

# HEAT PLAN COPENHAGEN



## Heat Plan Greater Copenhagen Area

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Vice president CTR

**Choose The Right**



# The Greater Copenhagen DH system

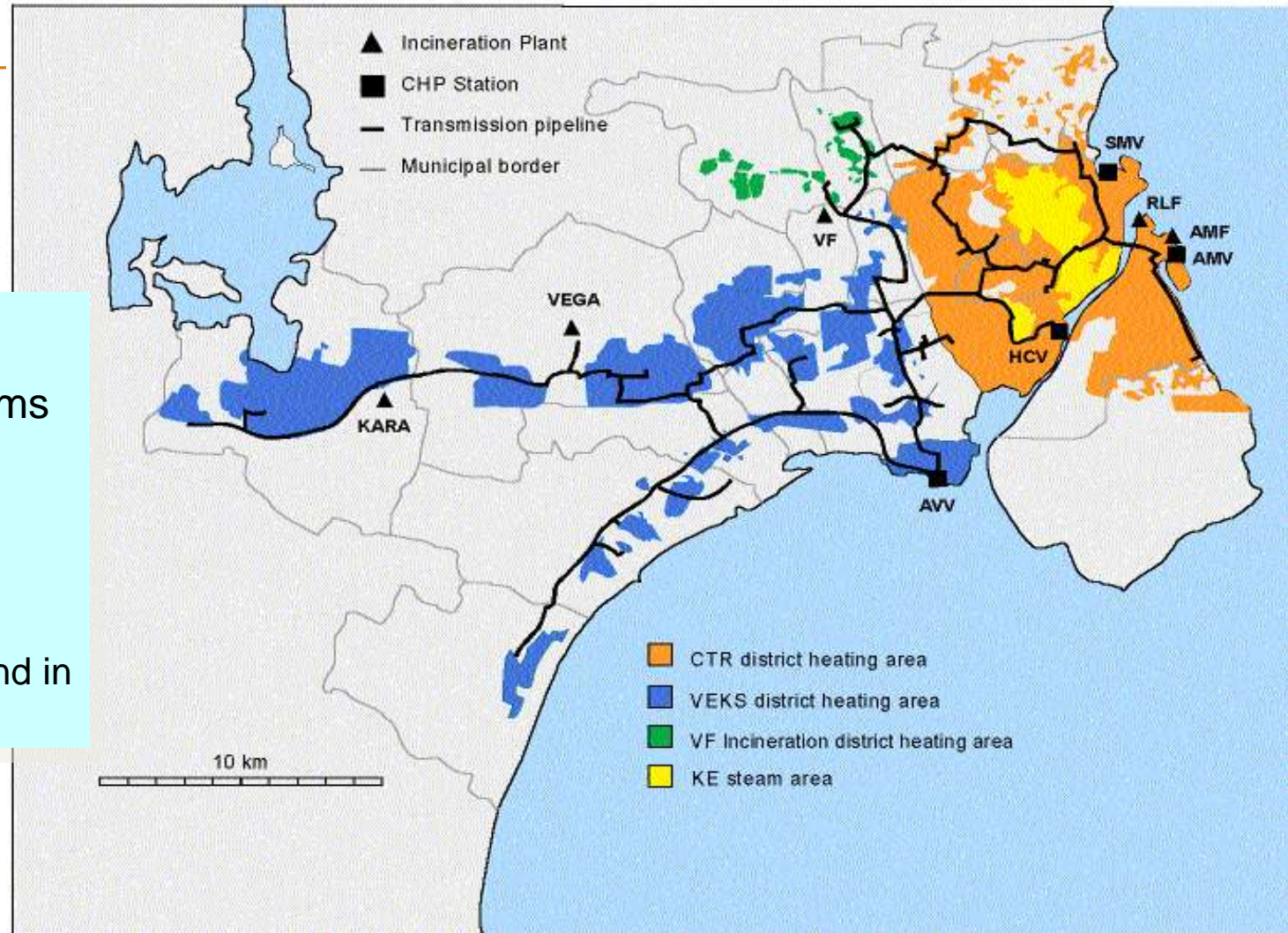
18 municipalities

4 integrated DH systems

500,000 end – users

34,500 TJ (9,600 GWh,  
32,700 GBtu)

Approx 20 % heat demand in  
Denmark



# The Companies Behind the Heat Plan

- **VEKS** established in 1984. A joint municipal company between 11 municipalities. By heat and supply 19 DH companies in the Western part of the greater Copenhagen area
- **CTR** established in 1984. A joint municipal company between 5 municipalities. By heat and supply 5 DH companies in the central part of the greater Copenhagen area
- **KE** was established in the present form in 2005. End user supplier of heat, gas, water and sewages . Supplier of district heating since 1925.
- Ea Energy Analyses consultant



# Existing Heat Production Capacity

- 4 Waste to heat, 400 MW
- 4 CHP, 1.800 MW
  - 7 units
    - Steam turbines
    - Gas turbines
    - Coal, oil, gas, straw, wood pillars
- 1 Geothermal, 14 MW
- Several peak and reserve HOB



# Background for the Project

## Climate !!!

- International focus on climate issues: UN climate panel prescribe 50% - 80% CO2 reduction in 2050 in order to keep two degree target.
- EU target for 2020: 20% CO2 reduction, 20% Renewable and 20% energy efficiency.
- DK increased targets.
- DK municipalities local climate targets, CO2 neutral districts. City of Copenhagen CO2 neutral 2025.
- End-user demand on climate aspects.
- Climate summit COP15 in Copenhagen December 2009.



# Purpose of Project

- To secure a reasonable development in **heat price** and energy **efficiency** on the long run and at the same time maintain **security** of supply.
- To put focus on the role of DH when talking about **CO2 reduction** and **renewable energy** in the local society.
- To evaluate consequence on **economic** and **macro economic** issues on short and long run
- To generate **interest** for the development of the DH system in the Greater Copenhagen Area.
- To propagate the **role** of the DH companies.
- **Is it realistic to reach 70 % RE in the DH system before 2025**



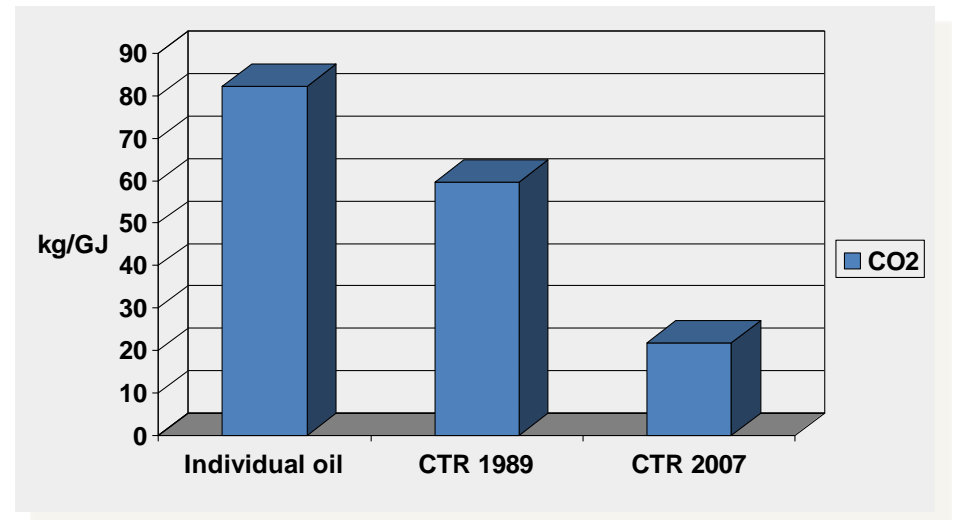
# Political Conditions for DH in Denmark

