

An isometric illustration of a town. In the upper left, there are several small houses with red roofs and Danish flags on poles. A road winds through the town. In the lower right, a blue tram is on tracks, with a yellow bus and a car nearby. Power lines with pylons run across the scene. The background shows a green landscape with trees and a blue sky.

Fast Transition to Renewable Energy with Local Integration of Large-Scale Windpower in Denmark

Gunnar Boye Olesen, SustainableEnergy & INFORSE for
13th International Workshop on Large-Scale Integration of Wind
Power into Power Systems, Berlin, November 12, 2014

Denmark has targets of 100% renewable energy economy-wide in 2050 and 100% renewable energy in power and heat supply in 2035 (in 2020 more than 50% of Danish power will be windpower)

**SustainableEnergy and Friends of the Earth Denmark promotes 100% renewable energy economy-wide by 2030
– 16 years from now**

The project "Hurtig omstilling til vedvarende energi – ud af den fossile blindgyde" (Fast Transition to Renewable Energy) is supported carried out by SustainableEnergy (VedvarendeEnergi) with financial support from the VELUX FOUNDATION



100% renewable energy in 2030

- 2°C Climate target require fast action, such as greenhouse gas neutrality by 2050 – and some countries has to lead and decarbonise faster
- The transition will also give cleaner air, employment, security of supply
- Transition to 2030 is realistic for Denmark
- Good economy, if we also save energy and make transport transition

Energy Transition until 2030 is realistic for Denmark & the economy can benefit

- Analysis of energy system – hour by hour with the EnergyPLAN programme shows that an electricity system with 84% windpower and 7% solar can supply in all hours of the year.
- Compared with continued use of fossil fuels, renewable energy supply can be cheaper in 2030, if we also save energy and make a transport transition



PENGEAUTOMAT

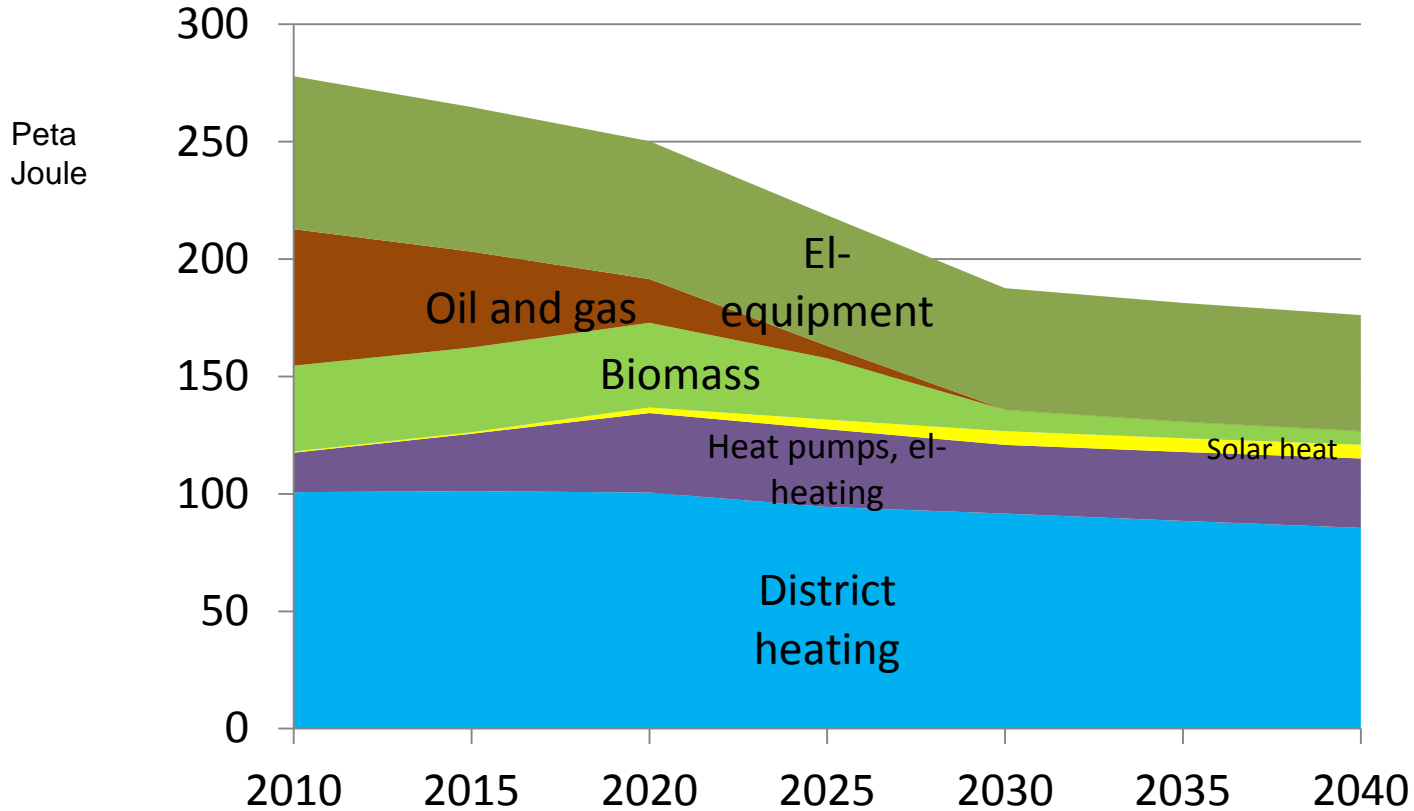
Transition Sector by Sector

- Buildings (dwellings and service sector)
- Industry, agriculture
- Transport
- Renewable energy supply



