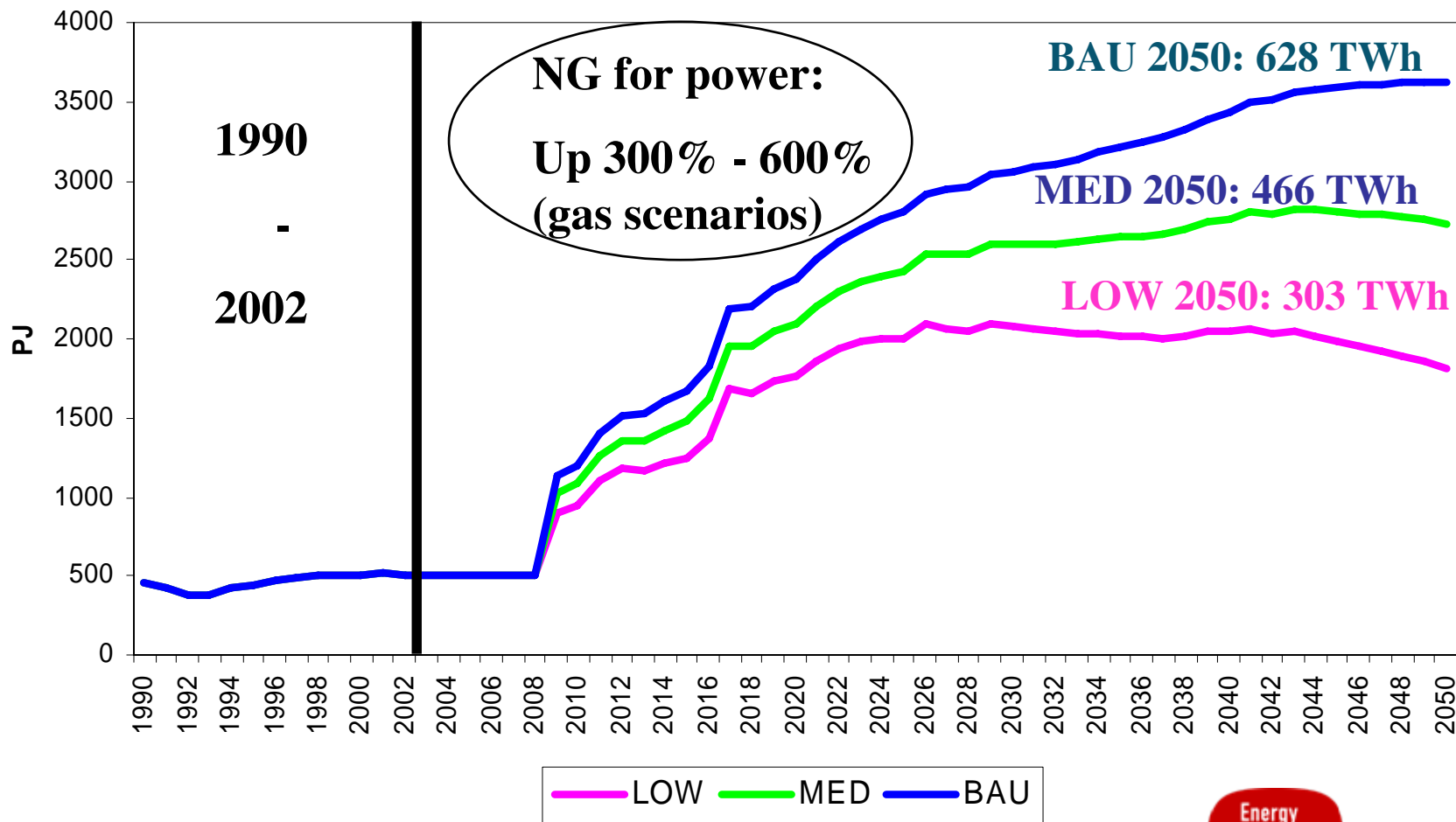
# CO2 emissions in Germany

corresponding to the three scenarios, MOD, MED, BAU

