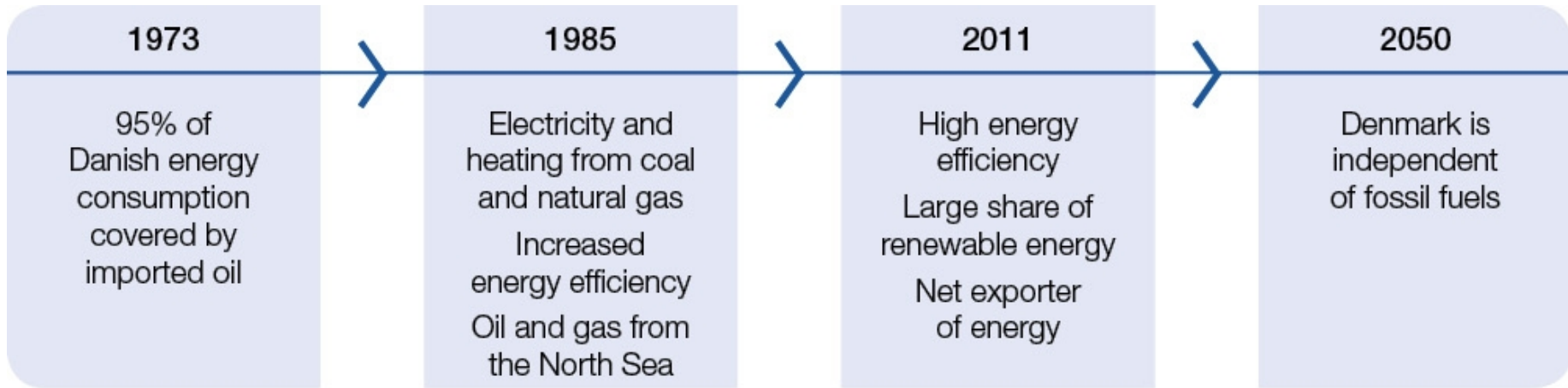


Green electricity innovation - Transformation of the Danish energy system to a non-fossil fuel system in 2050

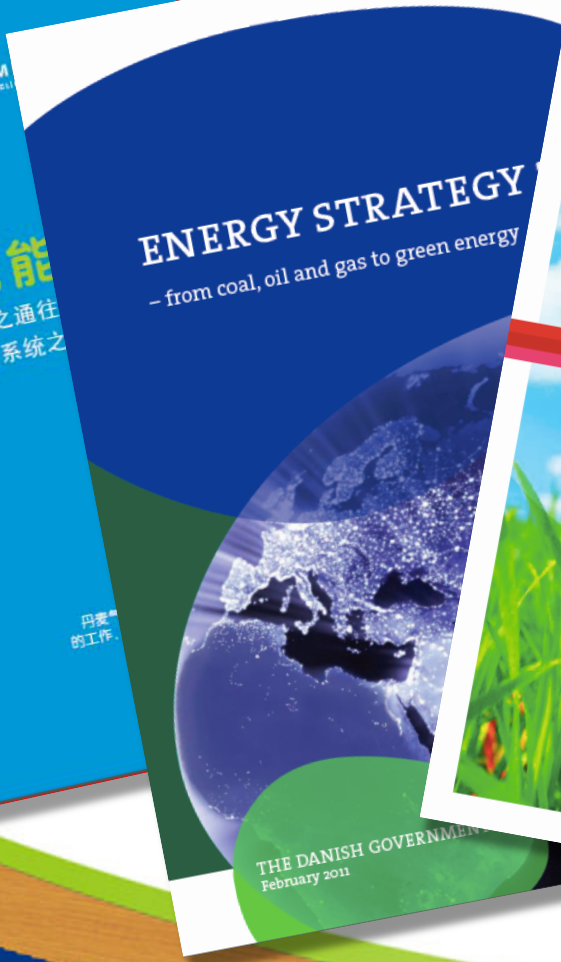
Green Electricity Innovation Forum, Guangzhou 10
November 2012

Kaare Sandholt
Chief Expert
China National Renewable Energy Centre

Transitions of the Danish energy sector



Background for the current Danish Strategy



Aftale mellem regeringen (Socialdemokraterne, Det Radikale Venstre, Socialistisk Folkeparti) og Venstre, Dansk Folkeparti, Enhedslisten og Det Konservative Folkeparti

Den 22. m...

om den danske energipolitik 2012-2020

Partene er enige om, at omstillingen til et Danmark med en energiforsyning dækket af vedvarende energi hviler på troværdige, stabile og langsigtede rammer om den danske energipolitik. Med denne aftale fastlægges konkrete energipolitiske initiativer for perioden 2012-2020. Aftalen vil understøtte fælles EU-målsætninger.

Aftalens længde:

- Aftalen dækker perioden 2012-2020.
- Partene gør årligt status for aftalens nye initiativer, analyser og eventuel videreførelse af de forventede besparelser som følge af reguleringsefforsynet mod forventning ikke realiseres, justeres energifektiviseringsindsatsen tilsvarende.
- Regeringen gør årligt status for realiserede besparelser, jf. aftalens bilagsvedførelse af initiativer, der løber ud.
- Partene mødes i 2015 for at drøfte videreførelse af initiativer og finansiering i aftalen, herunder udvælgelse af 60 mio. kr. årligt fra energieffektiviseringspakken i perioden efter 2015.
- Partene forpligter sig til inden udgangen af 2018 at optage drøftelser om konkrete supplerende initiativer for perioden efter 2020.

Med henblik på at opfylde aftalens formål er partene enige om at igangsætte følgende initiativer:

Et energieffektivt samfund med mindre energispild

Realisering af målet om en energiforsyning dækket af vedvarende energi forudsætter en øget energieffektivisering, som minimerer energispildet og energiforbruget i alle sektorer. Partene noterer sig, at det med finansloven er besluttet at indføre en tilskuds pulje for energioverføring i boliger i 2013 og 2014. Partene er derudover enige om følgende:

- Energielskabernes besparelsesforpligtelser øges i forhold til indsatsten i 2010-2012 med 75 pct. svarende til 10,7 PJ pr. år i perioden 2013-2014 og med 100 pct. svarende til 12,2 PJ årligt i perioden 2015-2020
- I forbindelse med de øgede besparelsesforpligtelser mårettes energielokabernes indsats eksisterende bygninger og erhverv. Der snles mod indgåelse af en omkostningseffektiv aftale med energielokaberne, som styrker konkurrencesættelsen af indsatsten. Der afsættes i alt 12 mio. kr. i 2012-2015 til understøttelse af energiparinitiativer.



Two challenges and an opportunity for future energy policy



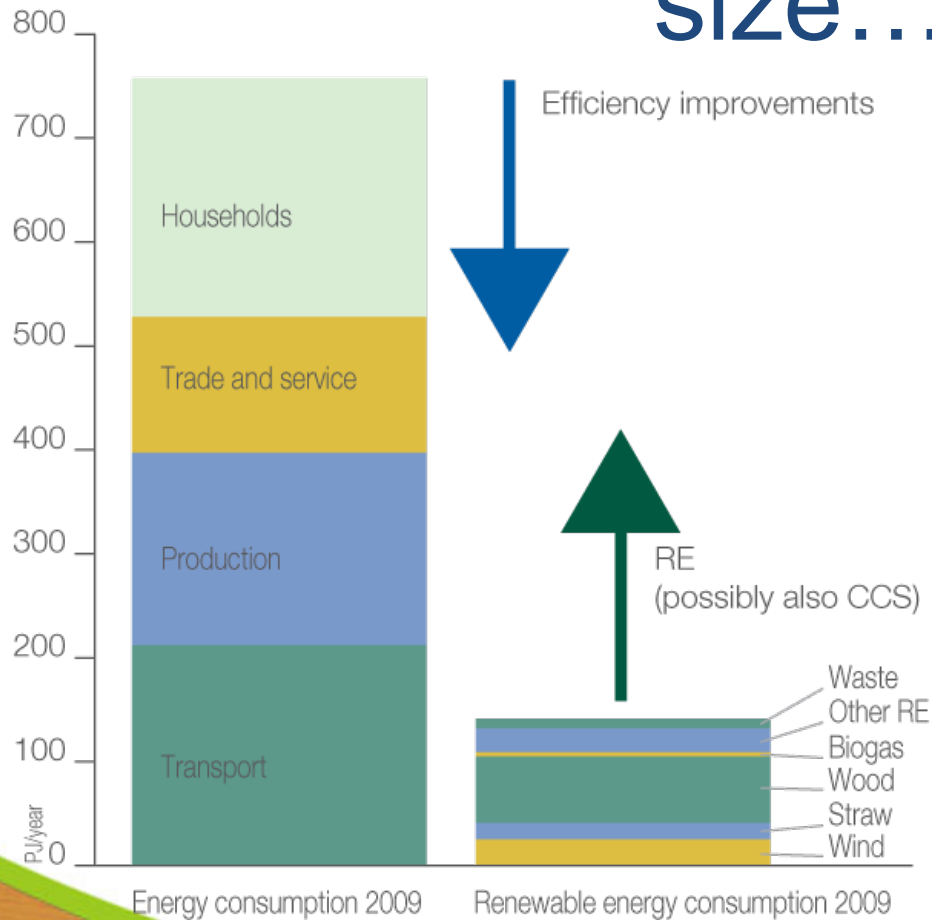
Opportunity

- The growing global demand for new, clean energy technology

Challenges

- Energy security of supply under pressure
- The need to curb global warming by reducing GHG emissions

The challenge is to make these columns approximately the same size...

