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

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China National Renewable Energy Centre

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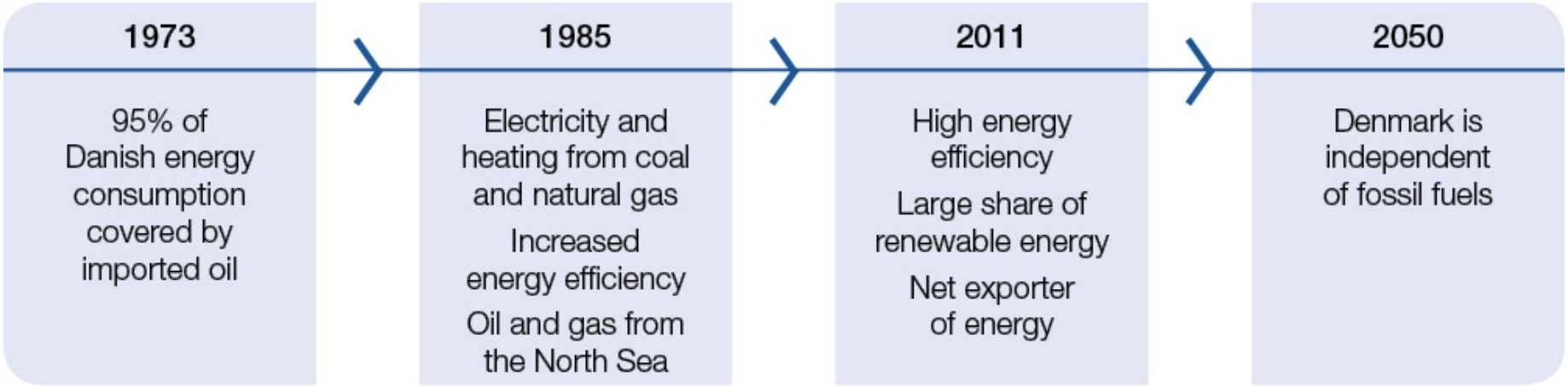
Transitions of the Danish energy sector



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Background for the current Danish Strategy

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

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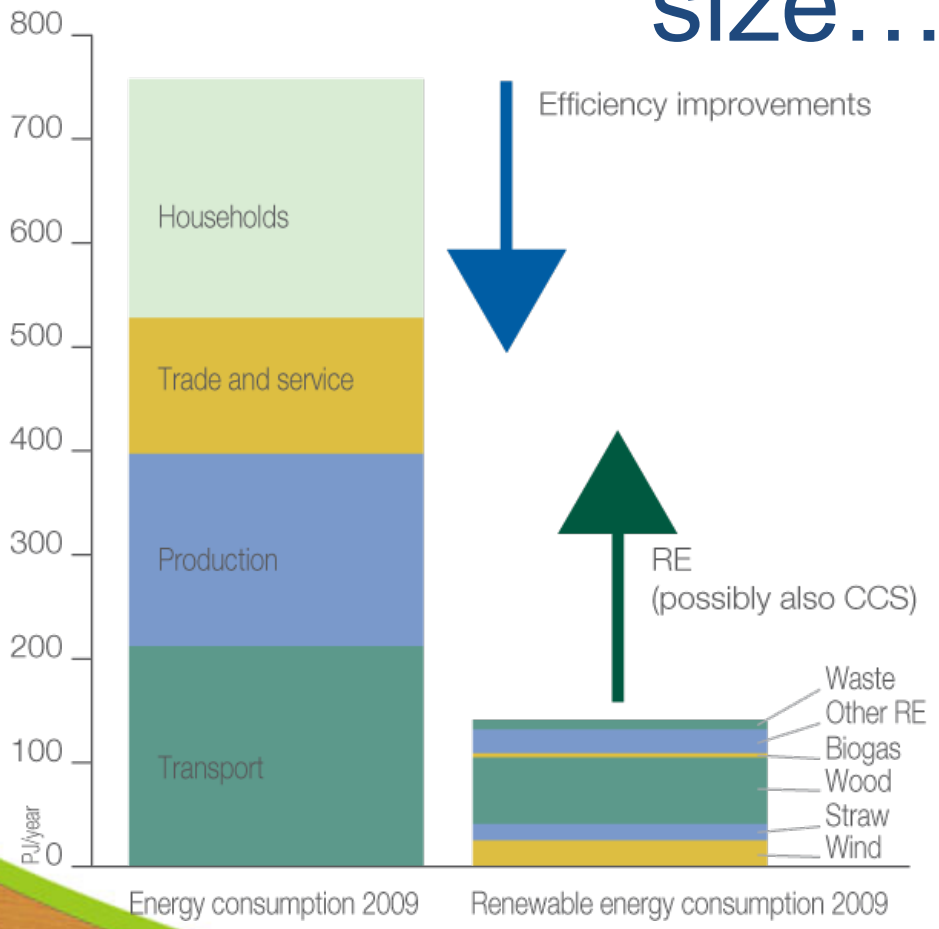
The challenge is to make these columns approximately the same size…