We can save 40% energy in buildings

- High requirements for new buildings – and quality control of construction & renovations
- Energy renovations – old buildings to reach 2010-standard + some air heat recovery



Transition of Dwelling and Service Sectors

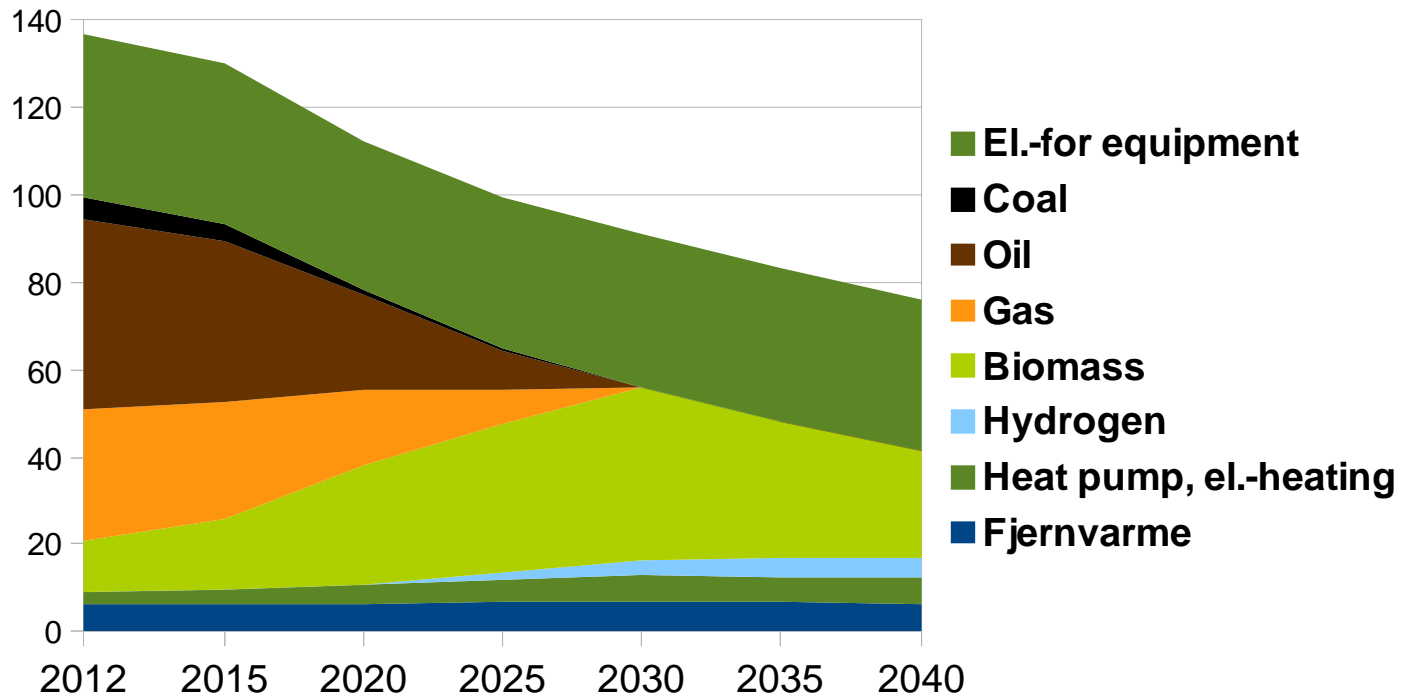


The industry can save 33% energy and convert to renewable energy

Today the industry invest with only 3-5 years simple pay-back

- The society will benefit from a more energy efficient industry with energy-efficiency investments up to 10 years pay-back time
- Vi propose that companies plan a transition to renewables in 10-15 years
- Vi propose state guarantees for loans for energy efficiency
- Vi propose tax rebates for companies that make a transition to renewables