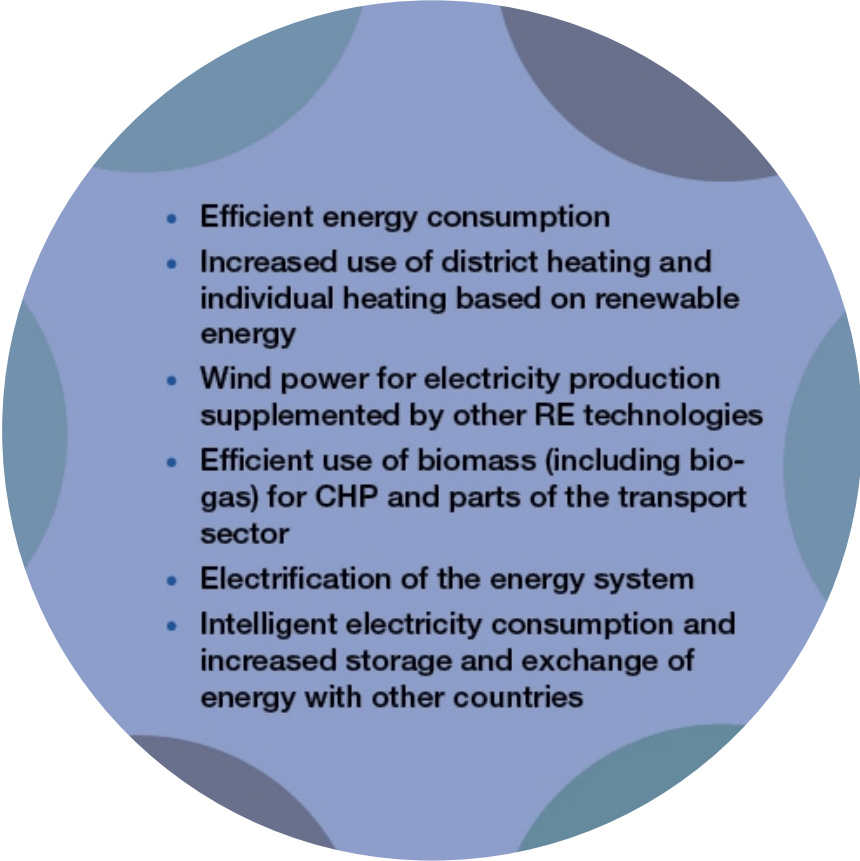


...by improving energy efficiency

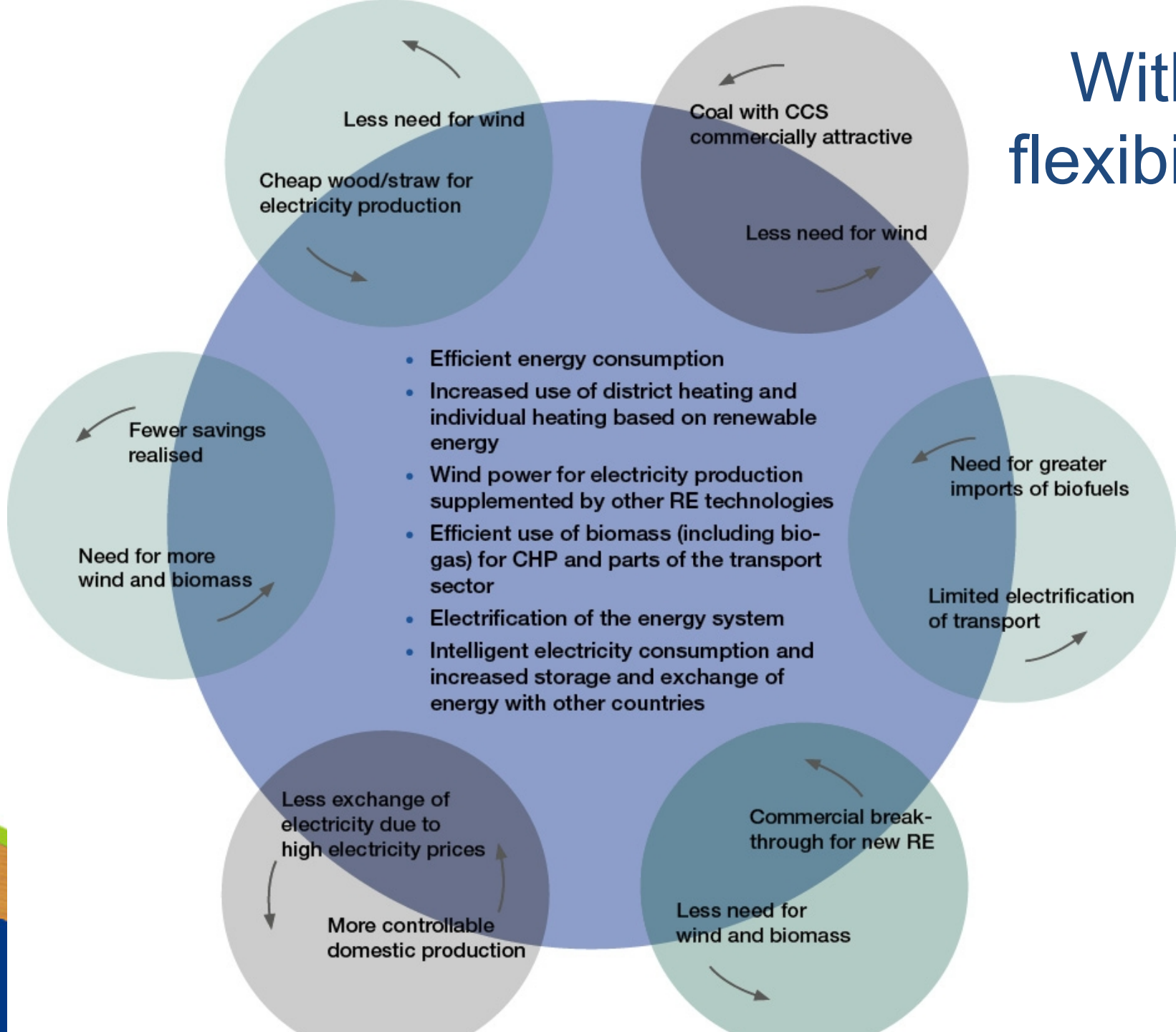
...in order for more energy services to be satisfied with less energy

...based on renewable energy sources

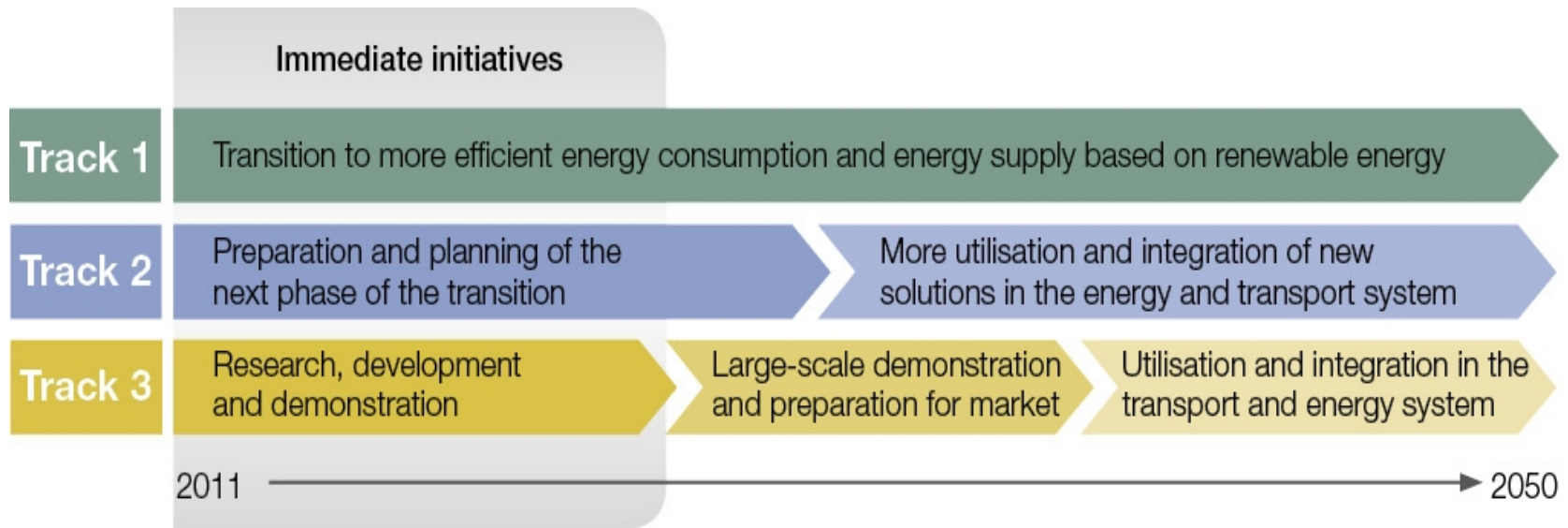
A clear strategy

- 
- Efficient energy consumption
 - Increased use of district heating and individual heating based on renewable energy
 - Wind power for electricity production supplemented by other RE technologies
 - Efficient use of biomass (including biogas) for CHP and parts of the transport sector
 - Electrification of the energy system
 - Intelligent electricity consumption and increased storage and exchange of energy with other countries