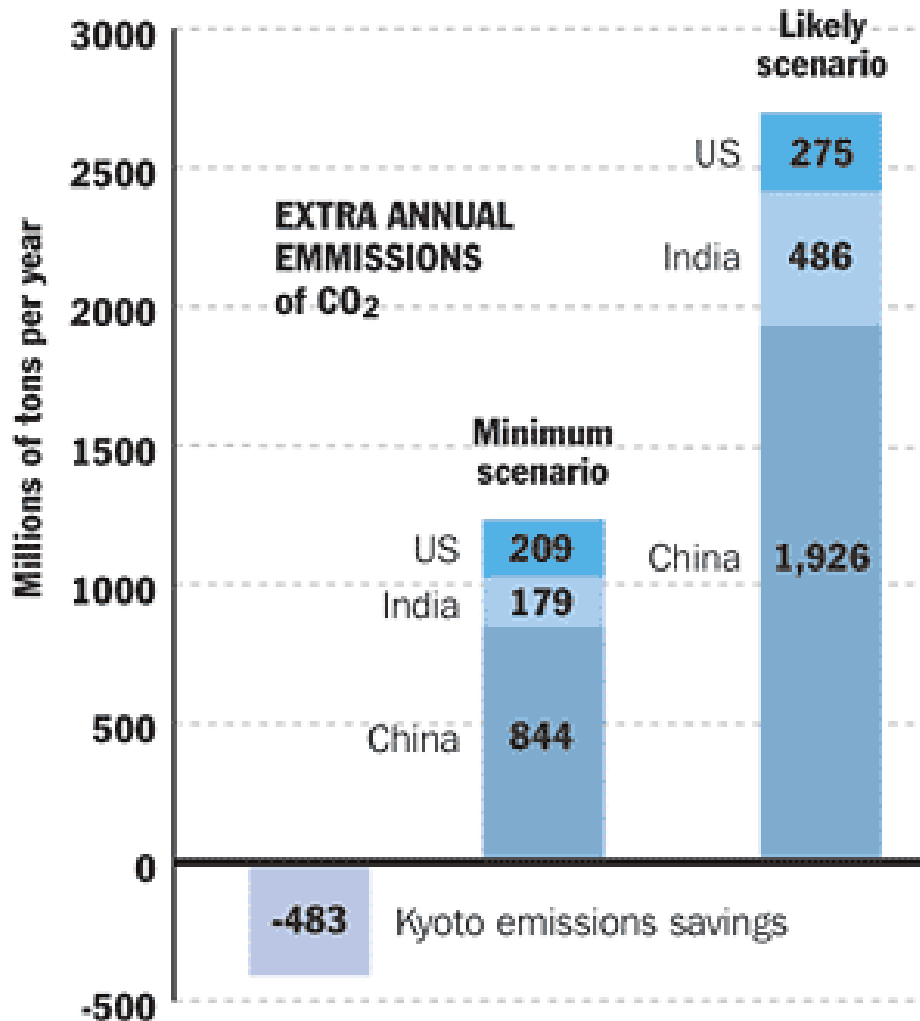


# German Natural Gas (NG) consumption 2000-2050

Note: Maximum use