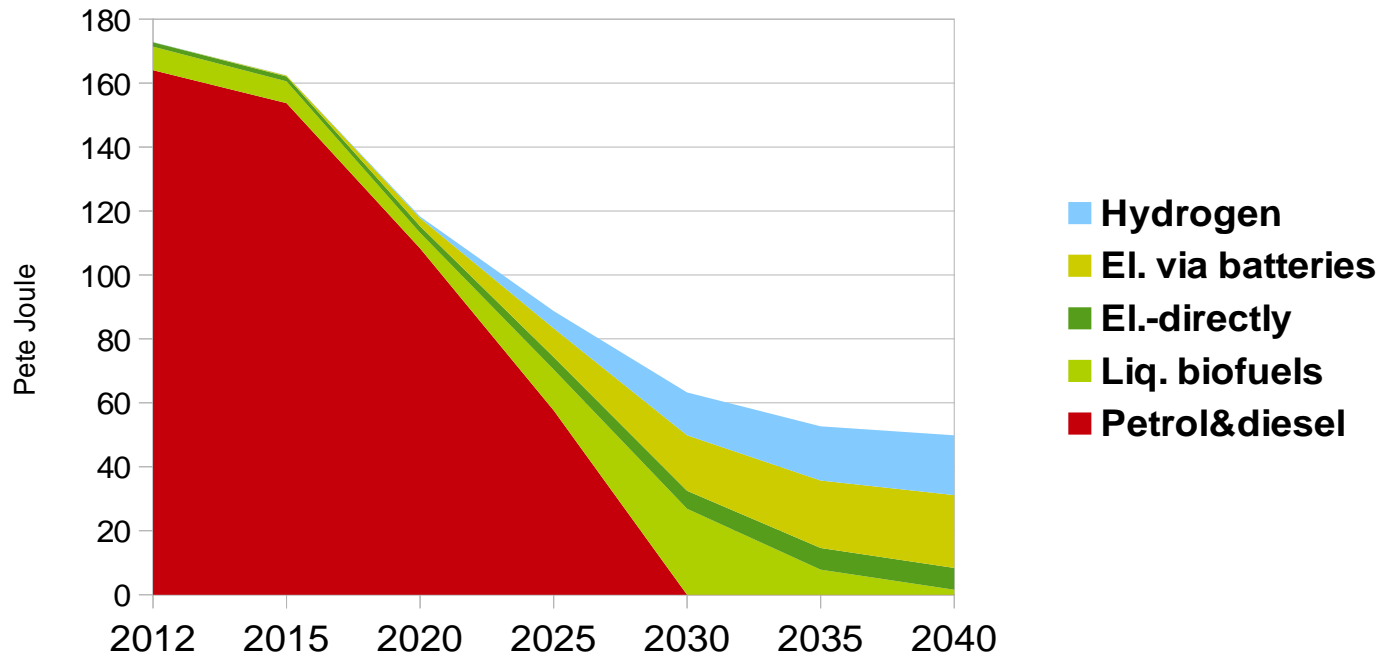
Peta
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Transition of Industry, Agriculture, Fishery and Construction

Transition to Intelligent transport

- Transport costs, we shall use it intelligently
- Electric cars will be cheaper than diesel from 2020, if we use them
- But for busy routes railways are cheaper – and bicycles are cheapest
- We should change transport investments from motorways to rail and bicycles , -and use car-sharing



Transport: Electricity and Collective
Transport Reduce Energy



VERSGO!
100%
VEDVARENDE
ENERGI

Expand renewable energy

11000 MW windpower in 2030, half on land (today 4855 MW)

4000 MW solar PV in 2030 (today 530 MW)

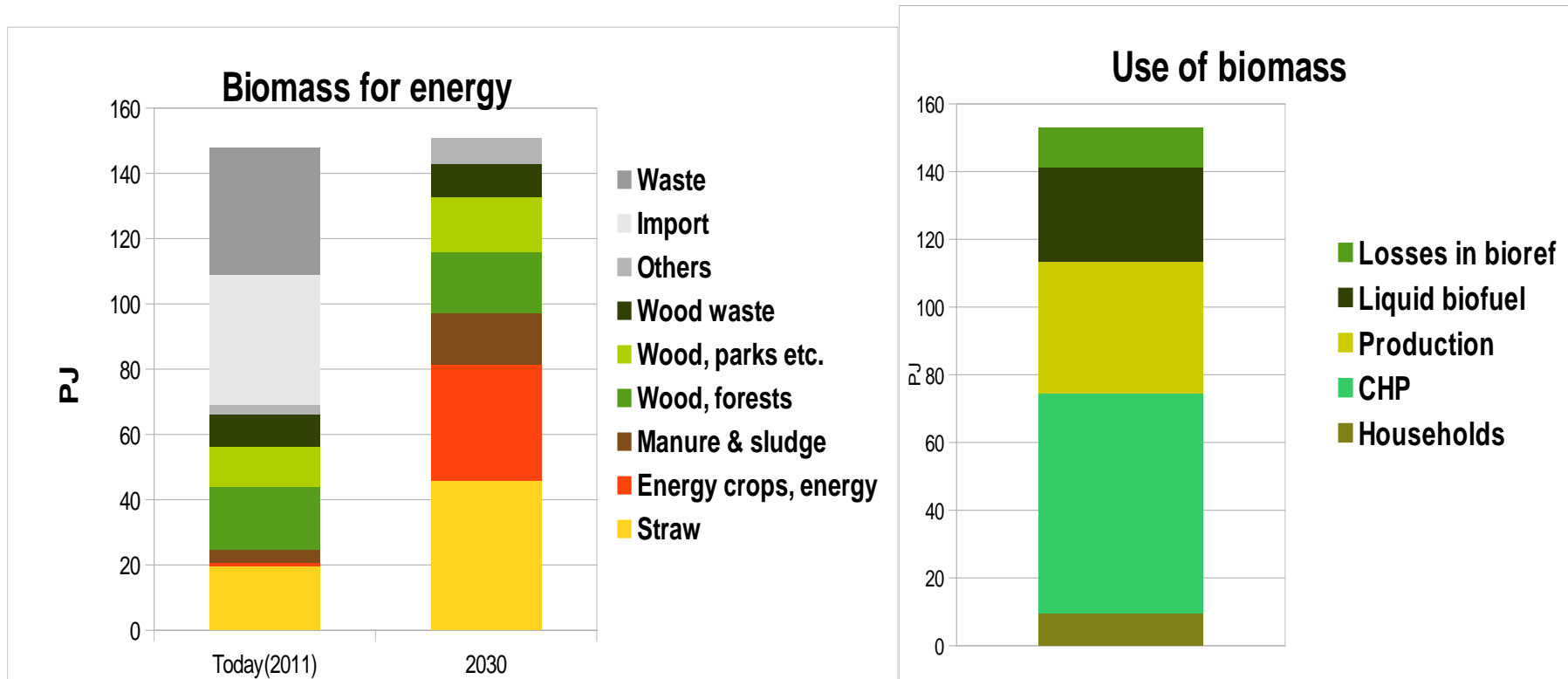
1800 MW heat pumps in district heating (today ca. 5 MW)