With flexibility



A three-track transition – reflecting technological maturity, prices and infrastructure lifetimes



The Danish government's milestones

The government's energy policy milestones up to 2050

In order to secure 100 pct. renewable energy in 2050 the government has several energy policy milestones in the years 2020, 2030 and 2035. These milestones are each a step in the right direction, securing progress towards 2050.

2020

Half of the traditional consumptions of electricity is covered by wind power

The initiatives up to 2020 will result in a greenhouse gas reduction by 35 pct. in relation to 1990.

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Oil burners phased out

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Oil burners phased out

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The electricity and heat supply covered by renewable energy

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2020

Half of the traditional consumptions of electricity is covered by wind power

2030

Coal is phased out from Danish power plants
Oil burners phased out

2035

The electricity and heat supply covered by renewable energy

2050

All energy supply – electricity, heat, industry and transport – is covered by renewable energy

The initiatives up to 2020 will result in a greenhouse gas reduction by 35 pct. in relation to 1990.

Consumption of fossil fuels in Denmark

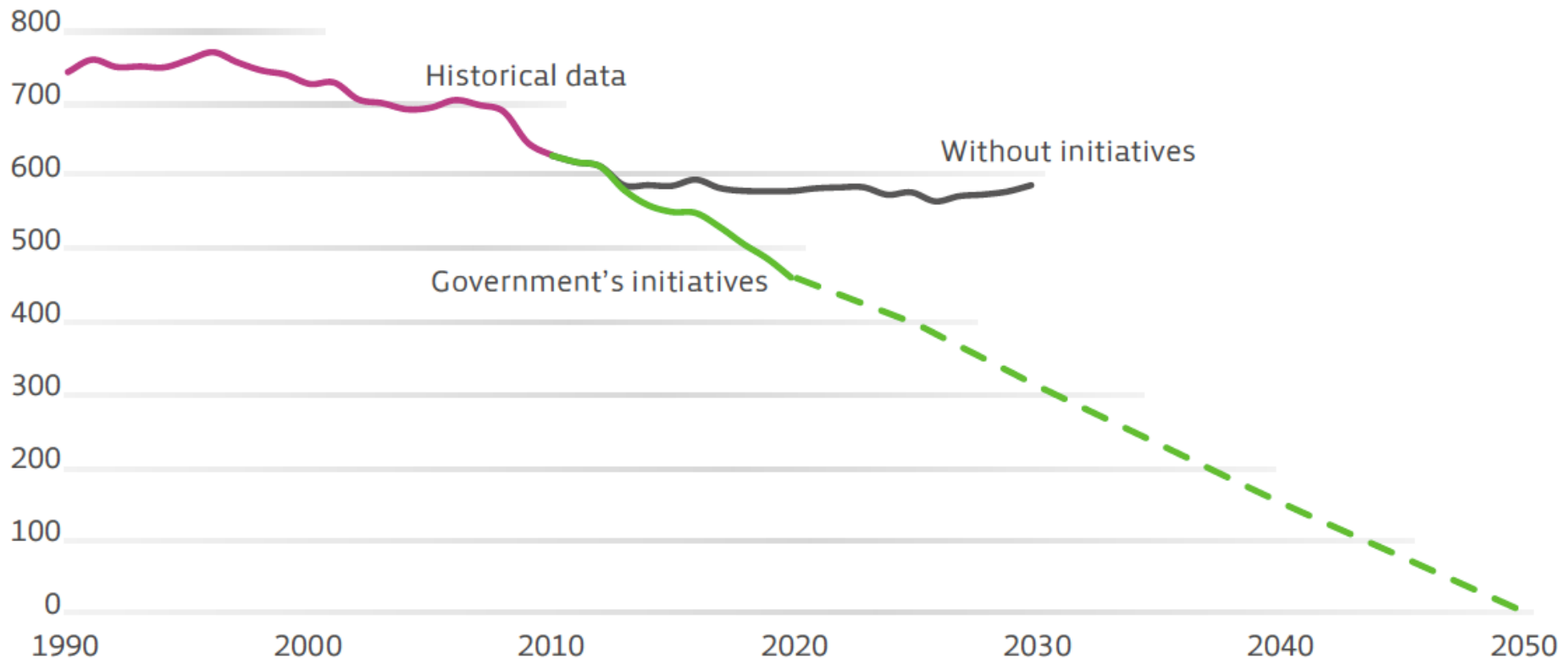


Figure 3.9 Consumption of oil, coal and natural gas (PJ)

Promoting electrification and smart grids

Initiatives to promote electrification and an intelligent energy system

- New electricity transmission lines between Denmark, Germany and possibly Sweden in connection with the offshore wind farm to be built at Kriegers Flak
- Establish agreements with grid companies on the installation of intelligent electricity meters
- Continued incentives for demonstration projects for dynamic tariffs in specific electricity distribution grids
- Efforts for an enhanced EU grid infrastructure and an efficient European electricity market
- State co-financing of re-charging stations for electric cars
- Efforts in the EU to promote electric cars with focus on harmonisation and roll-out of car recharging infrastructure
- Extension of tax exemptions for electric cars to the end of 2015
- Preparation of an analysis and plan for expansion of transmission capacity abroad
- Preparation of a strategy for expansion of smart grids in Denmark. The strategy will be presented before the end of 2012
- Preparation of an overall strategy for the promotion of energy-efficient vehicles such as hybrid plug-in, electric cars etc.

RE for electricity and heat

Initiatives to convert to renewable energy in electricity and heat production

- Call for tenders for 1,200 MW offshore wind turbines up to 2020, including 600 MW offshore wind turbines at Kriegers Flak
- Screening of areas in the first half of 2012 as well as setting the framework for testing and production turbines with a view to establishing 400 MW offshore wind turbines in coastal areas up to 2020
- Measures for more efficient tendering procedures and therefore cheaper expansion of offshore turbines
- Support municipal planning in order to establish 1,800 MW new wind power onshore (500 MW more than anticipated in the 2010 baseline projection), including an ambition to promote the Wind Turbine Secretariat in collaboration with the industry
- Tendering state-owned areas to erect wind turbines
- Gradual phase-out of premium for onshore wind turbines with introduction of a new cap of DKK 0.6/kWh for the electricity market price and premium, after which the premium will be gradually phased out for electricity market prices over DKK 35/kWh. This will apply for new onshore wind turbines connected to the grid on and after 1 January 2014
- Shift from coal to biomass in central CHP production through greater freedom for producers and buyers to make agreements
- Retention of current fuel restrictions for small-scale combined heat and power combined with targeted consultancy and greater flexibility in choice of fuel for the up to 30 district heating plants with the highest heat prices
- Fund to promote new renewable technologies (large heat pumps, geothermal energy etc.)
- Analysis of the use of bioenergy in Denmark. The analysis will focus on whether the right framework conditions for efficient and environmentally sustainable use of biomass resources are in place in Danish energy supply

Dokumen

Cost-effective green transition

Initiatives to promote cost-effective green transition

- Regular evaluation of the impact of instruments and overall evaluation every four years in order to secure progress and cost effectiveness
- Development of economic model tools for the energy sector in order to realise a better decision base for the green transition
- Examination of the subsidy and tax system in order to assess the need for adjustments of the existing system, including possibilities to secure the right incentives for conversion to a green and flexible energy system
- Thorough investigation of the regulation of the Danish electricity supply sector with a view to securing incentives for green conversion, cost effectiveness, competition and consumer protection