…by improving energy efficiency

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

…based on renewable energy sources

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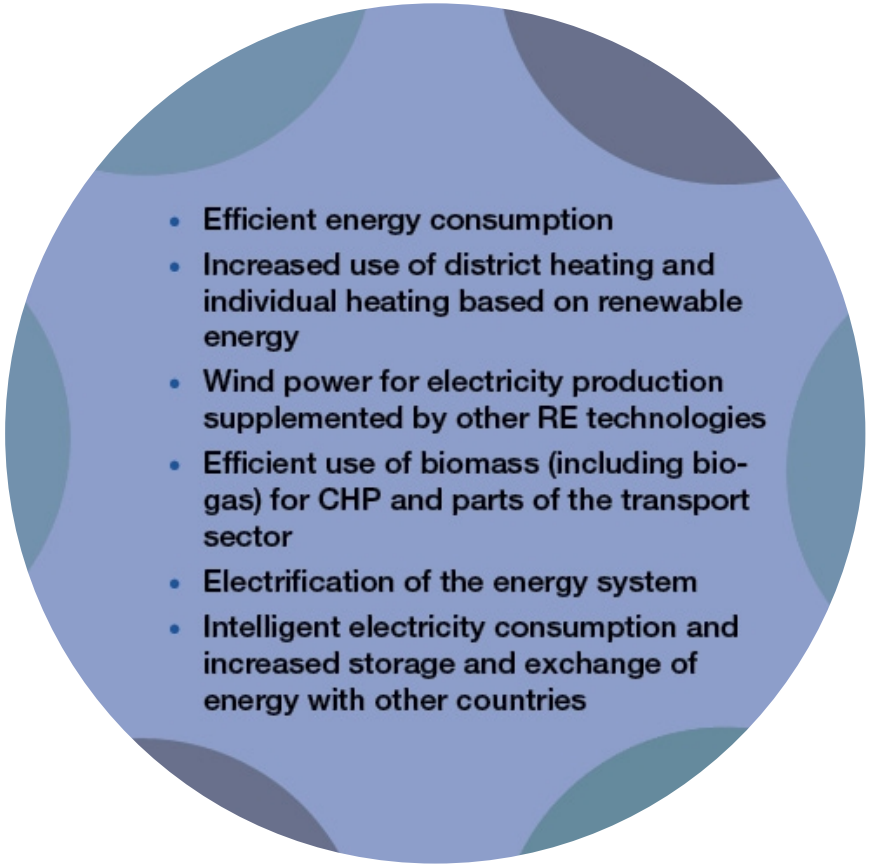
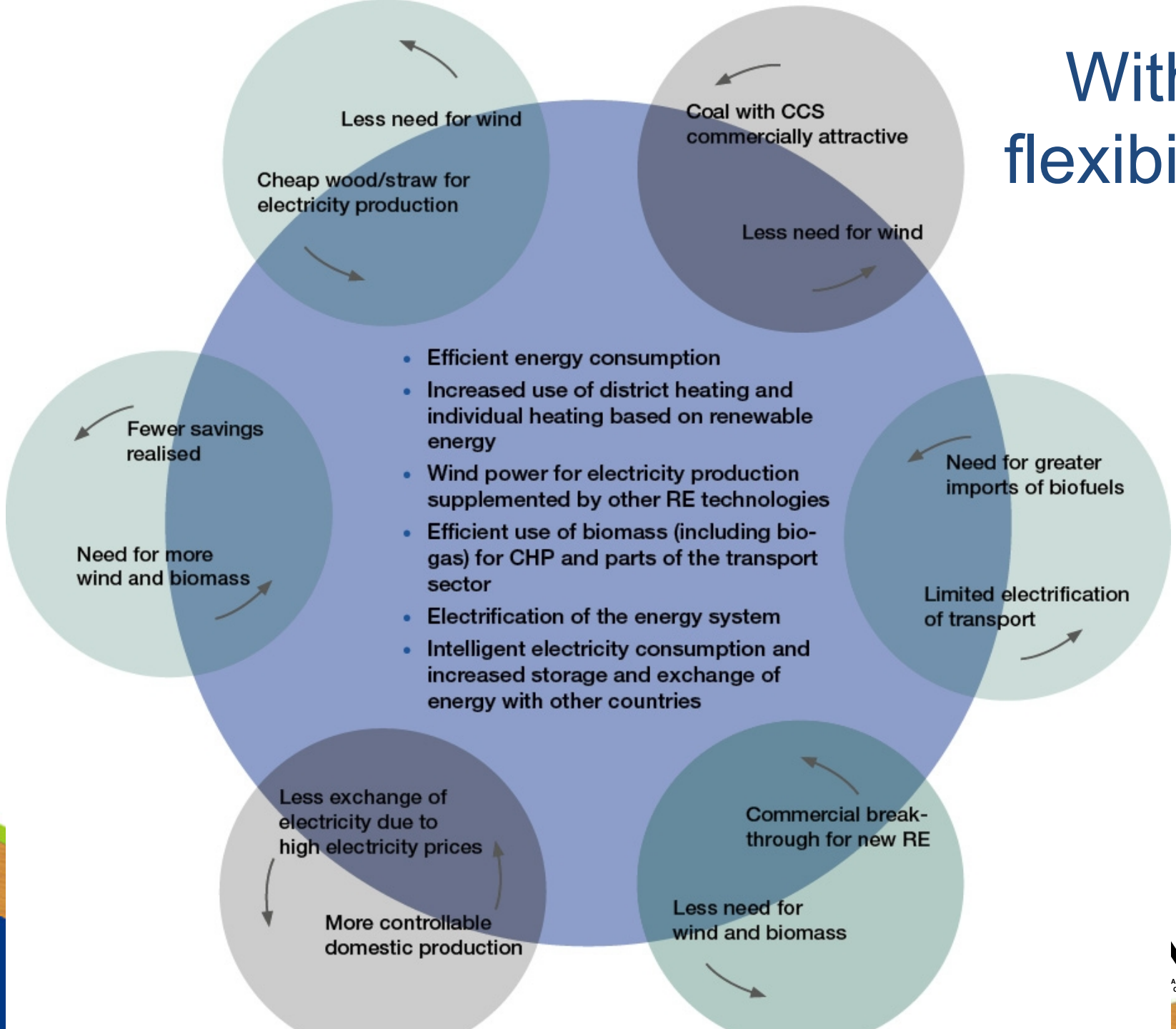
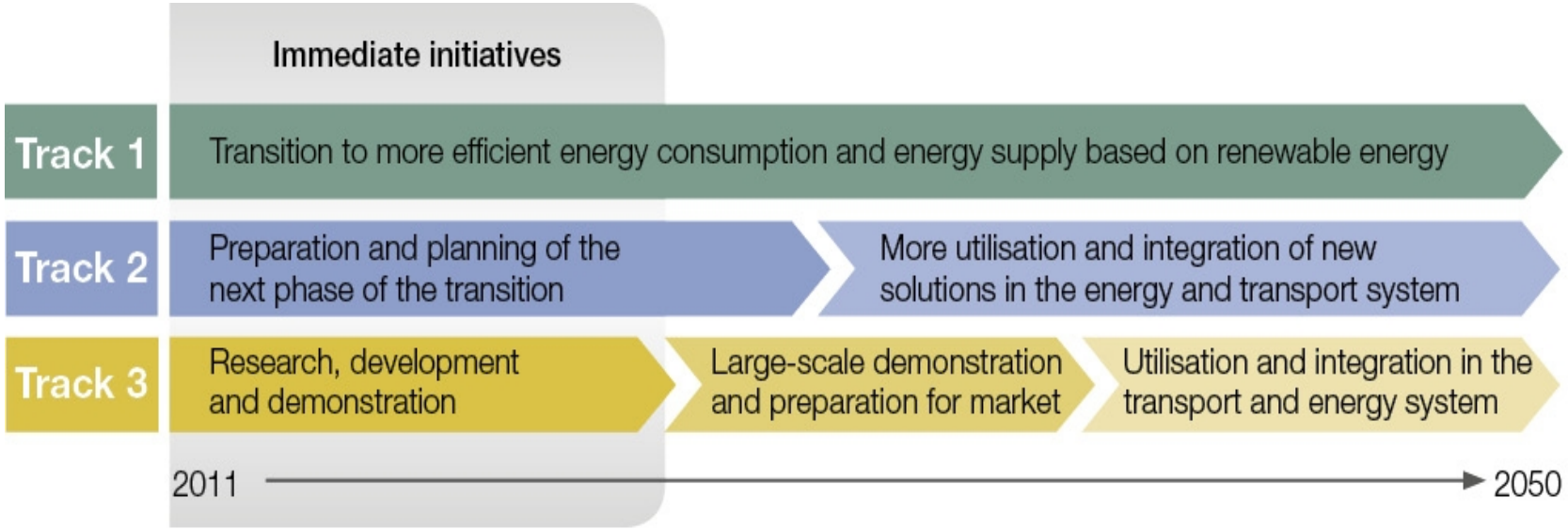
A clear strategy



With flexibility



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



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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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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.