850 MW bio-CHP and 3000 MW biogas peak power

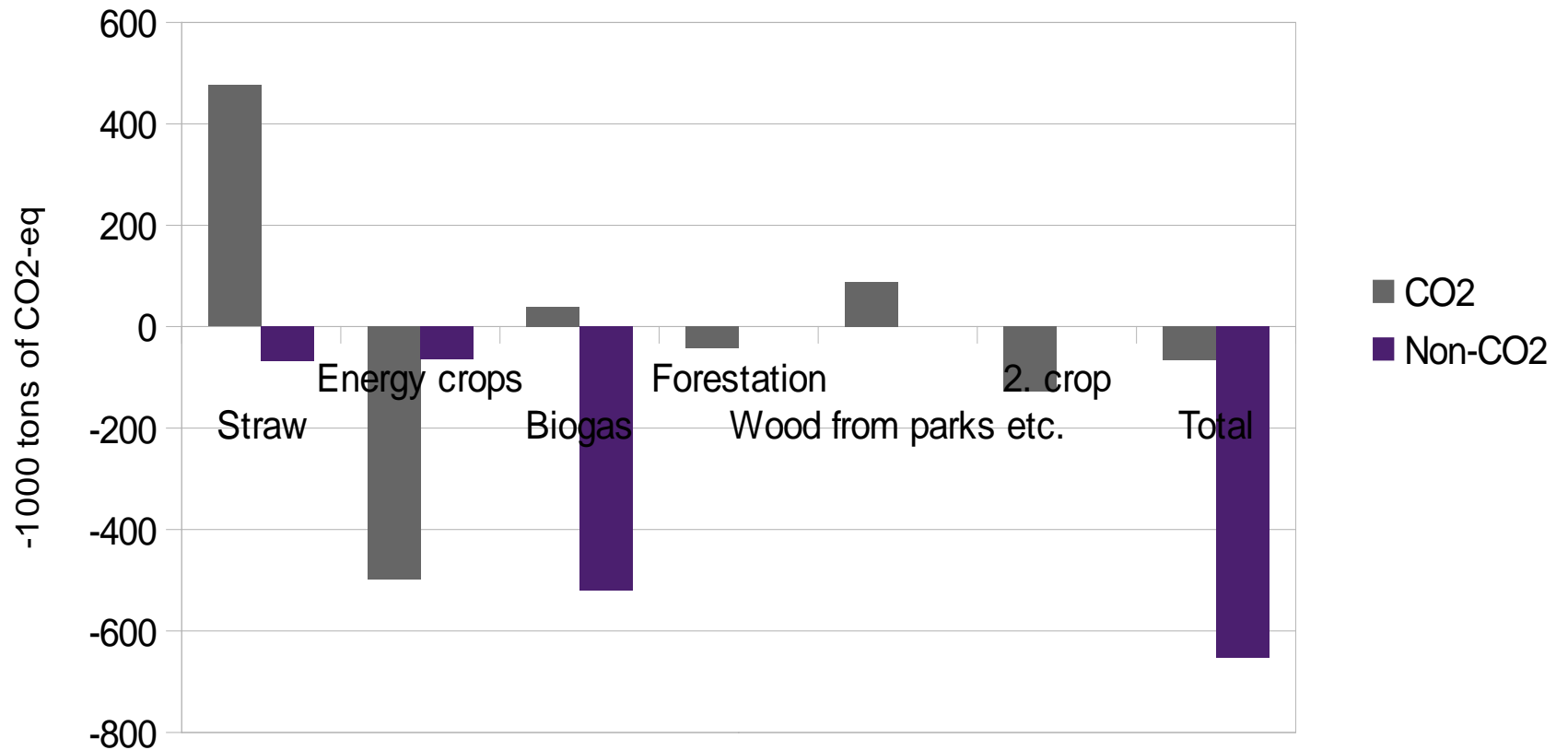
20 PJ solar heat (11 mill. m² = 1100 ha), 19 PJ geotermi