Electricity production by source

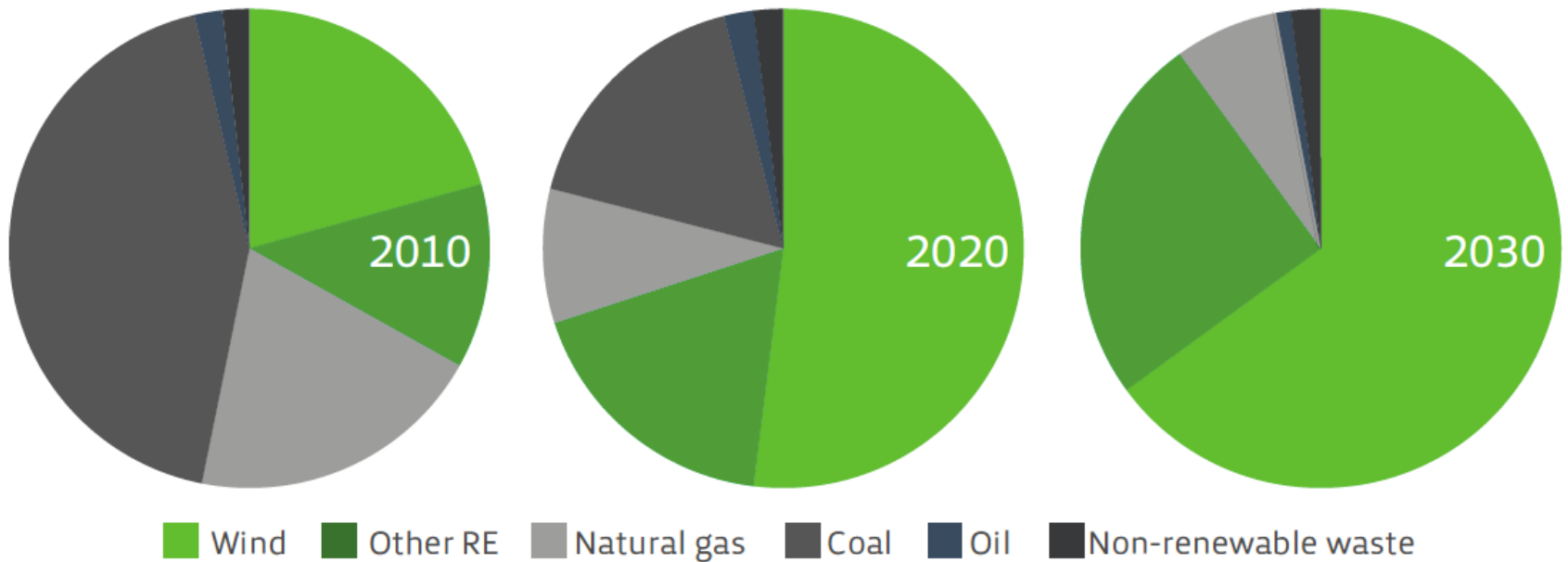
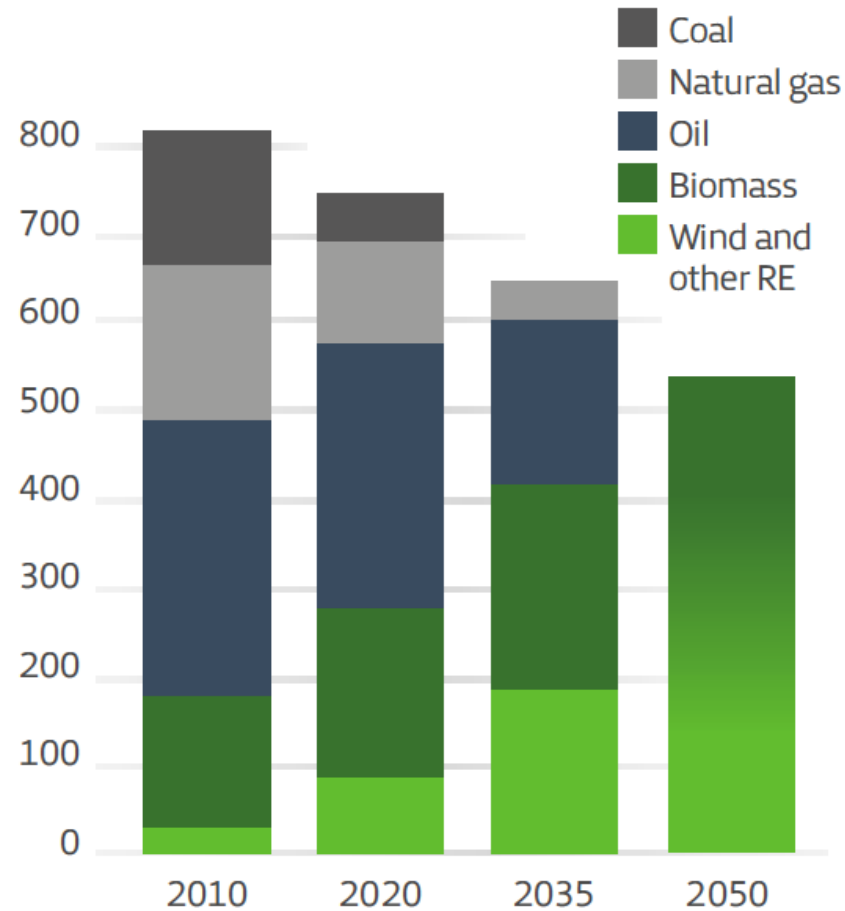
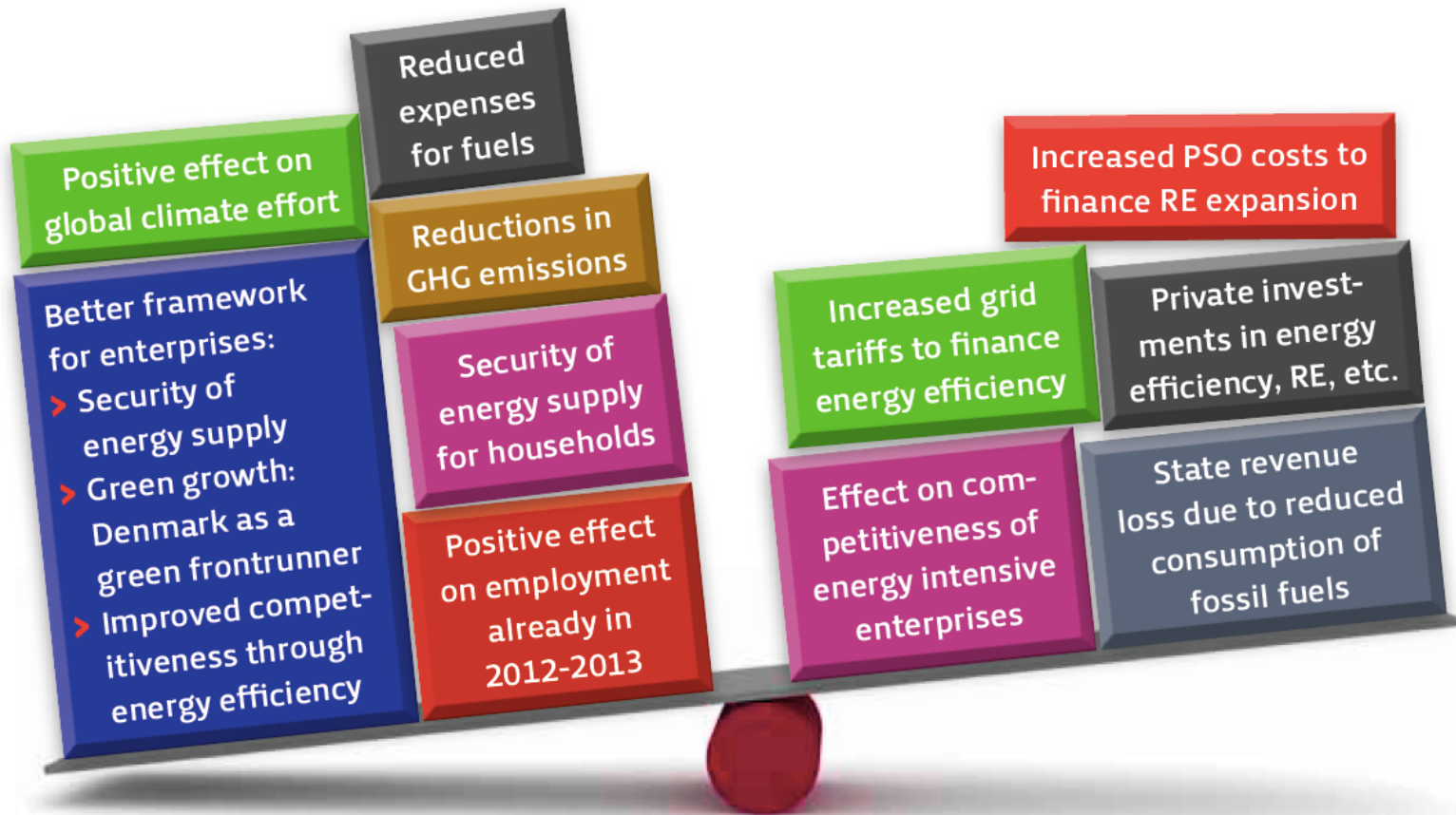