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Consumption of fossil fuels in Denmark

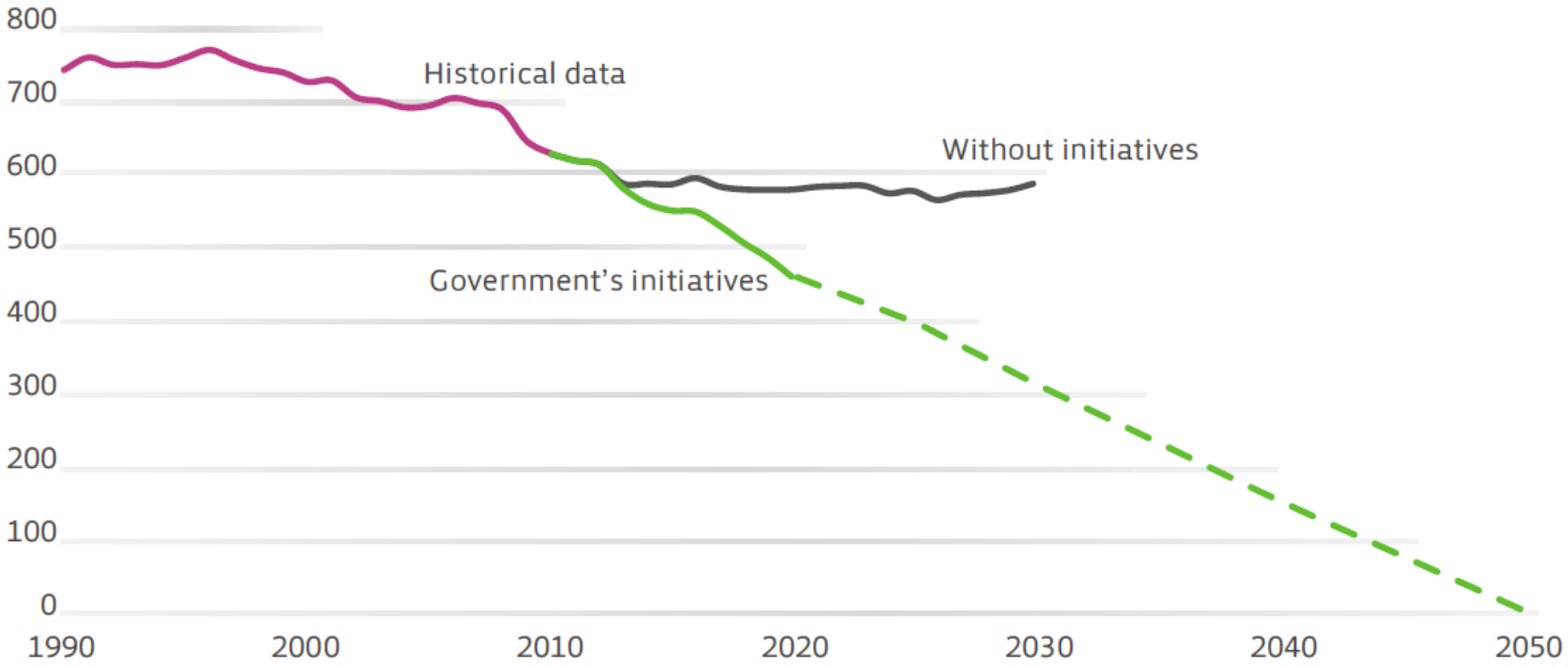

Figure 3.9 Consumption of oil, coal and natural gas (PJ)

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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 tarriffs 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.

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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

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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

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Electricity production by source

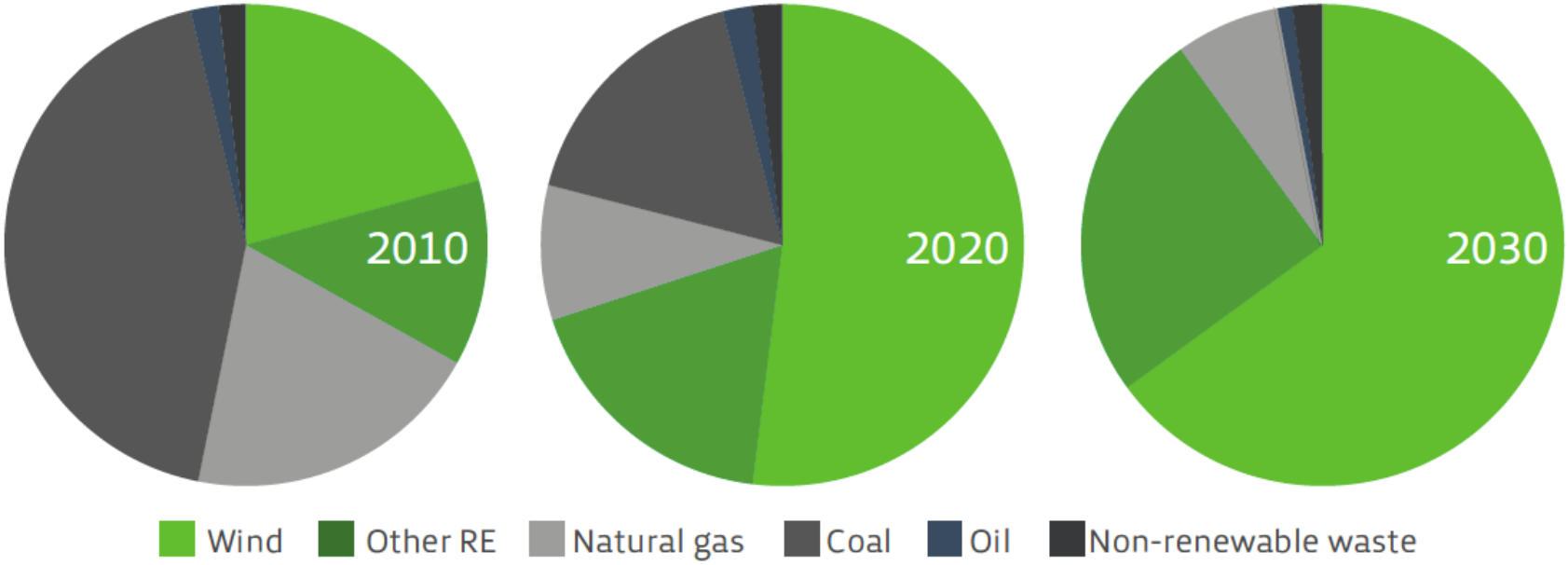

Figure 3.2 Electricity production by energy source (adjusted for electricity trading)