Sustainable biomass – 150 PJ in Danmark

Sustainable Biomass 2030 for DK



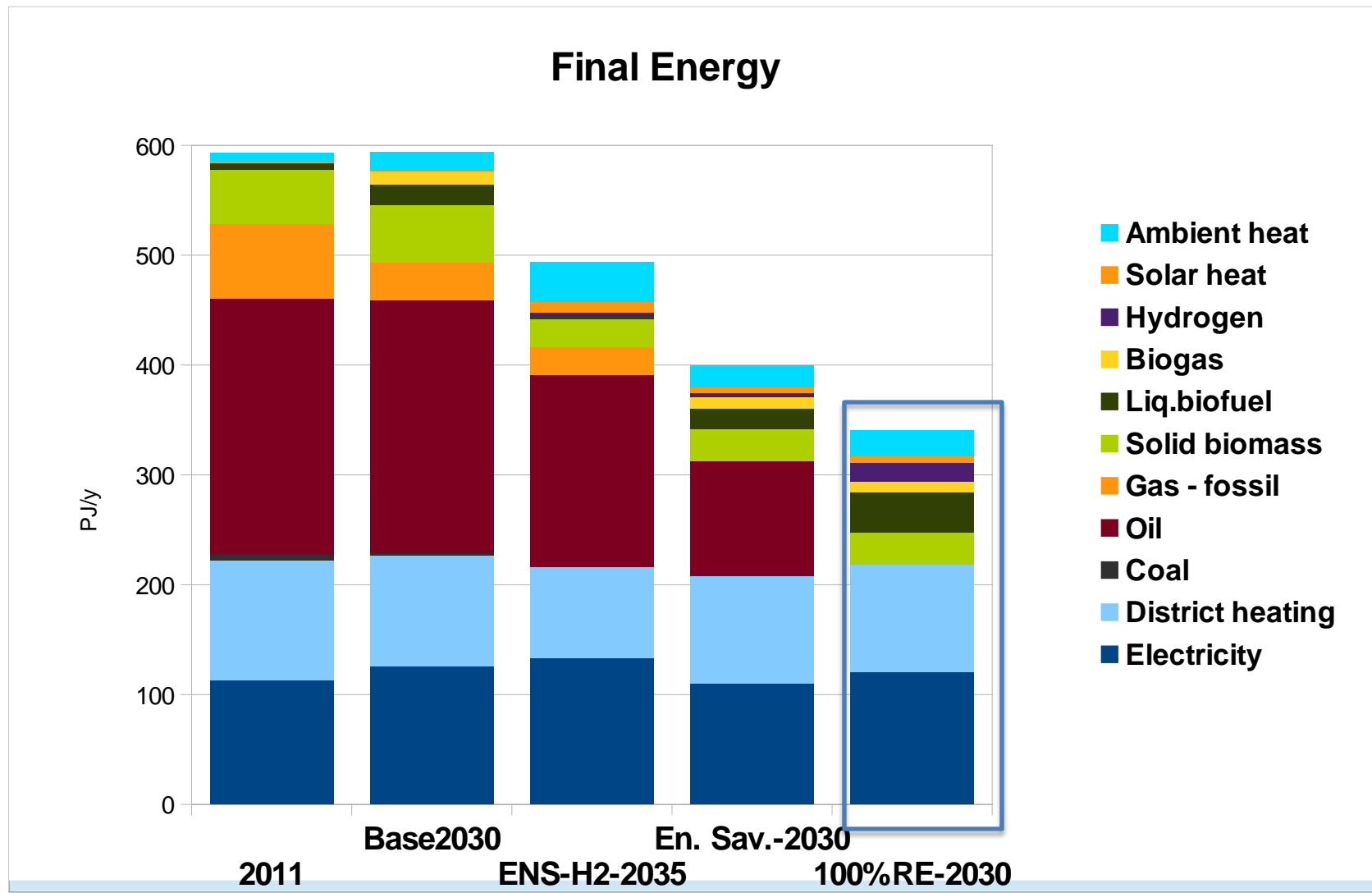
Greenhouse effects of increased Danish use of biomass 2012-2030