- Regulation, taxes and subsidy are important conditions for DH in Denmark.
- DK parliament energy agreement February 2008
  - Industrial waste used on power plants
  - Increased subsidy to renewable (wind, biomass)
  - Instructions on energy savings
- Political financing of general income tax reduction
  - 15 % increase in taxes on energy
  - Normalising tax on energy for CHP, 125 %
    - Increased CHP tax i Copenhagen



# Definition of Environment Factors

- Renewable Energy (RE)
  - Content of oil products in waste
    - CO2 emission increased from 17,6 kg/GJ to 32,5 kg/GJ
- CHP heat efficiency
  - Heat marginal, 250 % to 300 %
  - Power marginal, 90 %
  - Taxation, 125 %
  - Emissions, 200 %





# Scenarios Analysed

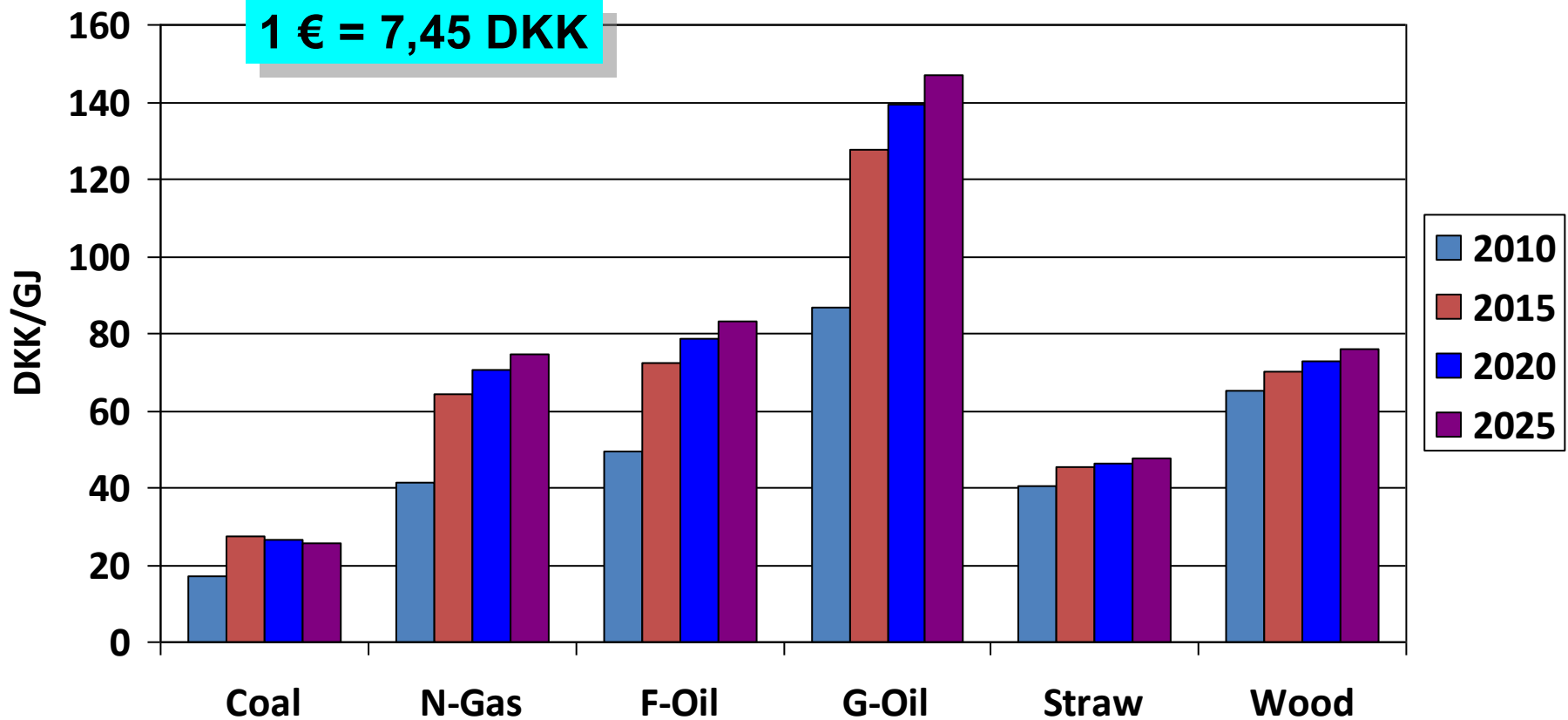
2010, 2015, 2020, 2025

- **Base**
  - Existing frames and decisions taken
- Decentralised – reduced market - **Savings**
  - Consumer savings, increased local RE
- Central – increased market – **Maxs. DH**
  - Conversion of N-gas, increased geothermal
- **100 % RE** (waste included)
  - Consumer savings, Conversion N-gas, increased geothermal
- **Perspective** – 2050 – new CHP production
  - 100 % RE, consumer savings, increased geothermal, heat pumps, new CHP technology

Development in scenarios is not based on an optimization but more an analyses of consequence