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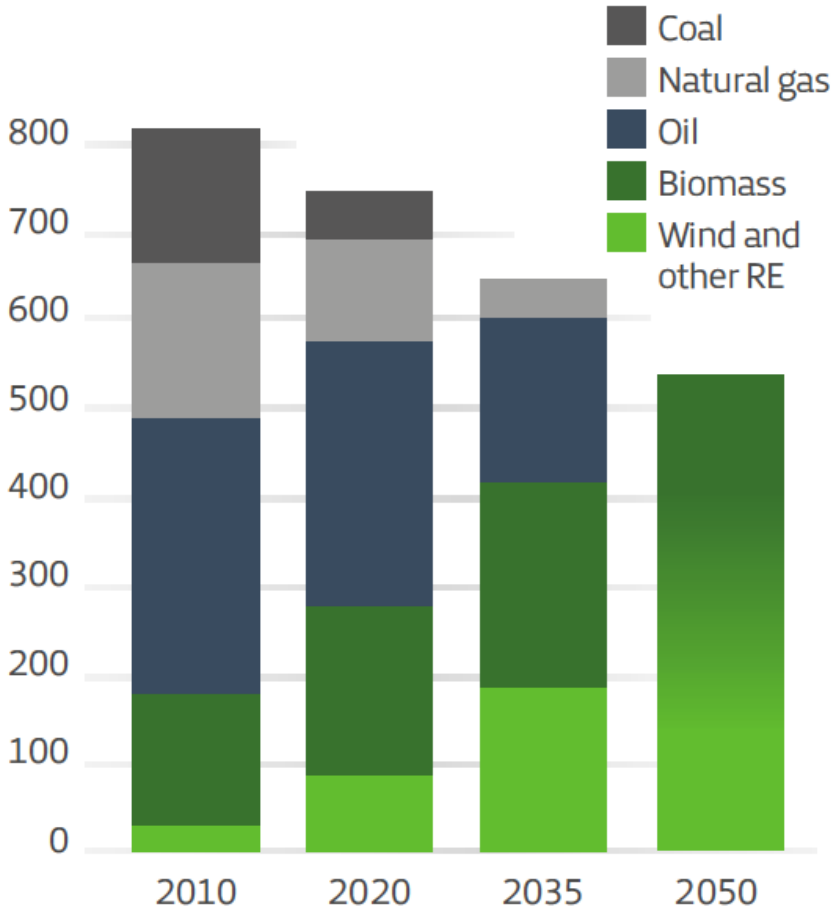
Consumption of fossil fuels and RE (PJ)



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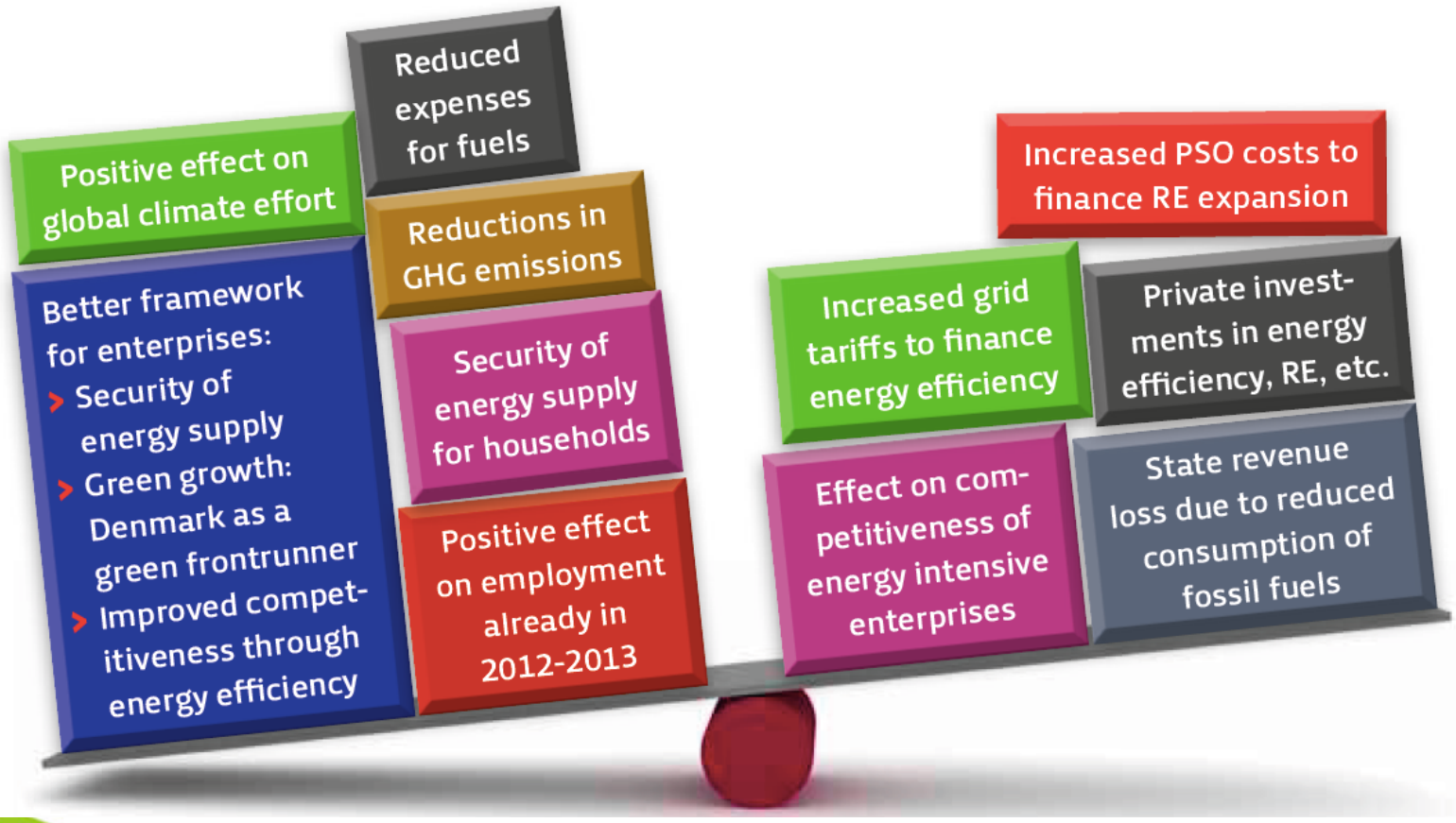
Benefits and costs