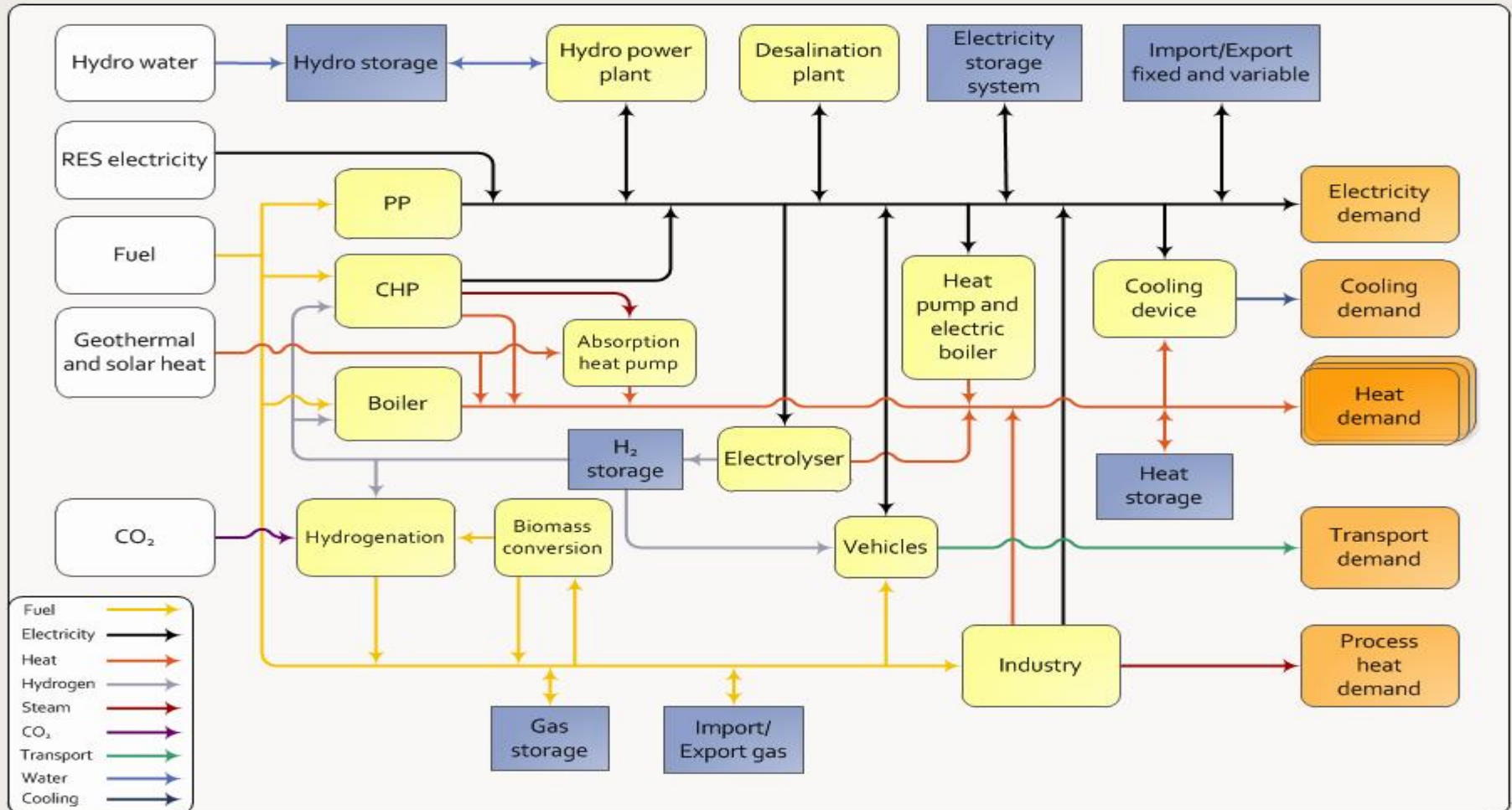
Comparing scenarios

- **Basis 2030: no new policies from 2020**
- **ENS-2030: most ambitious Danish official scen.**
- Energy savings 2030: high efficiency but no new renewables from 2020
- **100% RE - 2030**

Danish Final Energy Supply



EnergyPLAN model used



Power capacities

Supply(MWe)	Basis 2030	ENS-H-2035	RE-2030
On-shore wind	3500	3500	5000
Off.shore wind	3340	6000	6000
PV	2500	1000	4000
Solar heat	0	2 mill. m2	11,6 mill.m2
Geothermal		200 (therm)	750 (therm)
Bio-CHP	2600	1950	850
Peak power	2800	852	2900
Import/export	2800	3000	2800

Demands (MWe)

Heat pumps	6100	4700	4200
Heat pumps, centr	26	216	1800
H2-electrolysis	1,5	780	2400
DSM	0	455	812