Figure 3.2 Electricity production by energy source (adjusted for electricity trading)

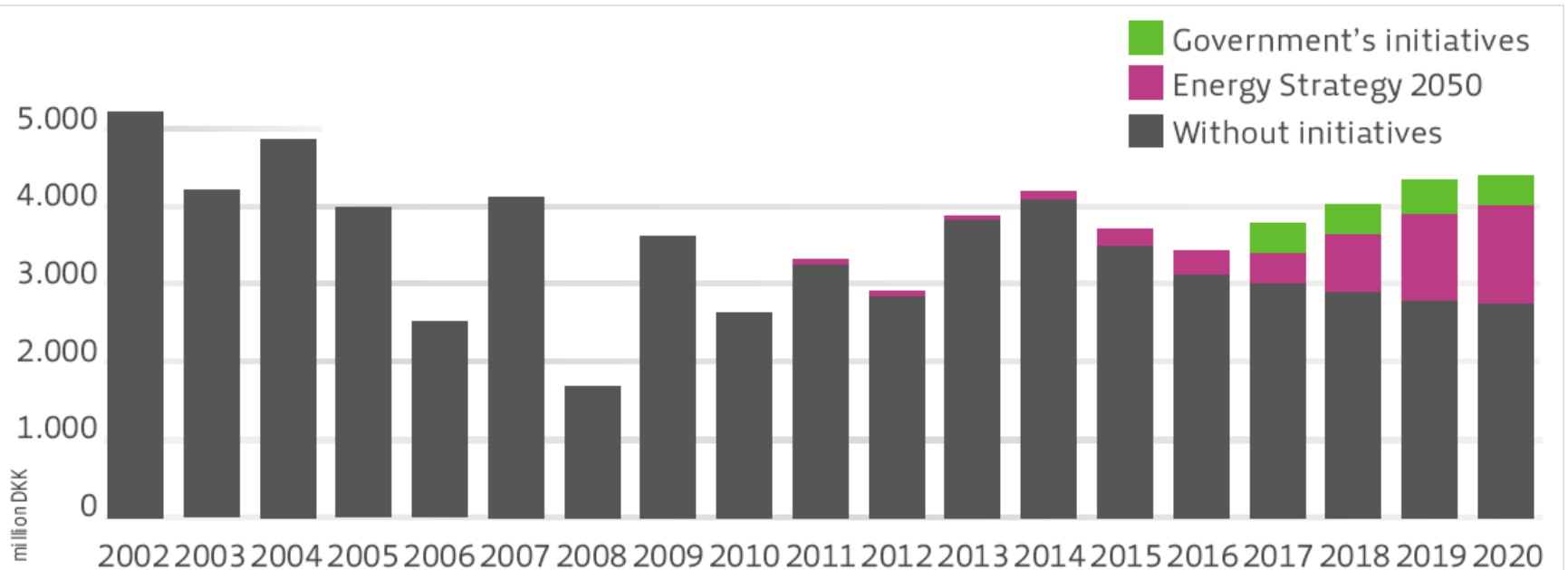
Consumption of fossil fuels and RE (PJ)



Benefits and costs

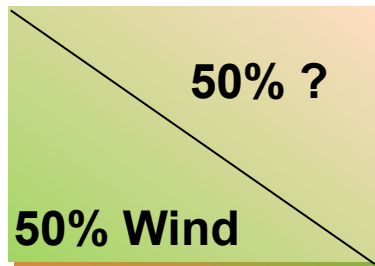


Development of PSO-financing



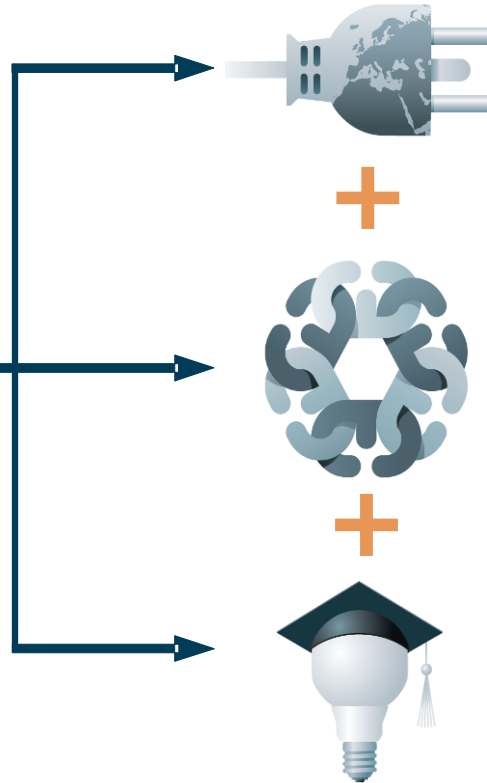
Instruments to effectively integrate large amounts of fluctuating renewable energy in the power system

Production



By 2020

Instruments

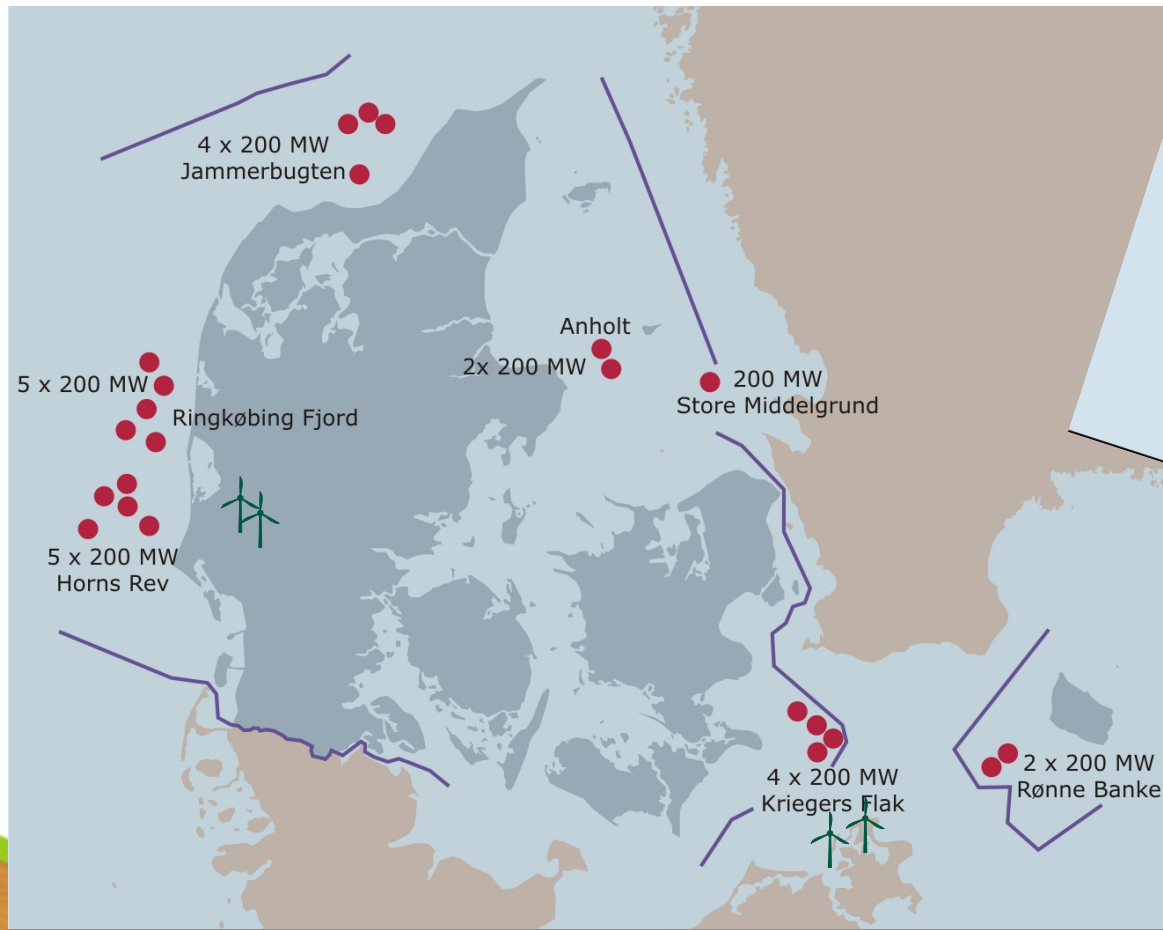


Strong transmission grid and interconnections - and well functioning energy markets