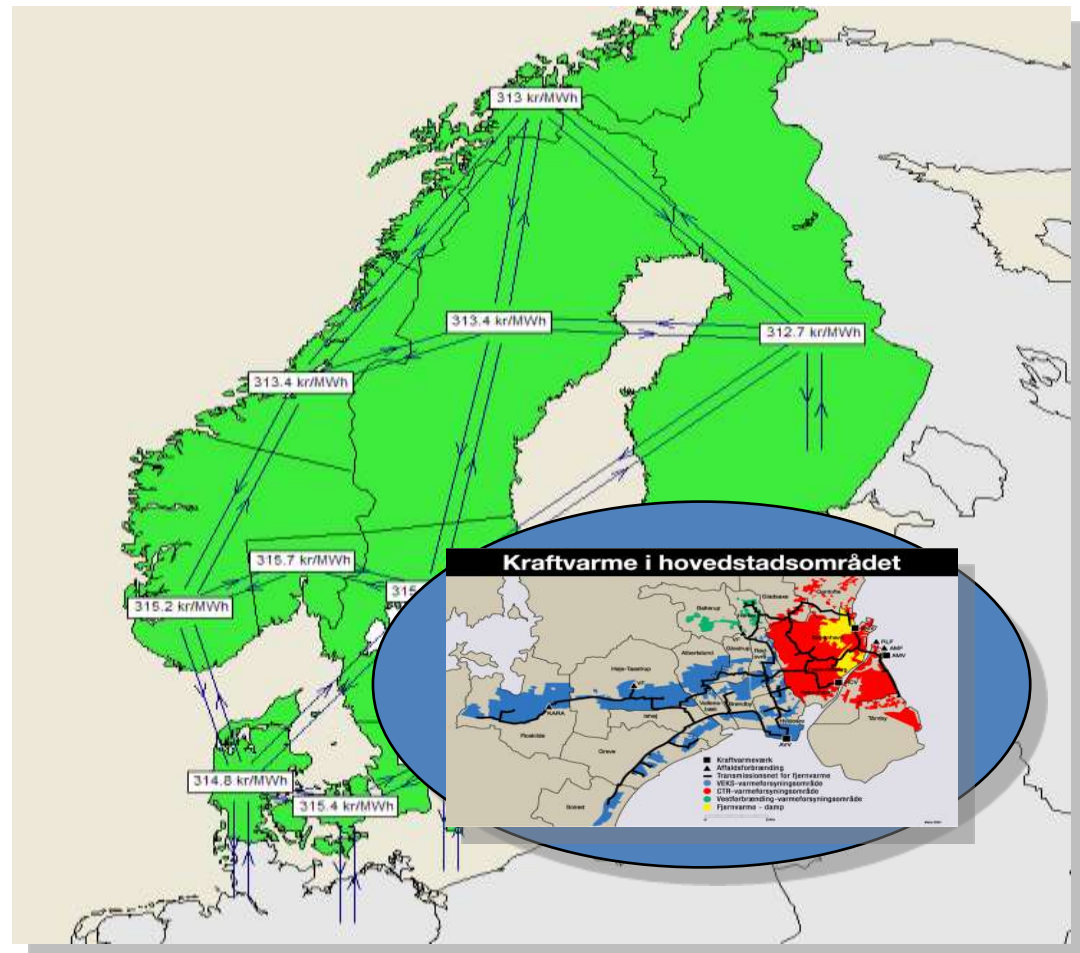
# Energy Prices



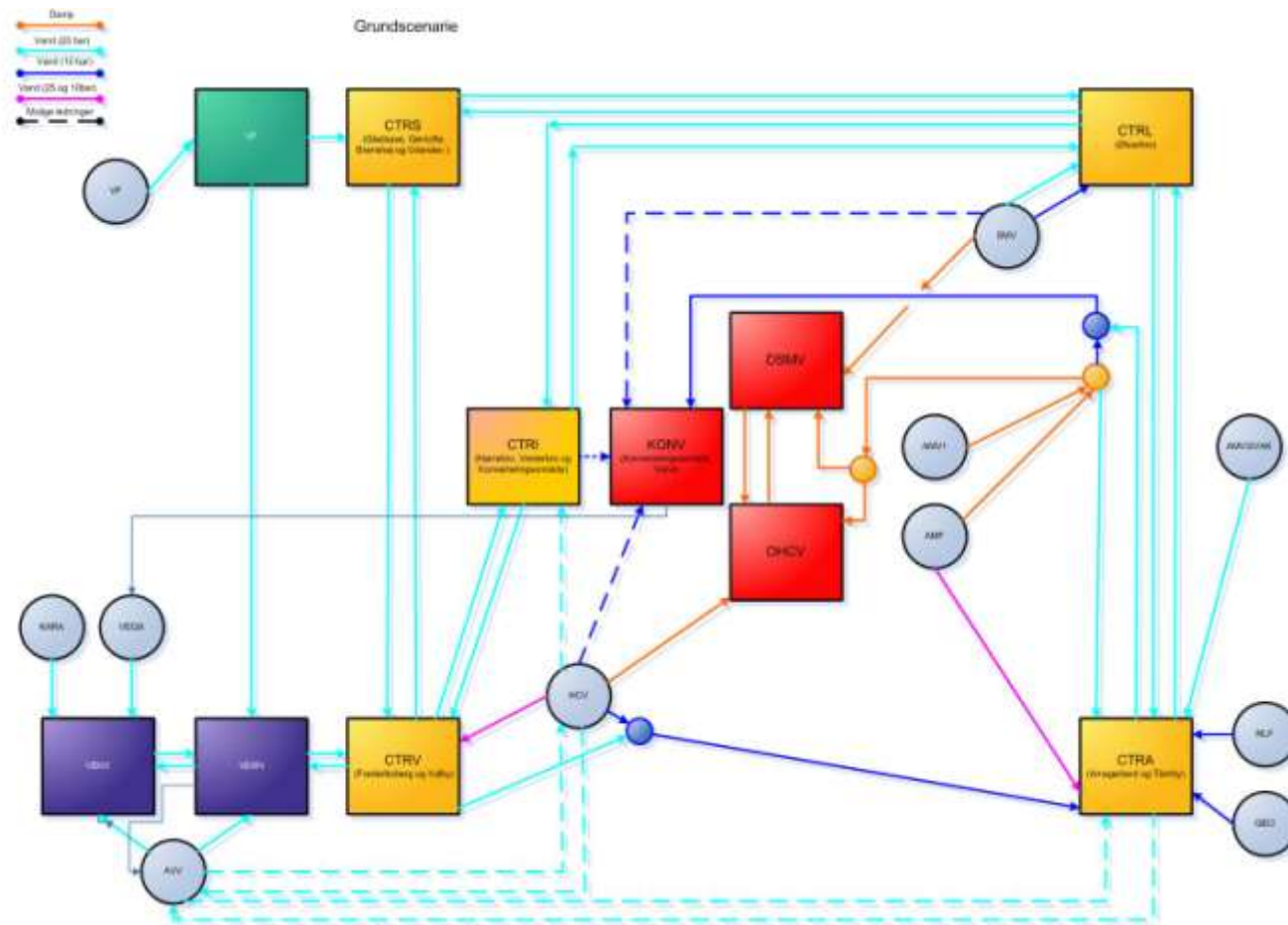
# Power and Heat are Inter Connected

Condition for DH depend on:

- Power market:
  - Precipitation (rain snow)
  - Wind
  - CO2
- Gas market
- Waste incineration
- **Balmorel Model**



# Baltimore Model of DH system in Copenhagen



# Analyses

Scenarios 2010, 2015, 2020, 2025 - 2050

## Model calculations

- Optimize production of heat and power (in total)
  - Plant in operation
  - Fuel to be used
  - Power production based on market (Nord Pool market)
  - Heat production based on demand and hydraulic restrictions (local)
- Price of power in market is calculated by the model
  - Value of power a macro economic income
- Economy
  - Society - Economic
  - Total heat and power – Macro economic