+ electric cars, local heat pumps

Large variations in power flows

RES12: Windpower

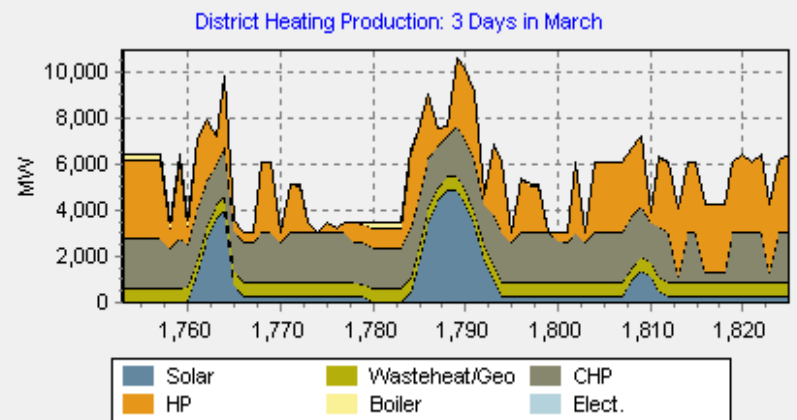
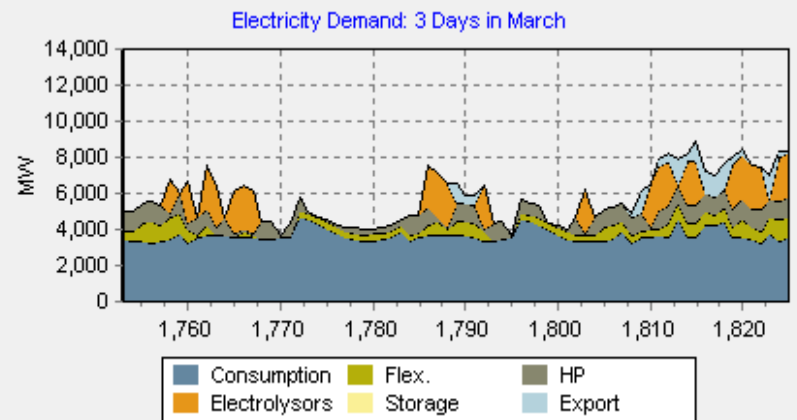
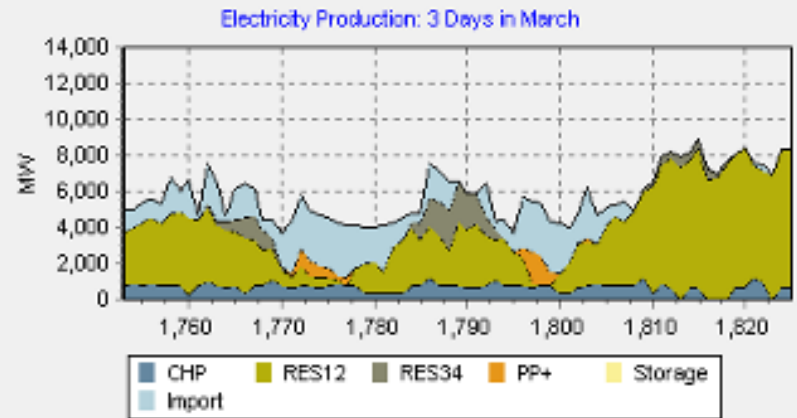
RES34: Solar PV