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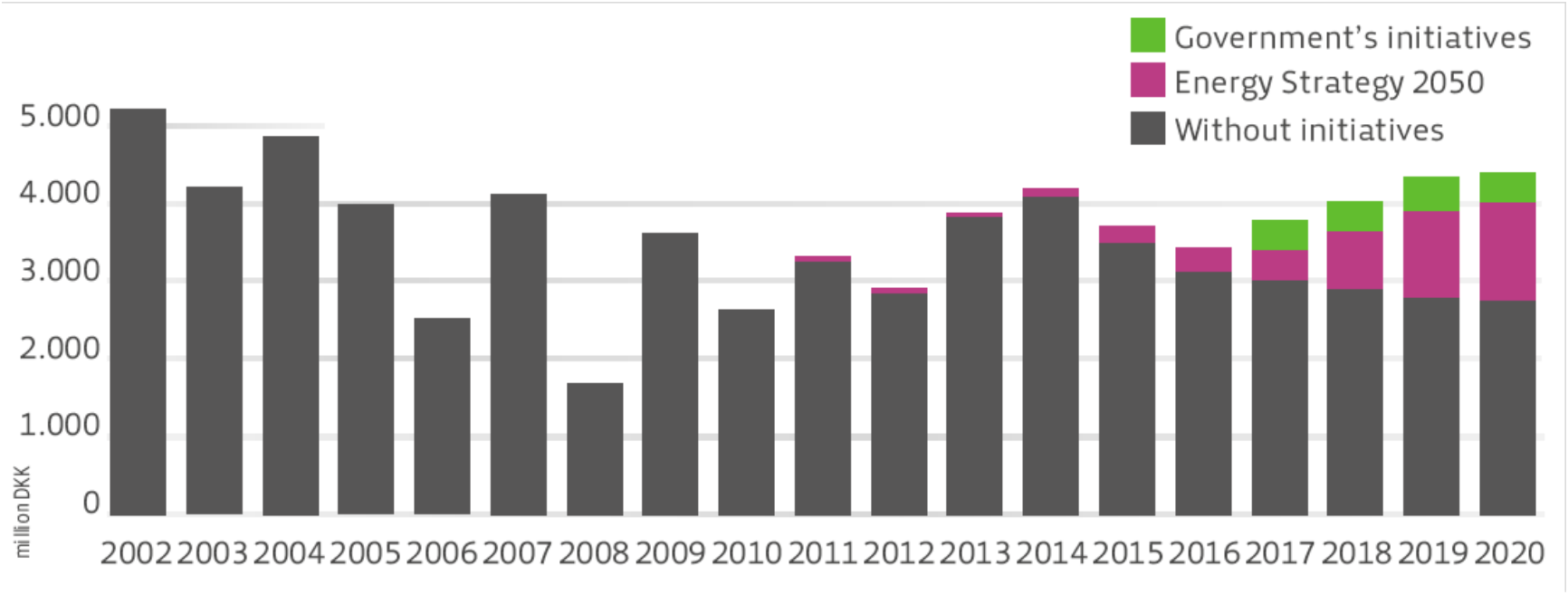
Development of PSO-financing



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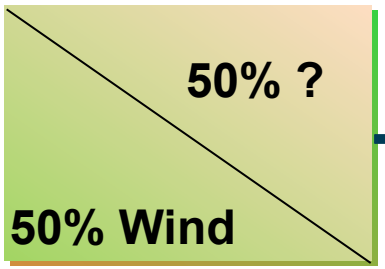
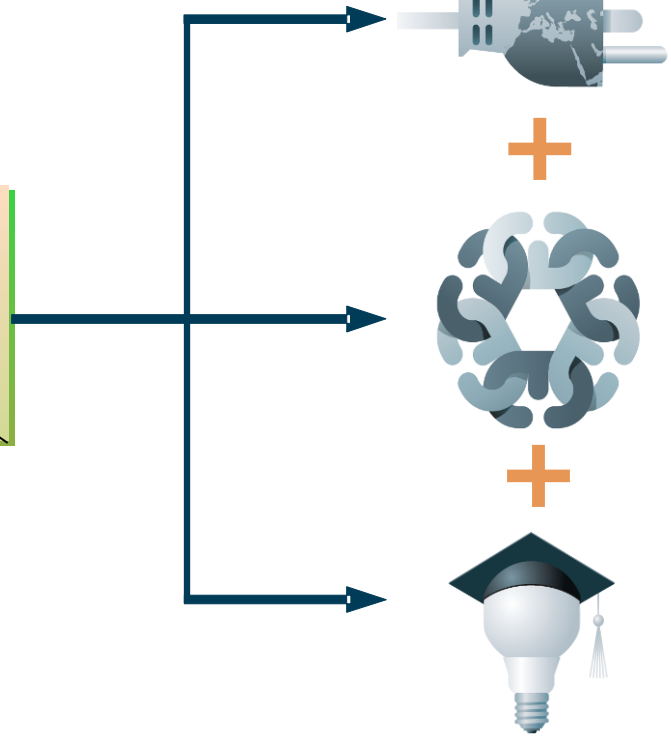
Instruments to effectively integrate large amounts of fluctuating renewable energy in the power system

Production

Instruments



By 2020



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

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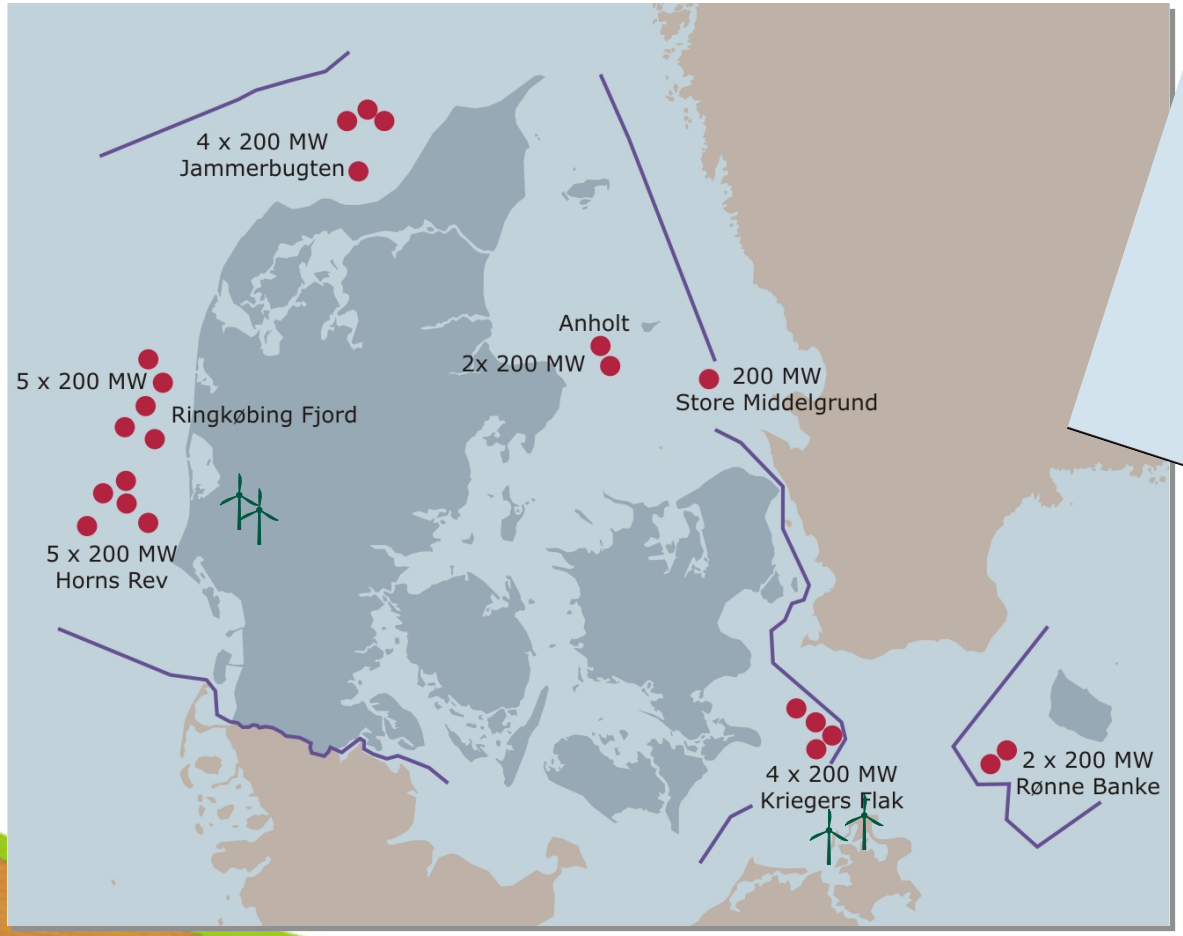
Offshore wind farms