of renewables



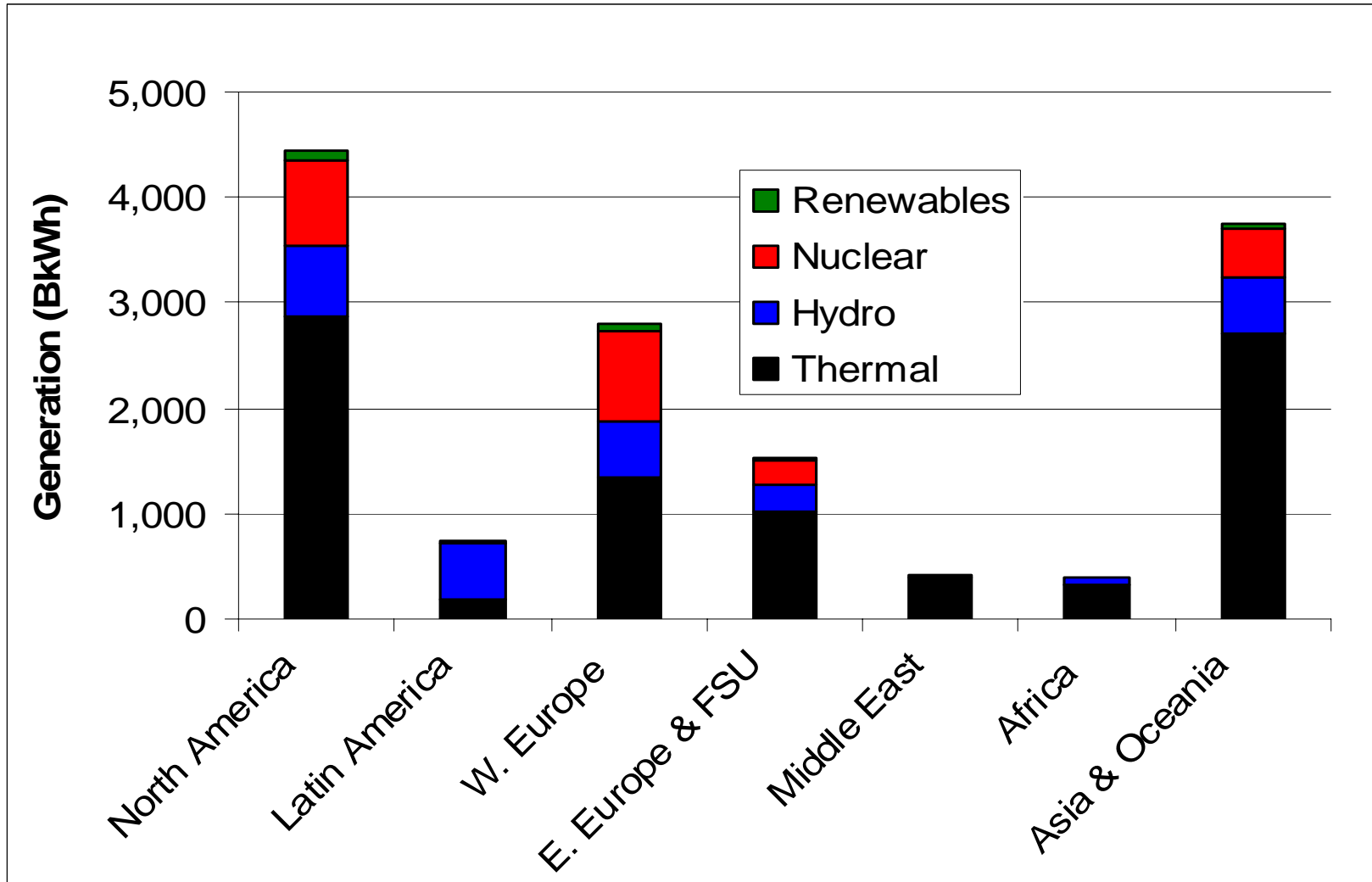
# Power generation global (expected new coal plants)