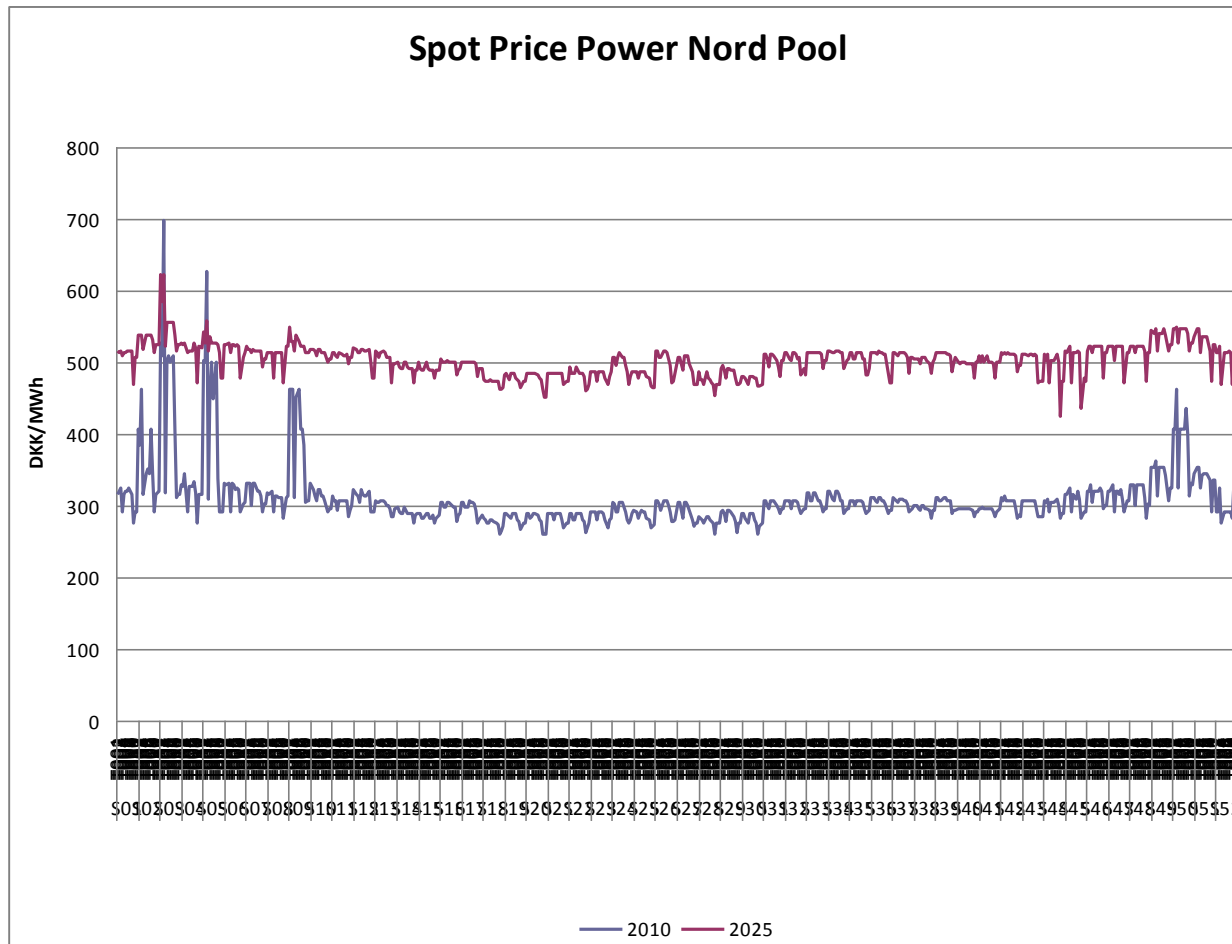
# Catalogue of Production Technology

## Existing Technology

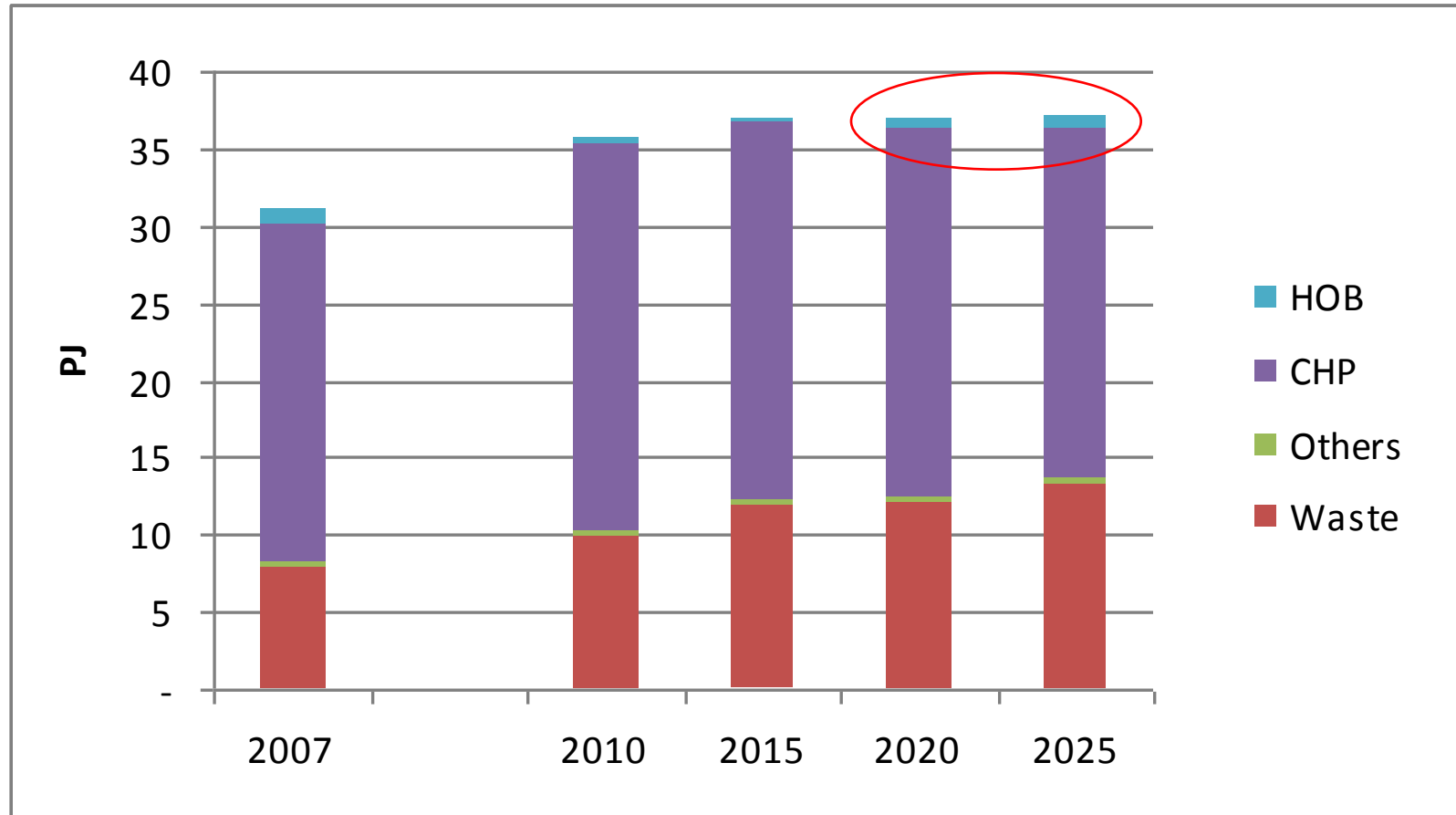
- CHP
  - Fuel conversion
  - Gasification technology – long run
- Waste to heat
  - Flu gas condensation
- Central RE
  - Geothermal
  - Heat pump
  - Solar heating
  - Surplus heat from industries
- Decentralised RE – consumer level
  - Heat pump
  - Solar heating