available sites for 4.6 GW offshore wind power

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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!

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

The Vattenfall power plant on Funen (Fynsværket) is one of the biomass-fired power plants, which will ultimately help make the heat supply in larger Danish cities carbon-neutral.

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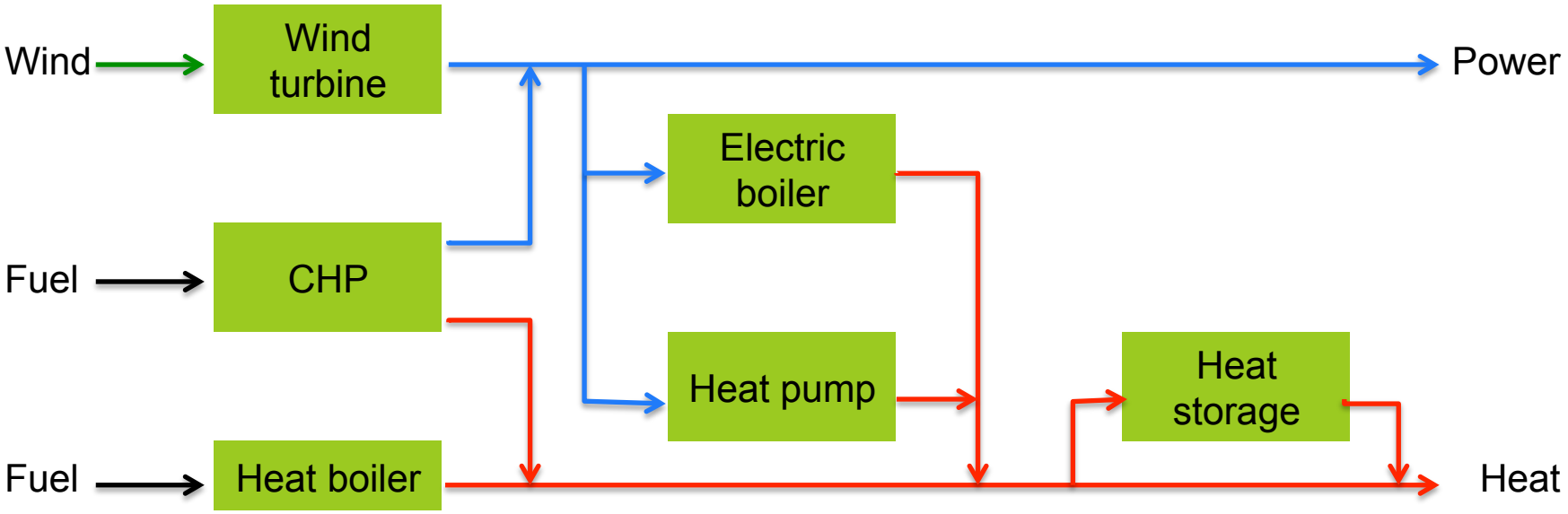
A flexible power and heat system



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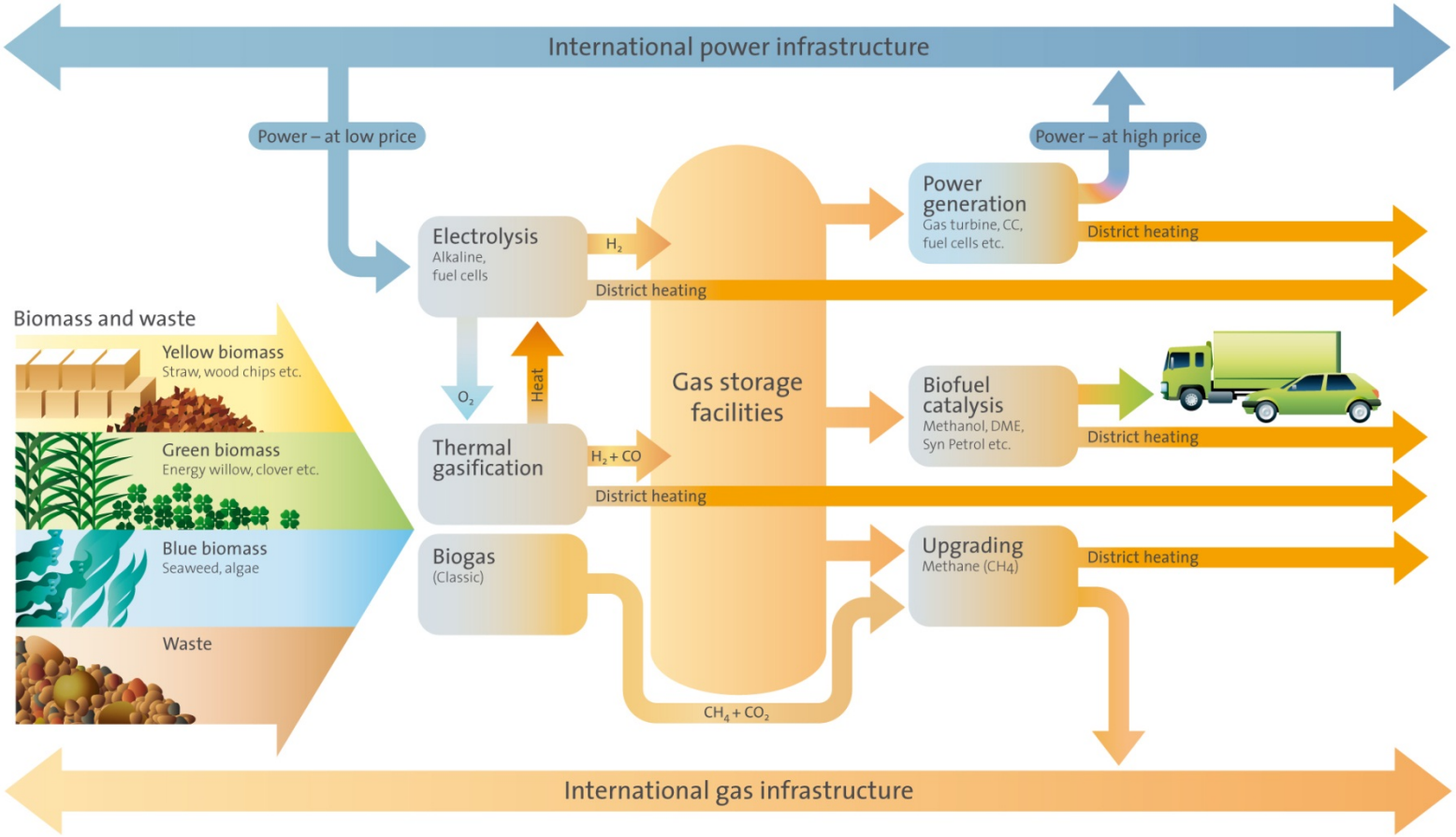
Integration of energy systems