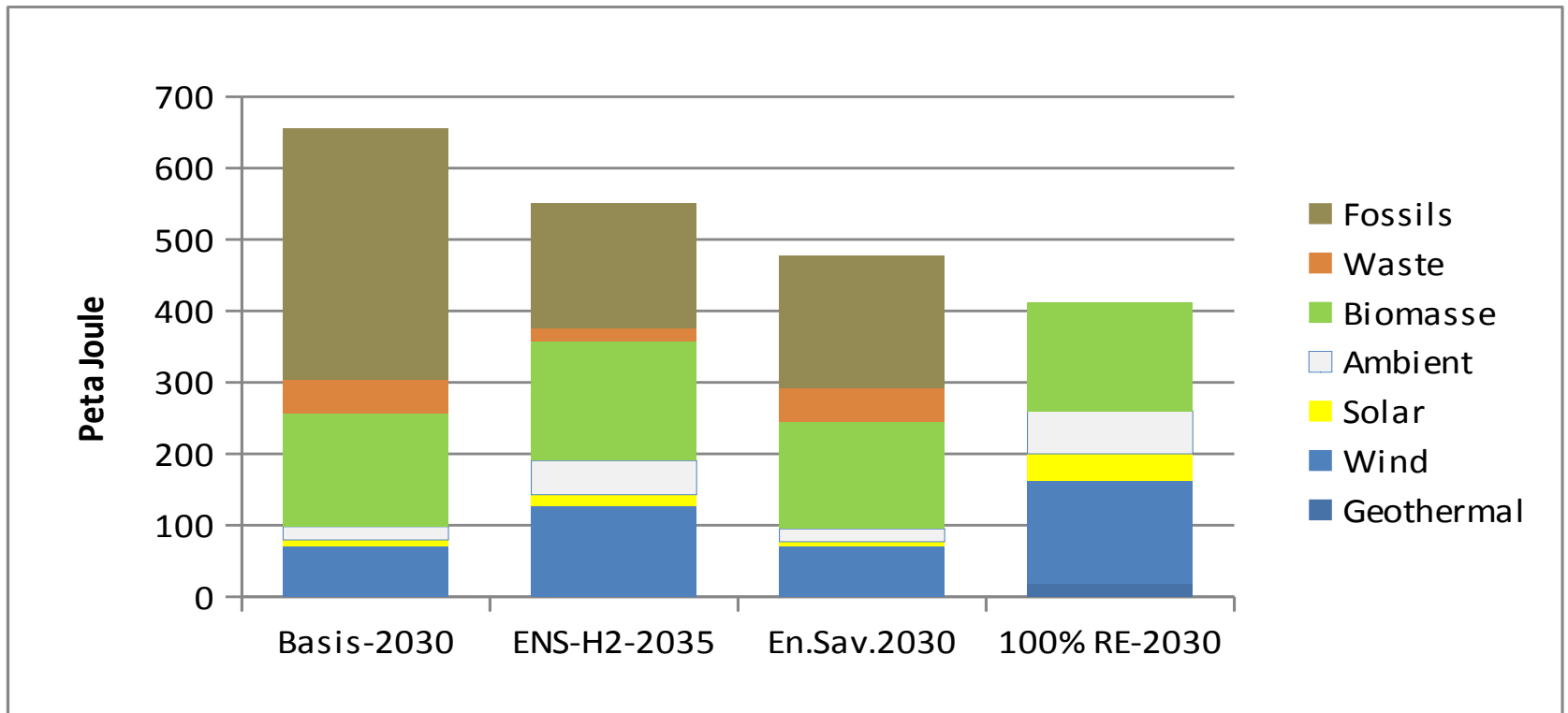
Flex: Flexible power demand

HP: Heat pumps

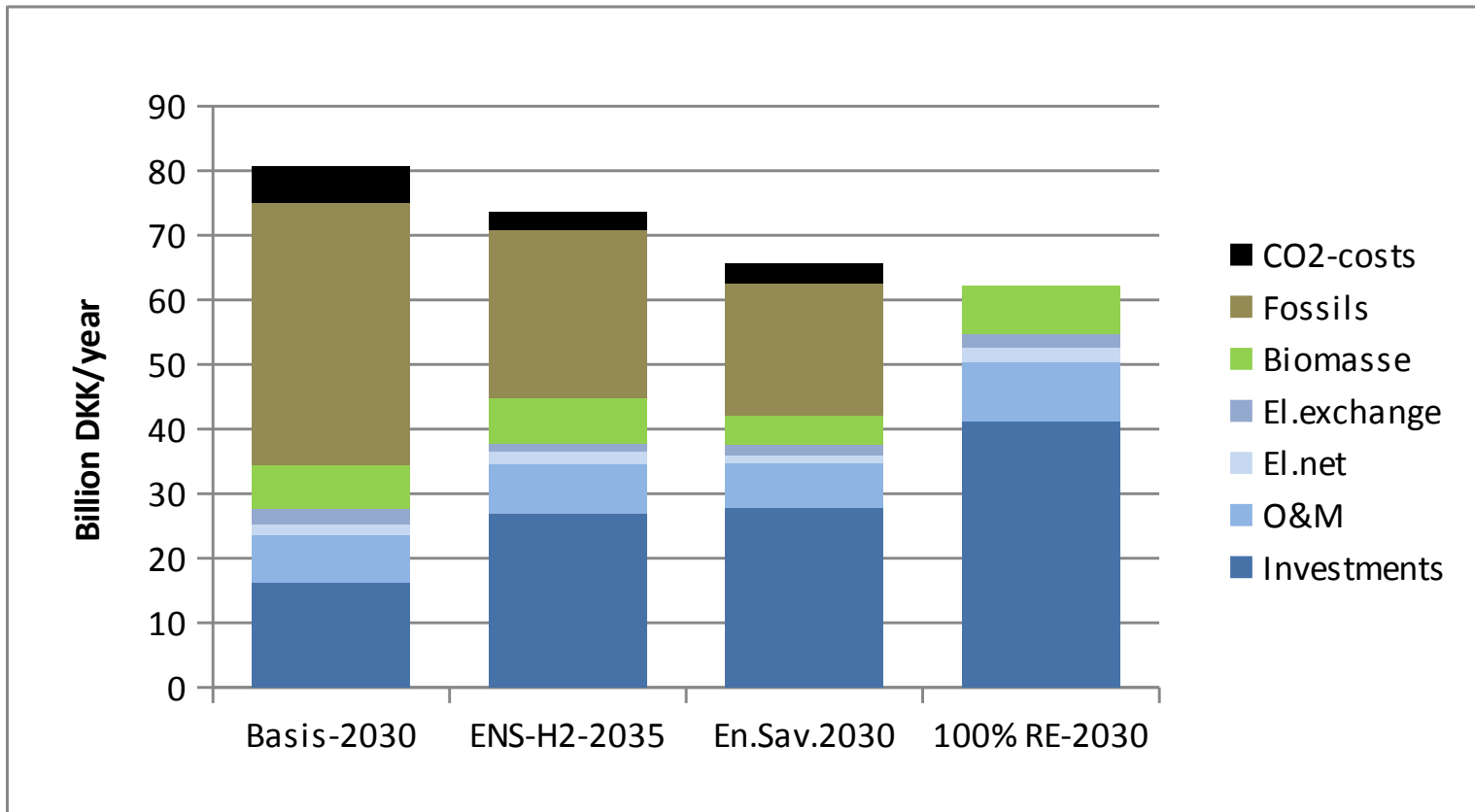
Wasteheat/Geo: geotherm. Heat

CHP: Combined heat & power





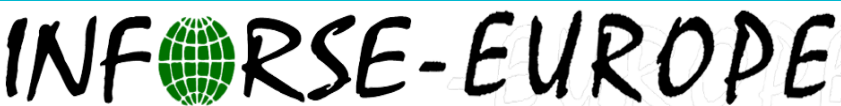
Primary Energy Supply, 2030



Energy System Costs DK 2030,
with Energy Efficiency Invest.

We have a planet

- and you are part of it



INFORSE-EUROPE

International Network for Sustainable Energy - Europe