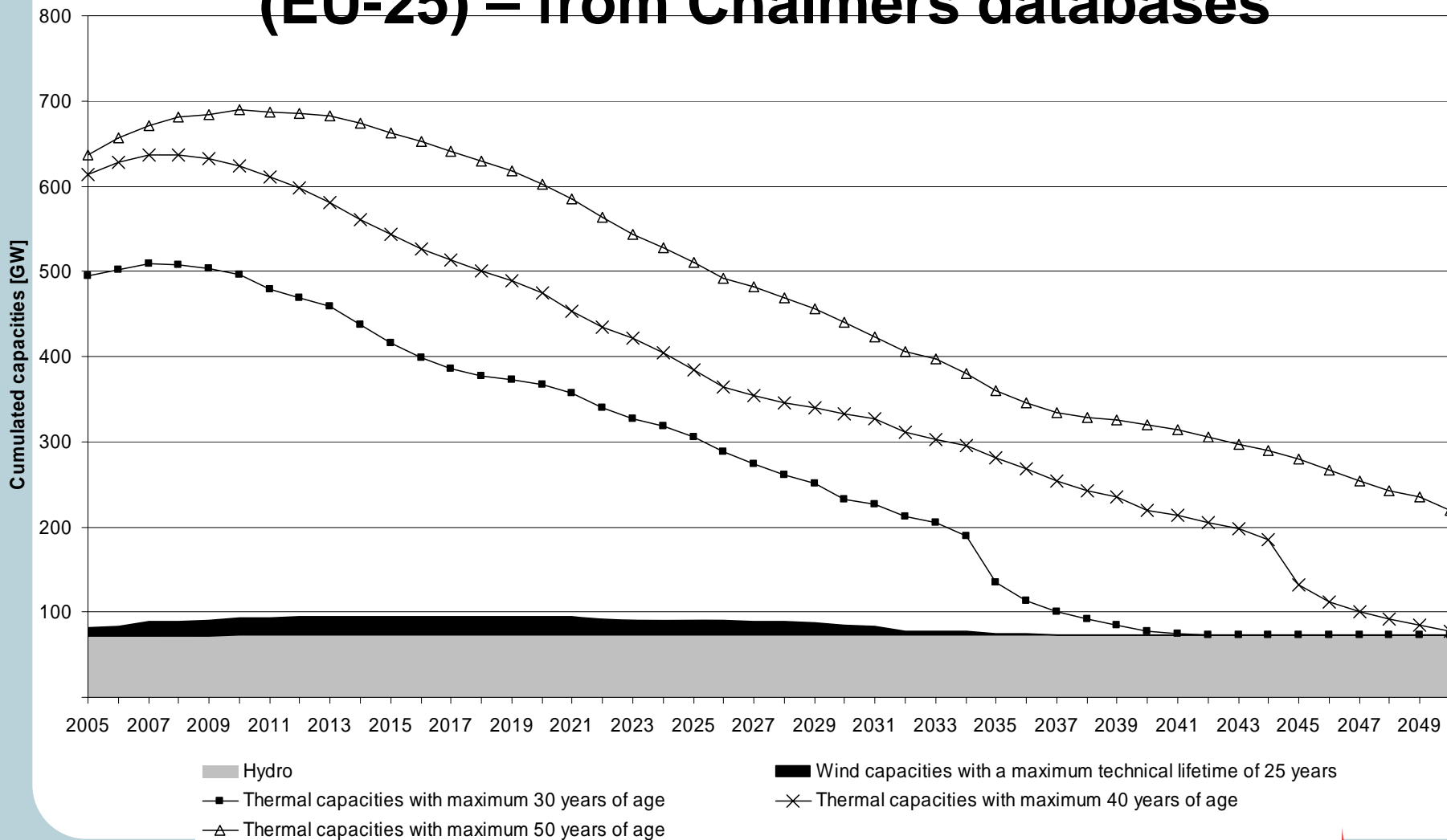
**COAL'S KNOCKOUT BLOW TO KYOTO:** By 2012, expected cuts in greenhouse-gas emissions under the Kyoto treaty will be swamped by emissions from a surge of new coal-fired plants built in China, India, and the United States

SOURCES: UDI-PLATT'S, US ENERGY INFORMATION ADMINISTRATION, AND INDUSTRY ESTIMATES; SCOTT WALLACE - STAFF

# Global Power Generation by Fuel



# Development of age distribution of present system (EU-25) – from Chalmers databases



# Conclusions

- Current development only gives little reduction – if any – in electricity for heating.
- Important to consider the capital stock turnover times, not only for the building itself but also for its different subsystems (“layers”)
  - renovations and replacement of heating systems