– synergy between gas and electricity



- Substantial storage capacity in the gas system

Competitive peak-load capacity from RE-Gas

Optimal use of bio resources

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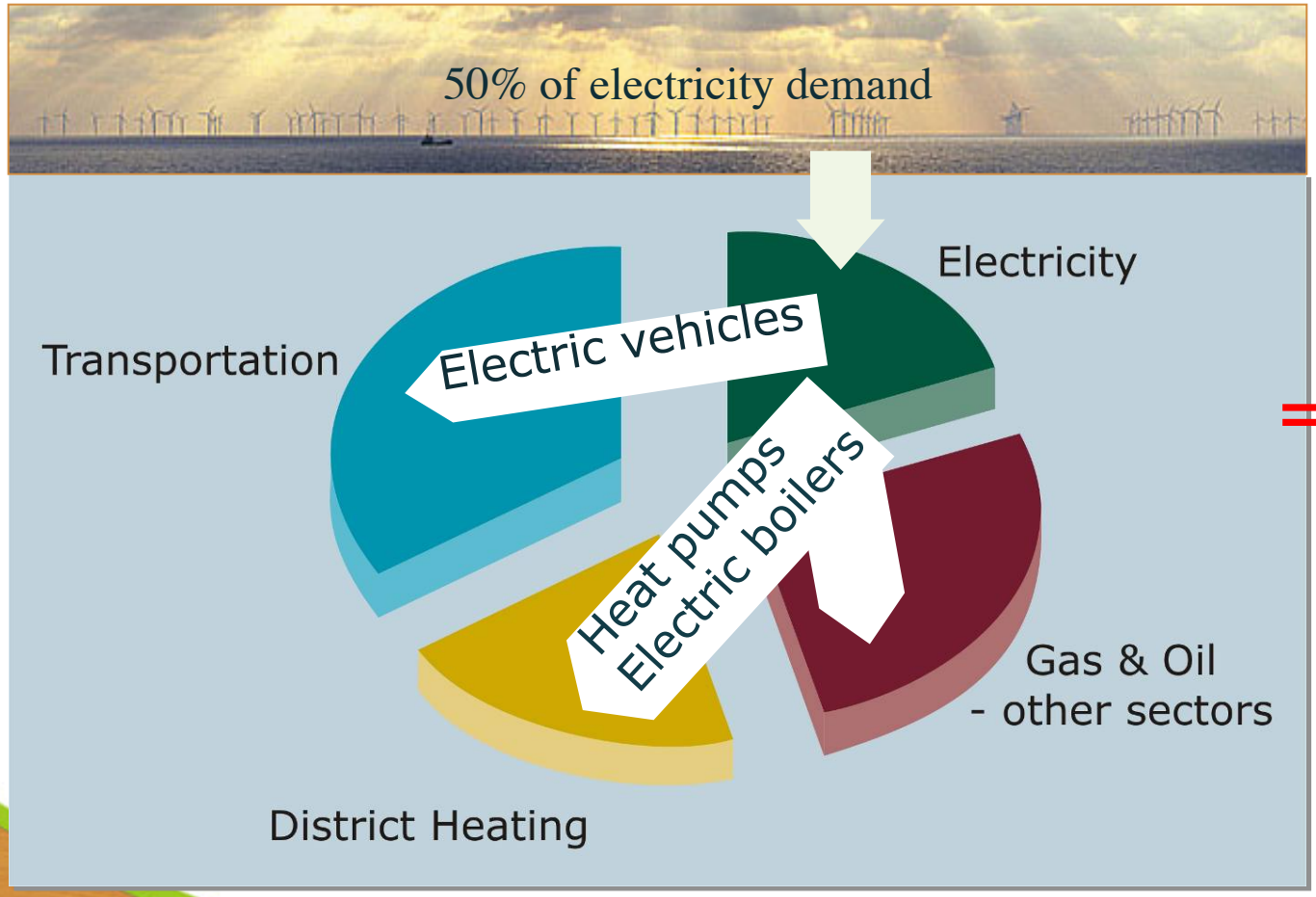
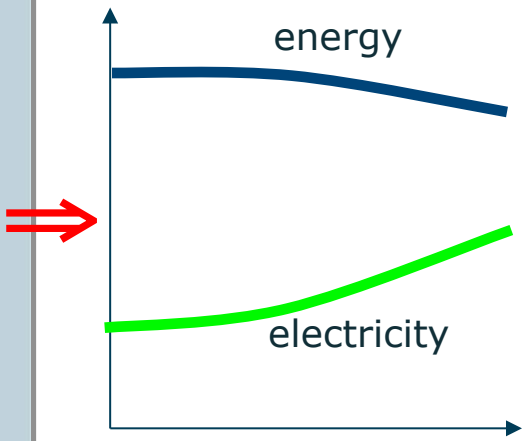
Coherent and flexible energy systems