Flexibility in production and consumption. Close integration with the heat, gas and transportation sector

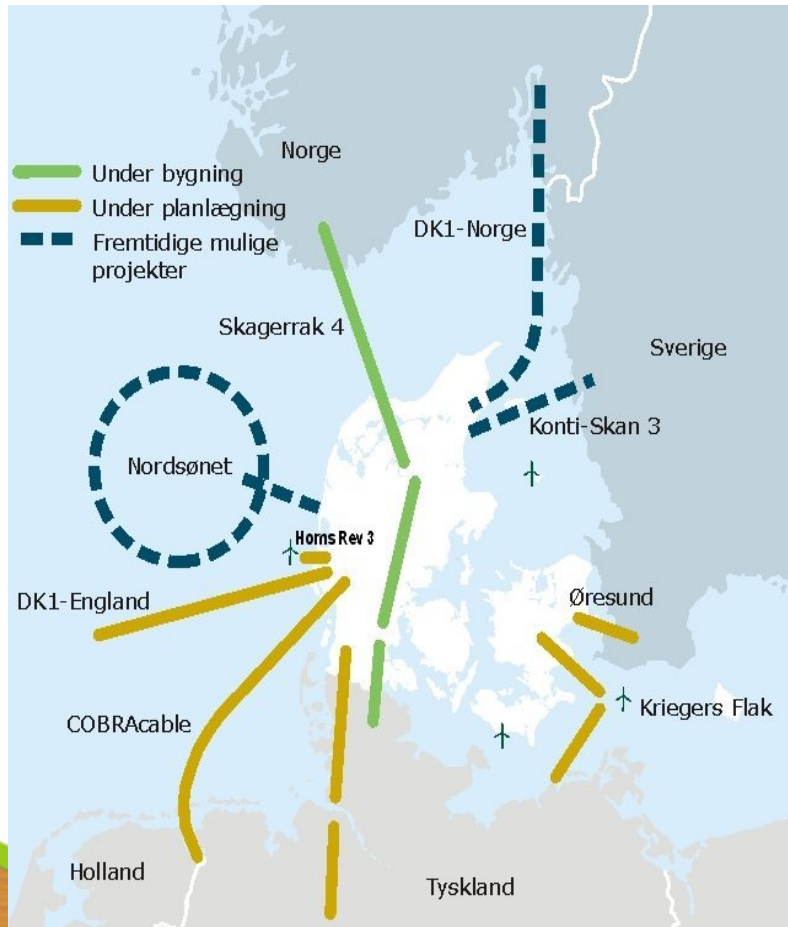
Smart Grid to implement intelligence in the power system

Offshore wind farms



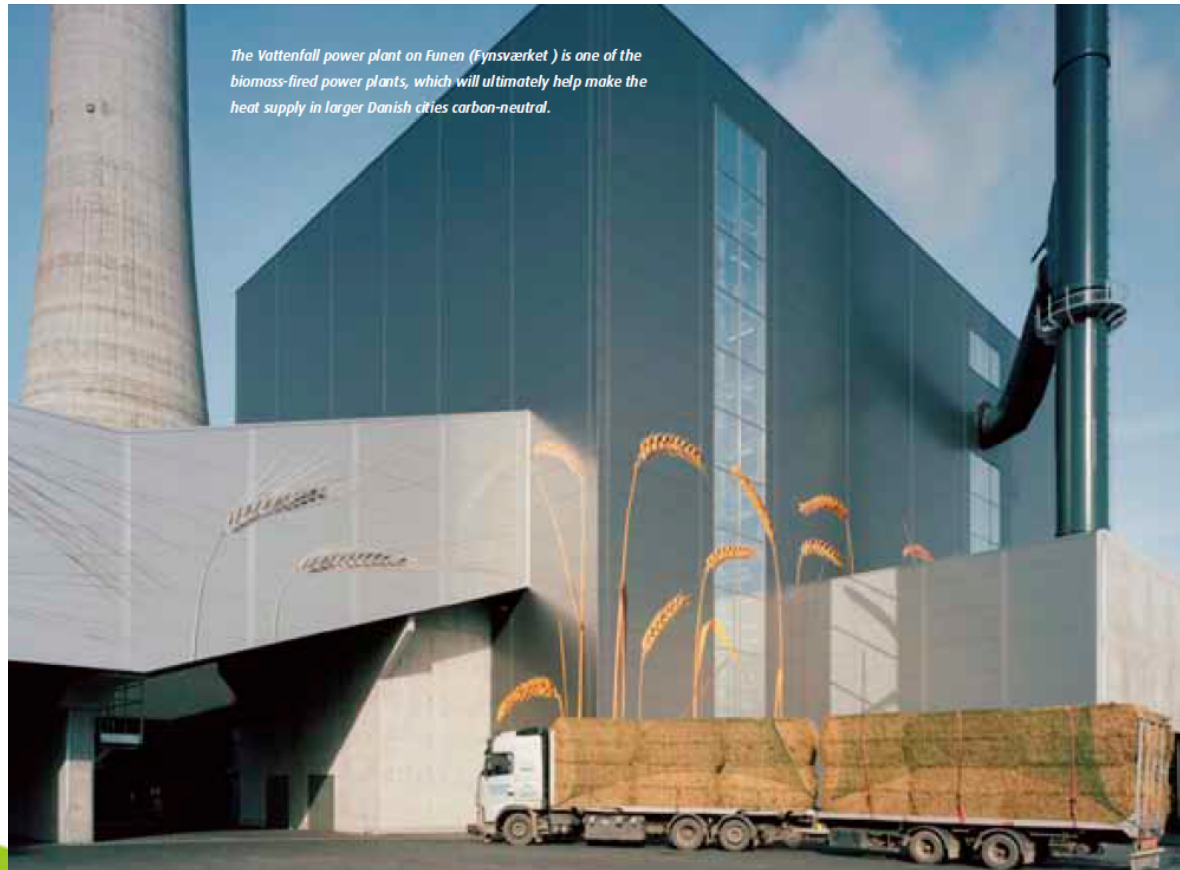
available sites for 4.6 GW offshore wind power

Development of the transmission grid

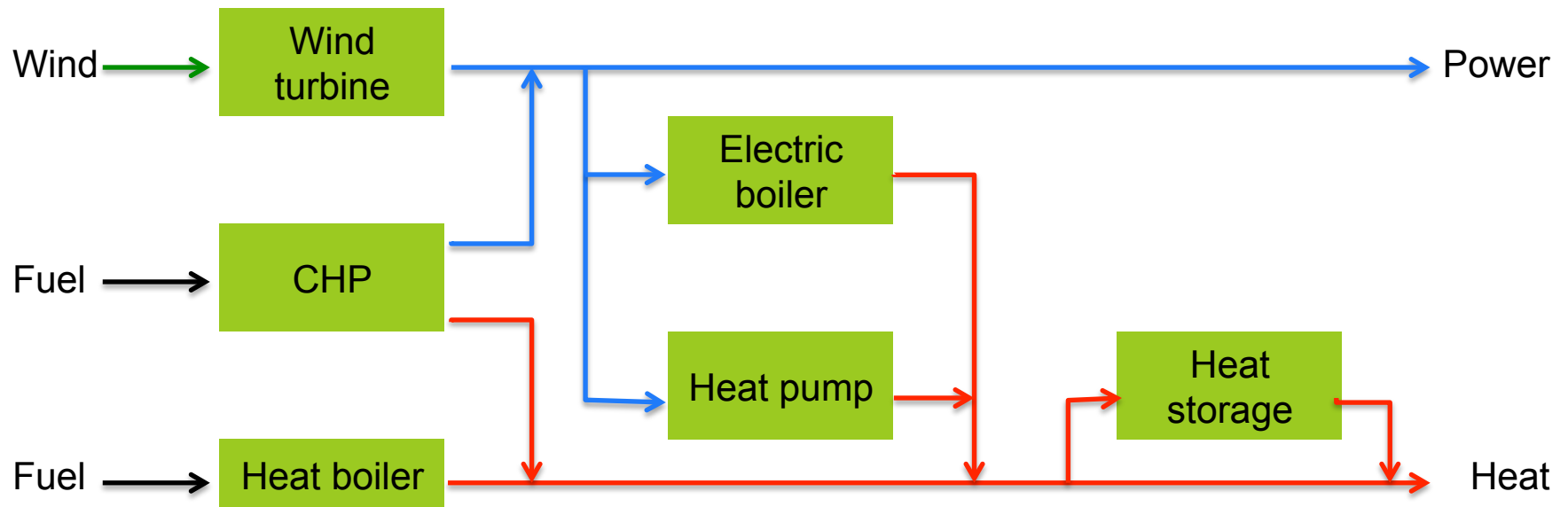


- Interconnector projects
- Reinforcement and reconfiguration of transmission grid
 - Last new overhead line
 - Underground cabling
- Combined offshore wind farm connection and interconnector
 - First offshore grid!