# Calculated Price of Power

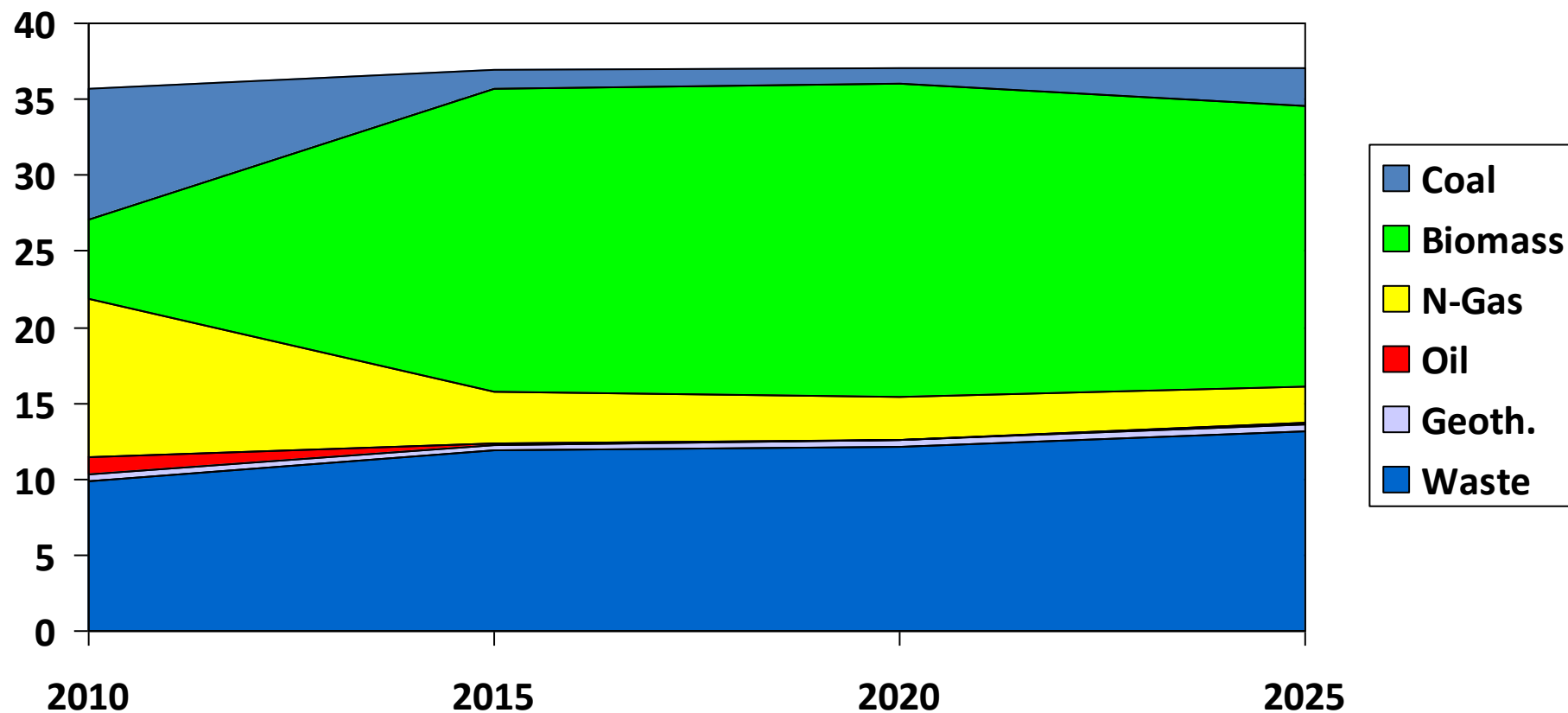


# Heat Production Base Scenario

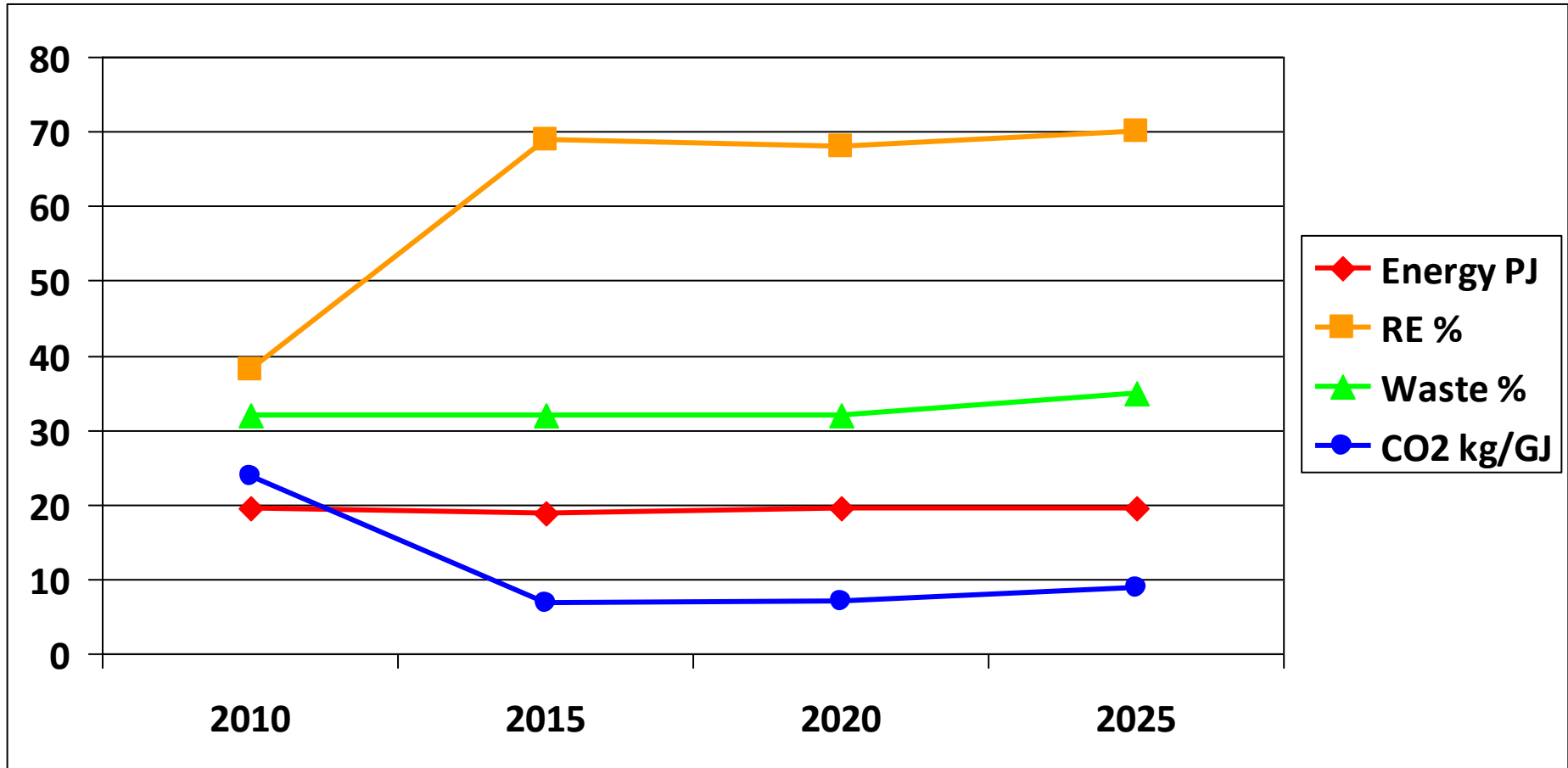




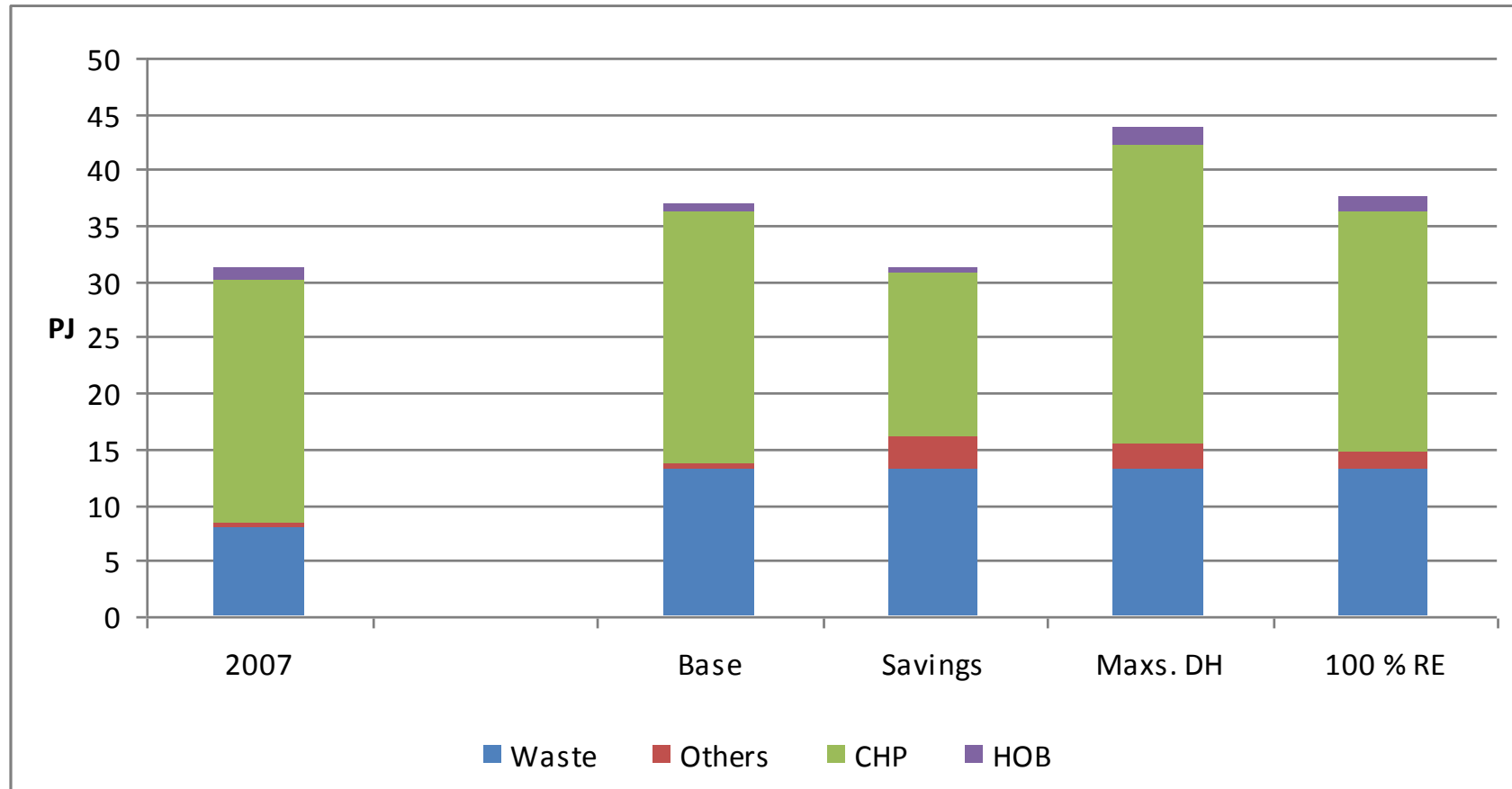
# Energy Base Scenario PJ/year



# Heat Production Base Scenario

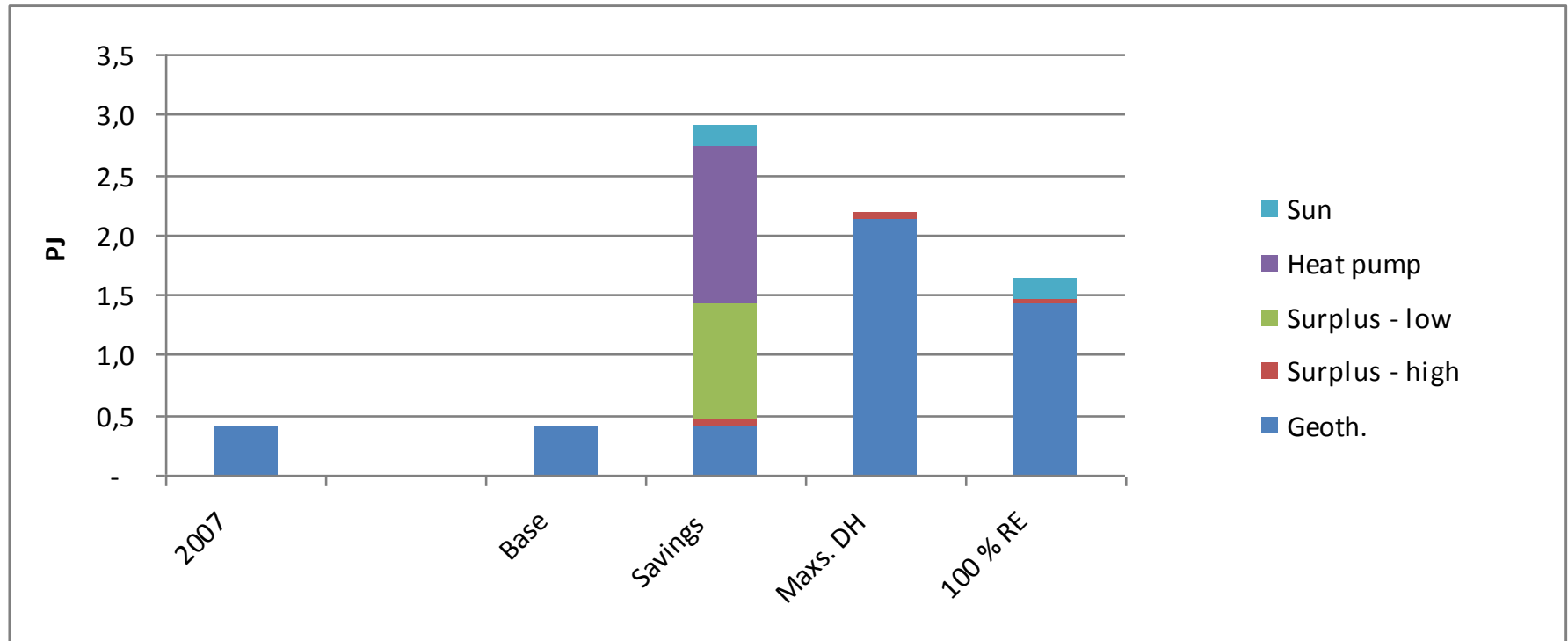


# Heat Production 2025 all Scenarios

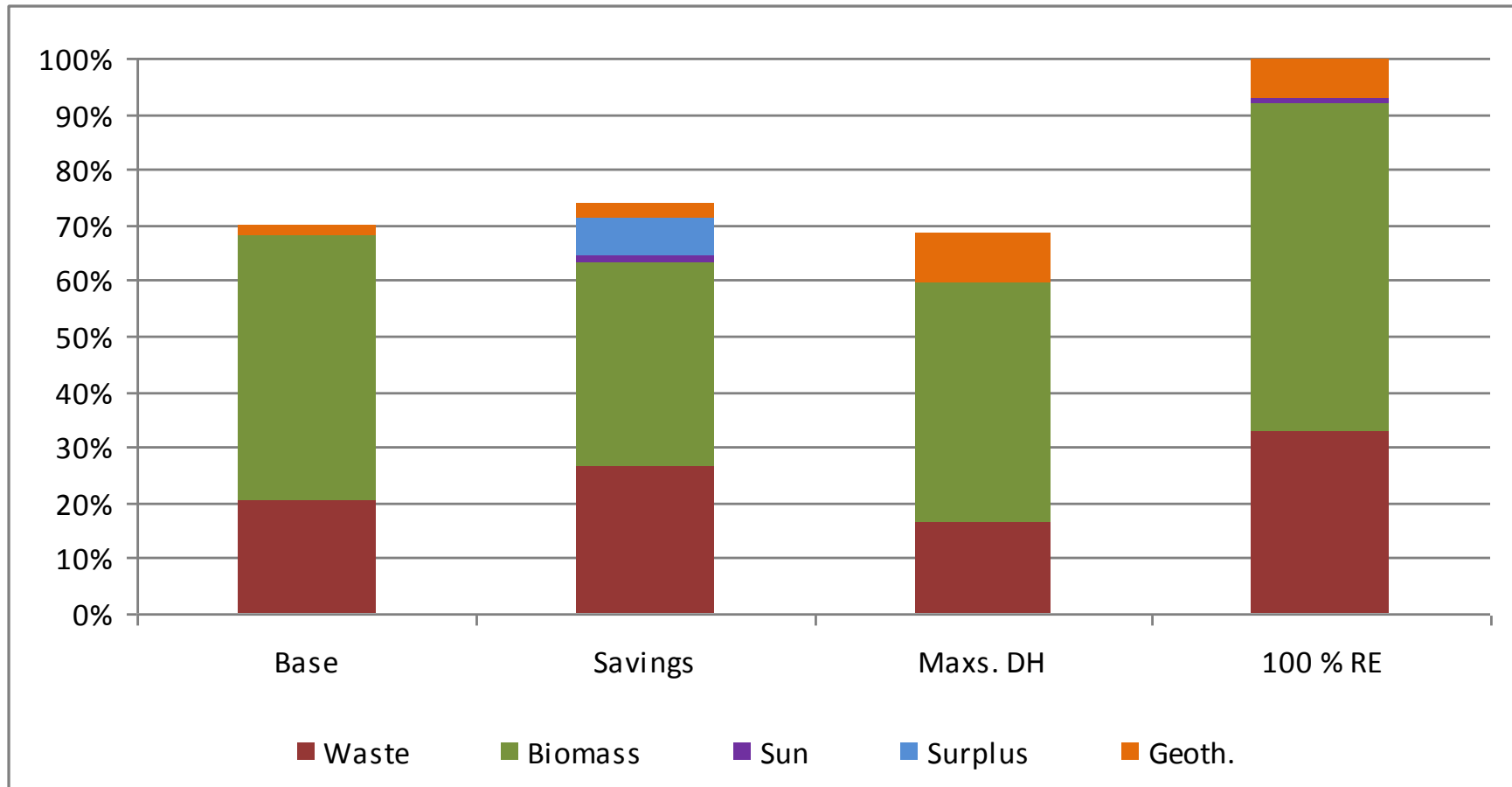


# "Others" Heat Production 2025

## All RE



# RE Share of Heat Production in 2025



# Economy and Energy in Figures

2025		Base	Savings	Maxs. DH	100 % RE
Power production	TWh	7,5	7,2	7,7	7,9
- CHP based	TWH	5	3,7	5,6	4,6
DH production	PJ	37,5	31,6	45,9	39,9
- Biomass based	PJ	15,9	11,4	18,2	20,5
-HOB	PJ	0,9	0,3	1,8	1,7
Macro economic	Mio. DKK/year	5717	5141	5491	-226 mio. DKK
- CO2	Mio. DKK/year	815	780	766	591
-Taxes	Mio. DKK/year	608	483	768	403
-Subsidies	Mio. DKK/year	-343	-318	-408	-438
Resulting economic	Mio. DKK/year	5.452	4.976	5.131	4.810
Society economic	Mio. DKK/year	6.075	5.554	5.929	-146 mio. DKK
Total 16 years	Billion DKK	59	56	57	58