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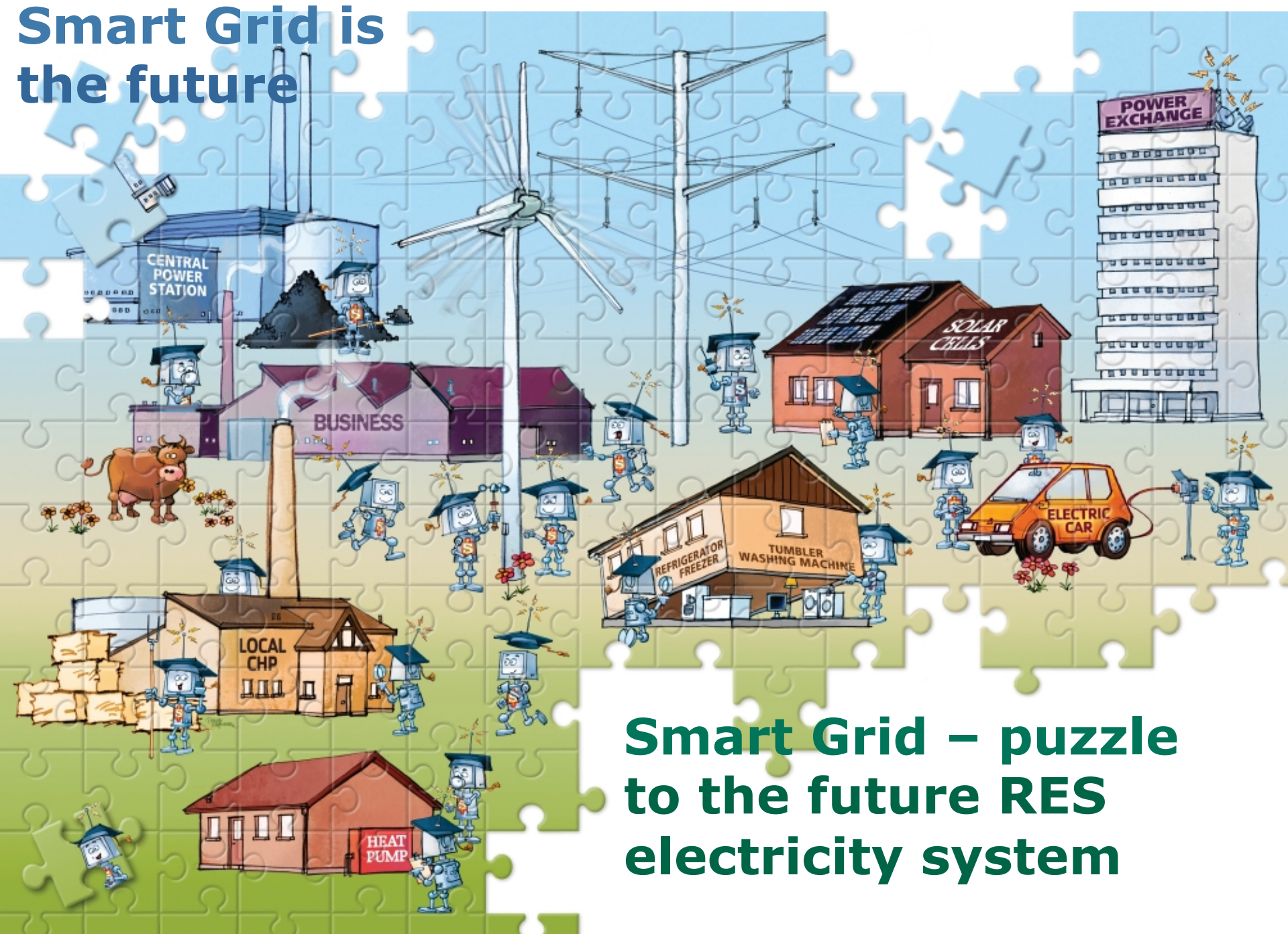
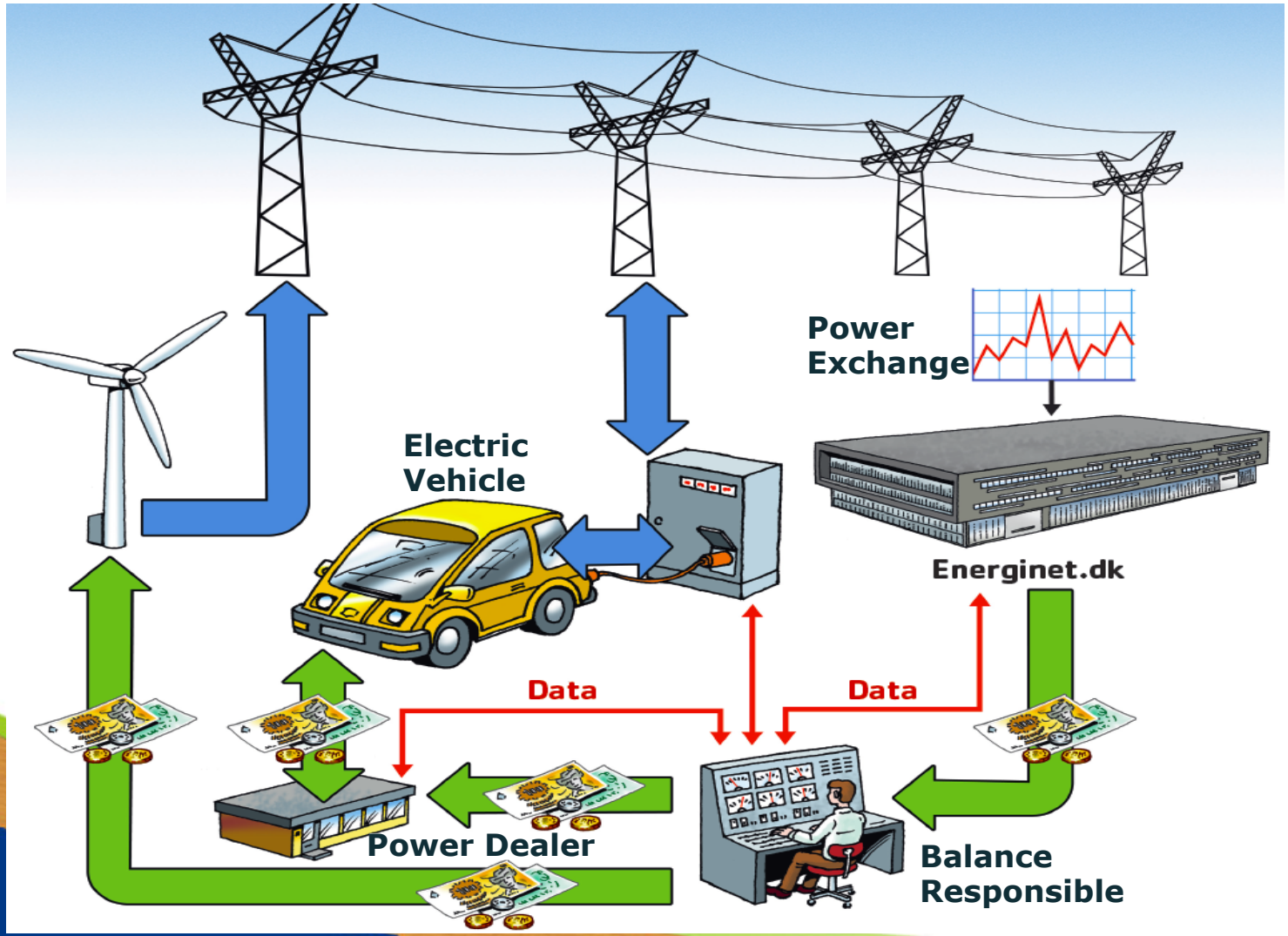
Smart Grid is the future



Smart Grid – puzzle to the future RES electricity system

EDISON – Large scale EV project in Denmark

Electric vehicles in a **D**istributed and **I**ntegrated market using **S**ustainable energy and **O**pen **N**etworks



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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!

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Thank you for your attention ☺

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