Straw and wood for CHP – in existing coal fired power plants

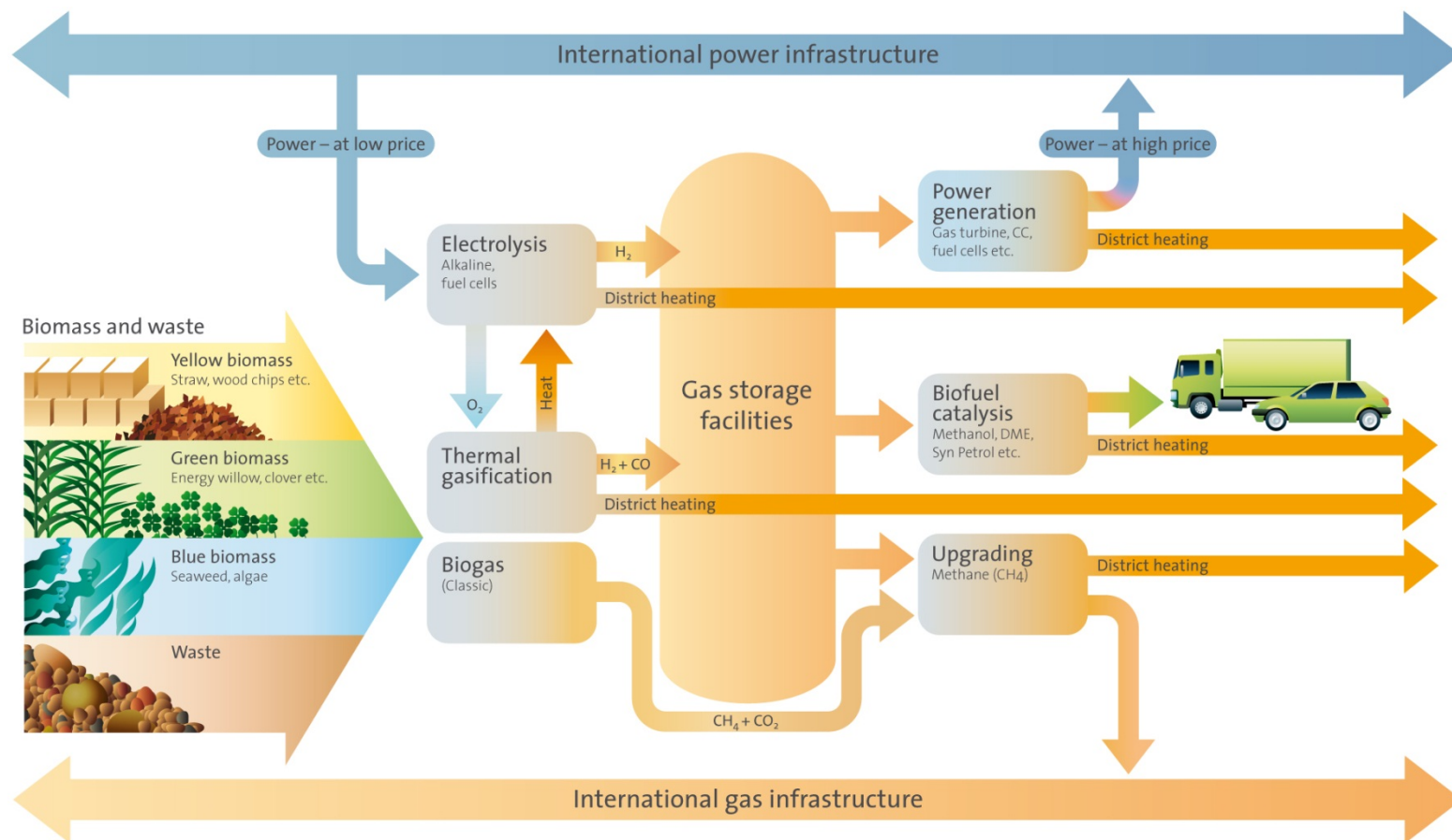


A flexible power and heat system



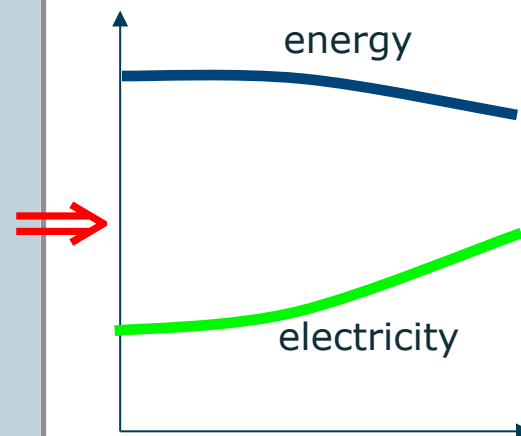
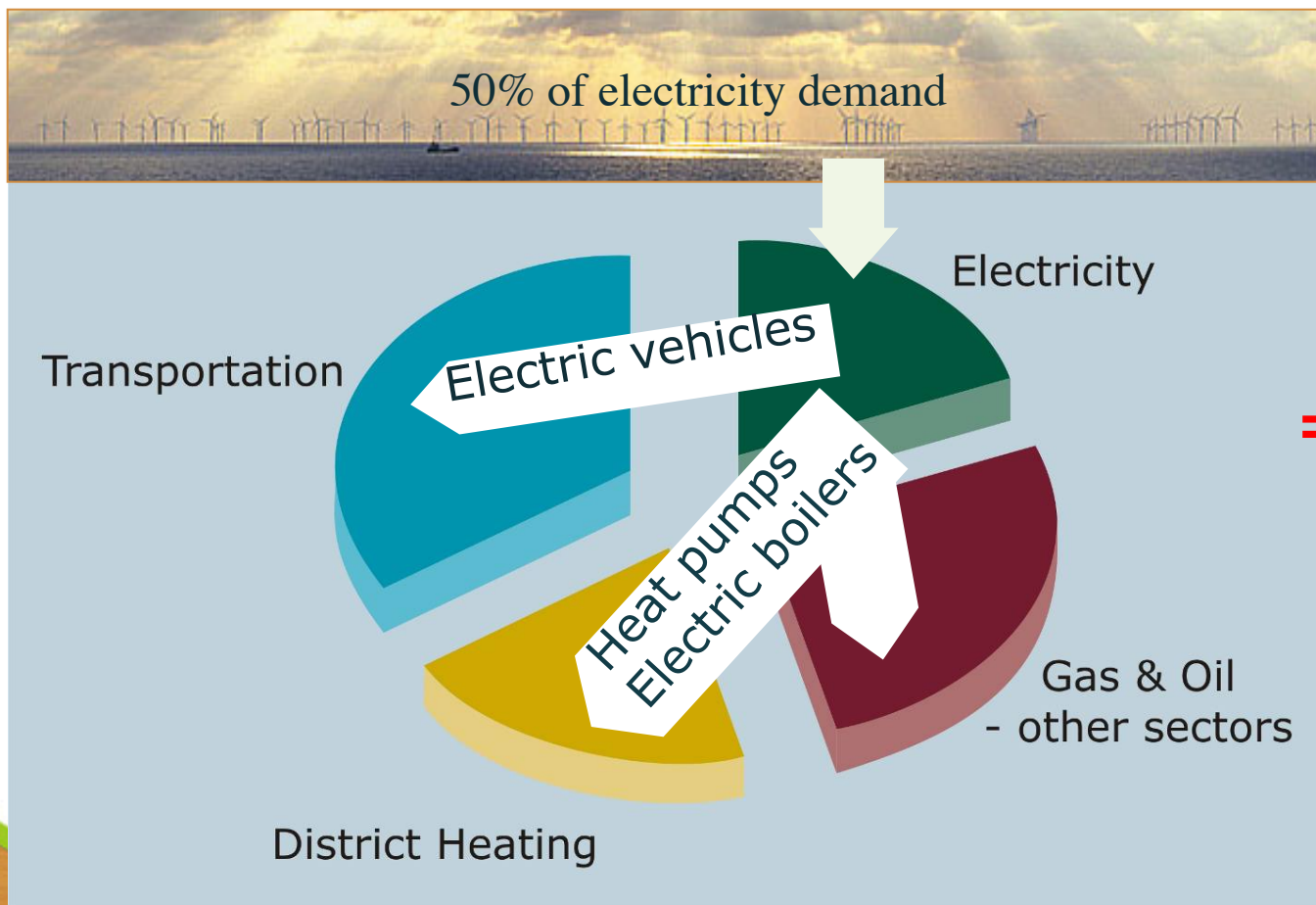
Integration of energy systems