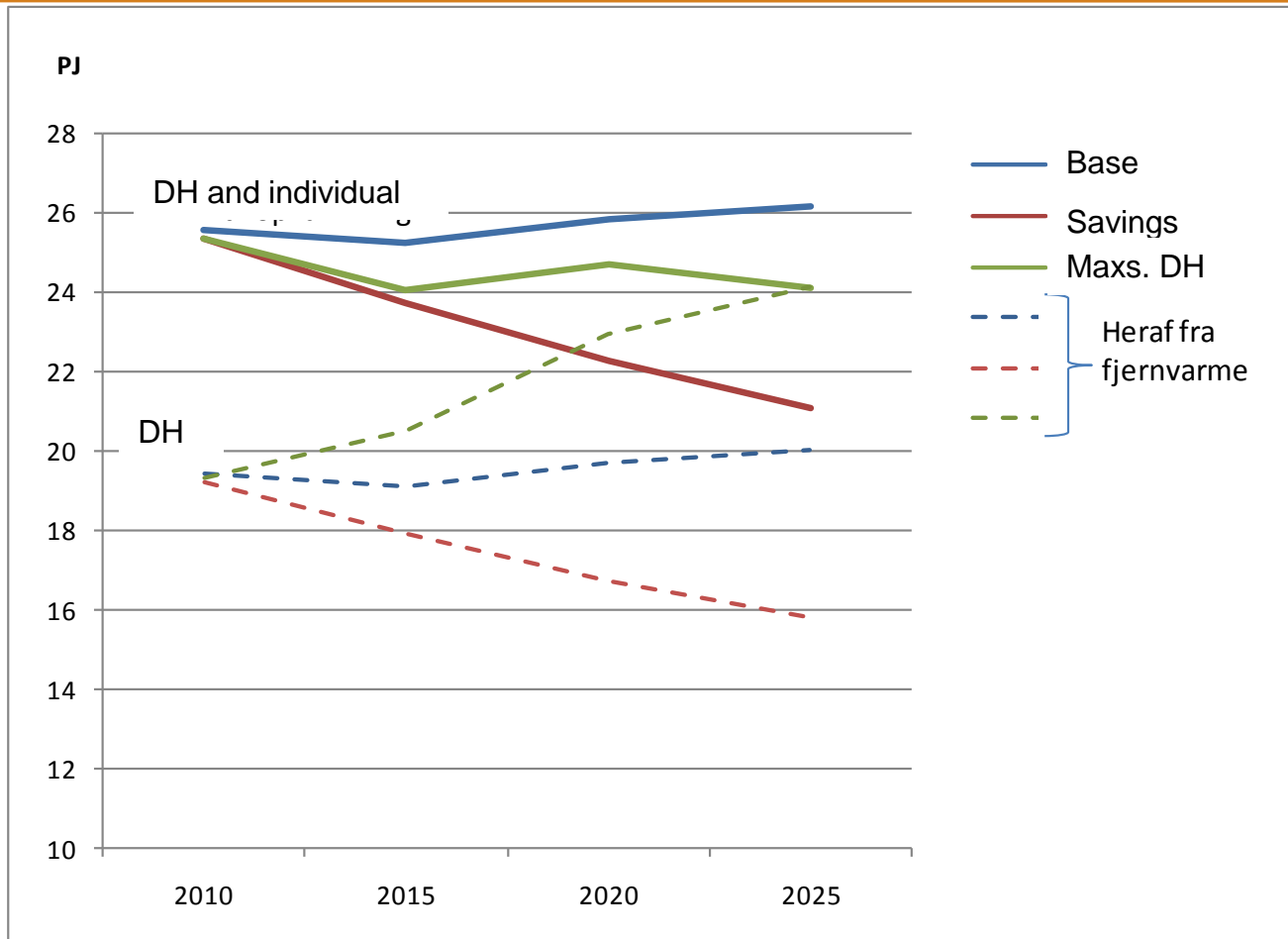
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-HOB	PJ	0,9	0,3	1,8	1,7
Macro economic	Mio. DKK/year	5717	5141	- 576 mio. DKK	4784
- CO2	Mio. DKK/year	815	780	766	591
-Taxes	Mio. DKK/year	608	483	768	403
-Subsidies	Mio. DKK/year	-343	-318	-408	-438
Resulting economic	Mio. DKK/year	5.452	4.976	5.131	4.819
Society economic	Mio. DKK/year	6.075	5.554	-521 mio. DKK	5.501
Total 16 years	Billion DKK	59	56	57	56



# Energy Consumption for Heating

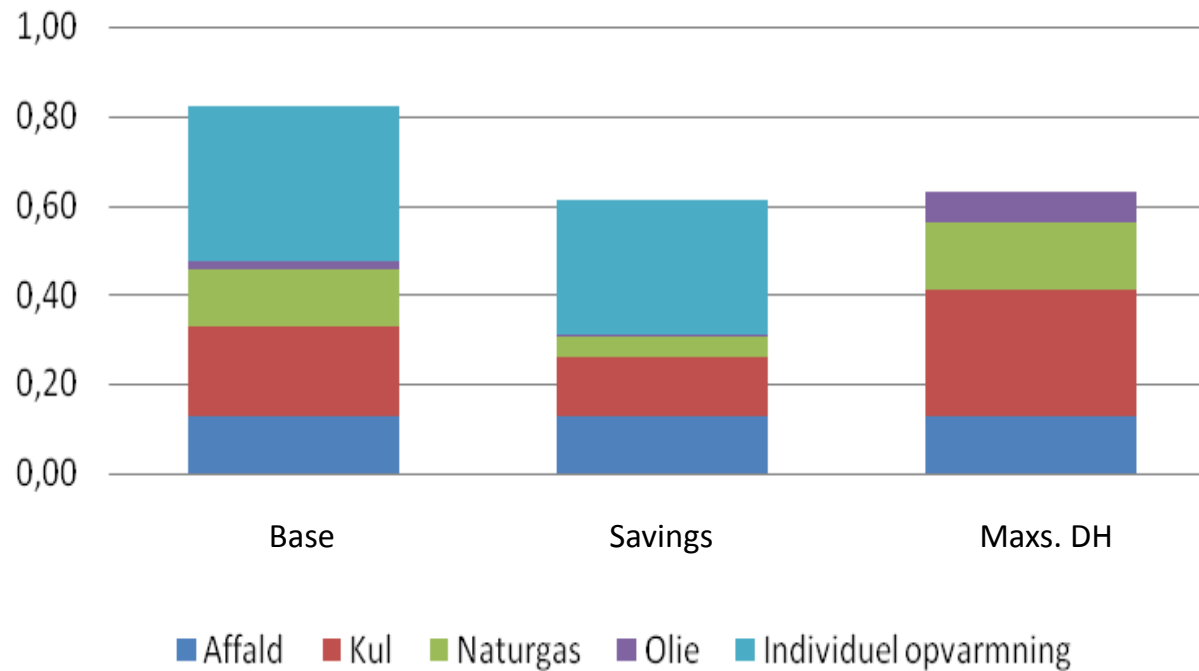
## 200% CHP method





# CO<sub>2</sub> Emission

CO<sub>2</sub> emission til varmeproduktion i 2025 fordelt på brændsler (Mt)



# Conclusions

- The Danish taxation system and programme for subsidy of RE, forms a balanced bases for 70 % RE in the Copenhagen DH system.
- 70 % RE can be reached in 2015 if the accessibility of biomass is good. Negotiation with power companies necessary.
- It is attractive for all parties (society, companies, consumers) to convert a majority of N-gas consumers to the DH system in Copenhagen.
- Reinforcement of parts of the transmission system should be analysed in order to optimize the extension of the system