– synergy between gas and electricity

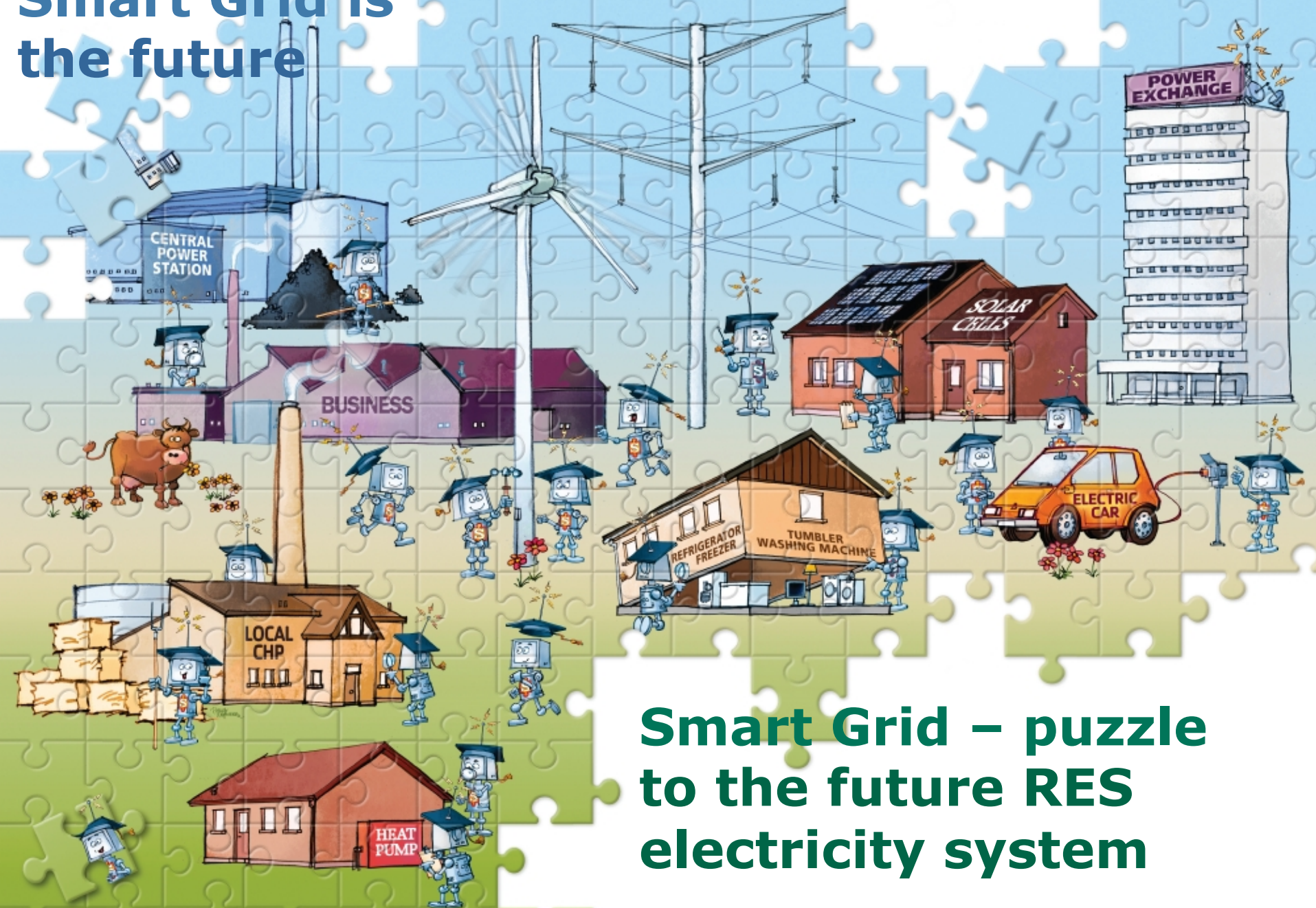


- Substantial storage capacity in the gas system
- Competitive peak-load capacity from RE-Gas
- Optimal use of bio resources

Coherent and flexible energy systems



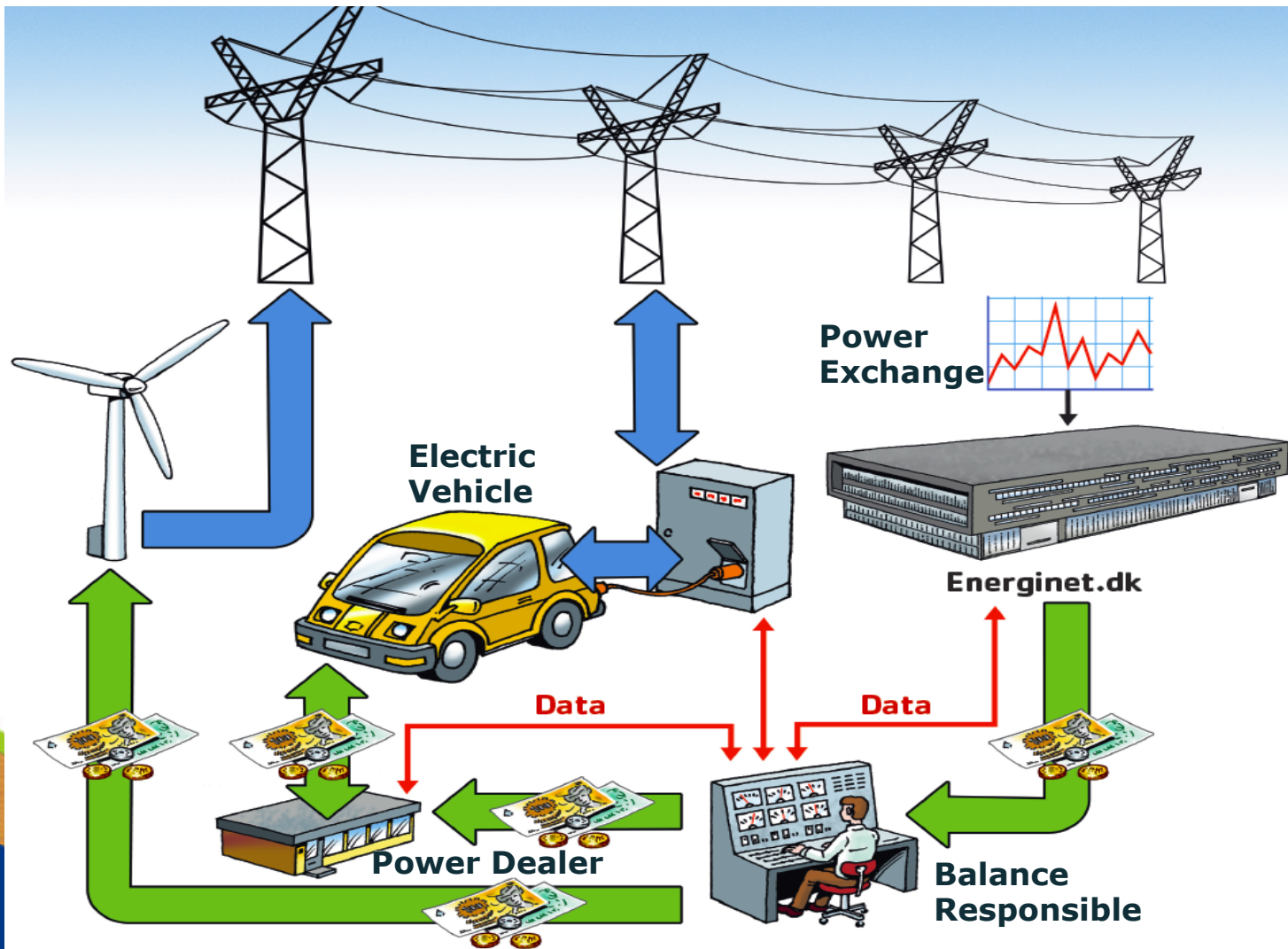
Smart Grid is the future



**Smart Grid – puzzle
to the future RES
electricity system**

EDISON – Large scale EV project in Denmark

Electric vehicles in a Distributed and Integrated market using Sustainable energy and Open Networks



EcoGrid EU – a prototype for the future energy system



- Demonstration of an electricity system with more than 50% wind power and demand flexibility to optimize the utilization of RES
- Bornholm is a unique place for testing
- 2.000 costumers will participate
- Test of a 5-minute local markets
- Test of new market products
- Co-operation with other Smart Grid projects on the island
- Local support – Bright Green Island vision

The modern energy system

A strong international transmission grid

to trade and balance in a wide geographical area

Efficient international electricity markets

with clear price signals and trading close to real-time

Coherent energy systems

electricity, gas, heating and transportation - to increase flexibility and economic efficiency and reduce environmental impact

High flexibility in generation and demand

with technical connection requirements for all resources – Grid Codes

A revised power system control architecture

improved control and observability of distributed resources - SmartGrids

Efficient solutions through Pan-European coordination!

Thank you for your attention 😊