

# Modern biomass utilisation



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# Modern biomass utilisation

## ■ Facts:

- **839 PJ Gross Energy Consumption**
- **52.7 million tons CO<sub>2</sub>**
- **Electricity capacity**
  - **13,400 MW Installed capacity**
    - of which: **55% CHP**
  - **3,000 MW wind turbines**
- **Electricity production**
  - **40 TWh**
    - of which **6.7 TWh from wind turbines**

# Modern biomass utilisation

## ■ More facts:

### ■ Renewable energy

- 15% of gross energy consumption

### ■ Biomass

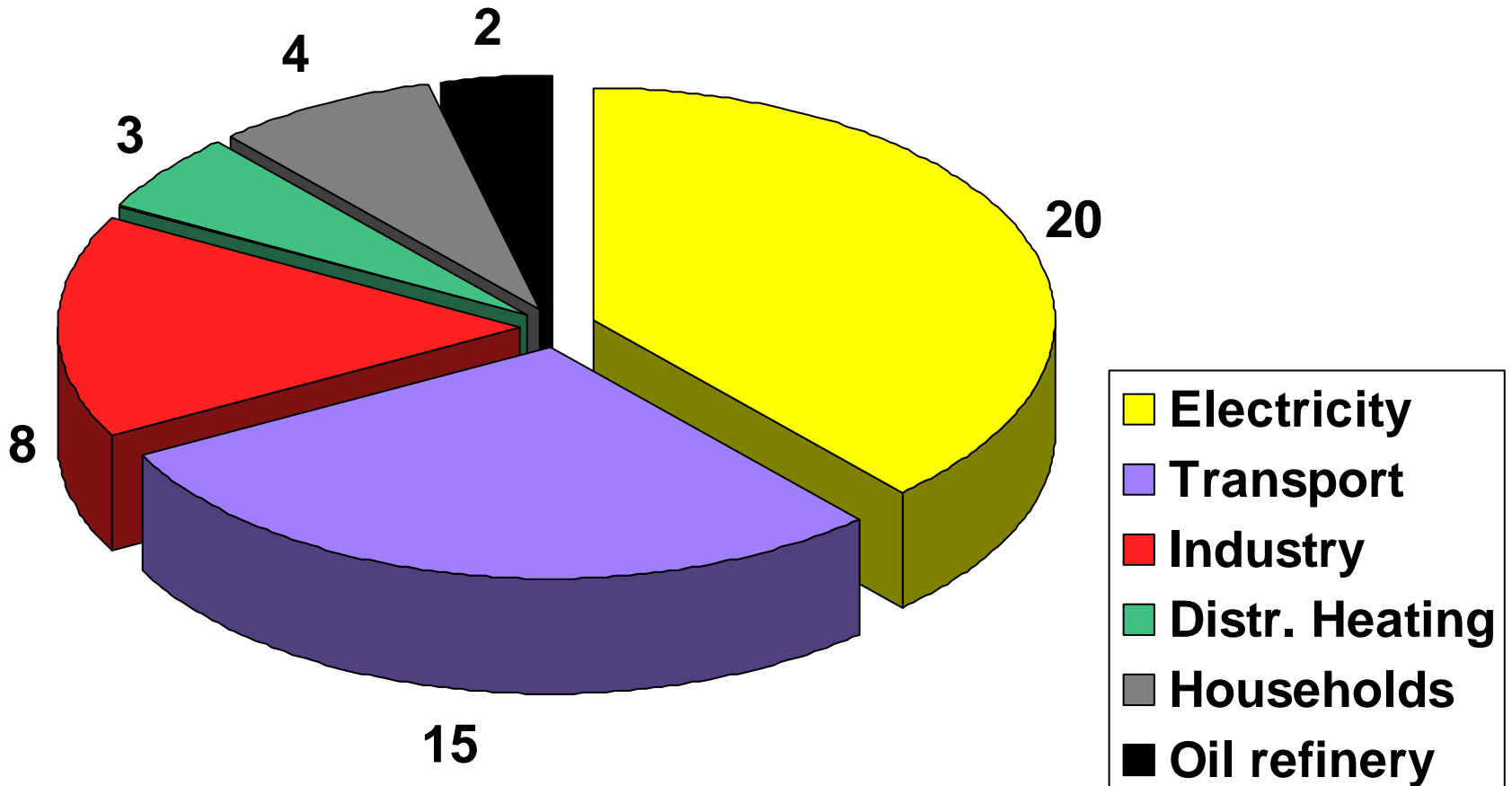
- 12% of gross energy consumption

### ■ Wind:

- 3% of gross energy consumption
- 16% of electricity production

# Danish CO<sub>2</sub> emission 2004

million tons



# Modern biomass utilisation

## ■ Policy Measures

### ■ Fossil fuels

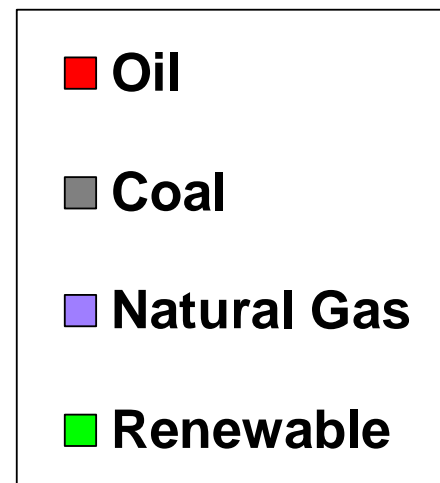
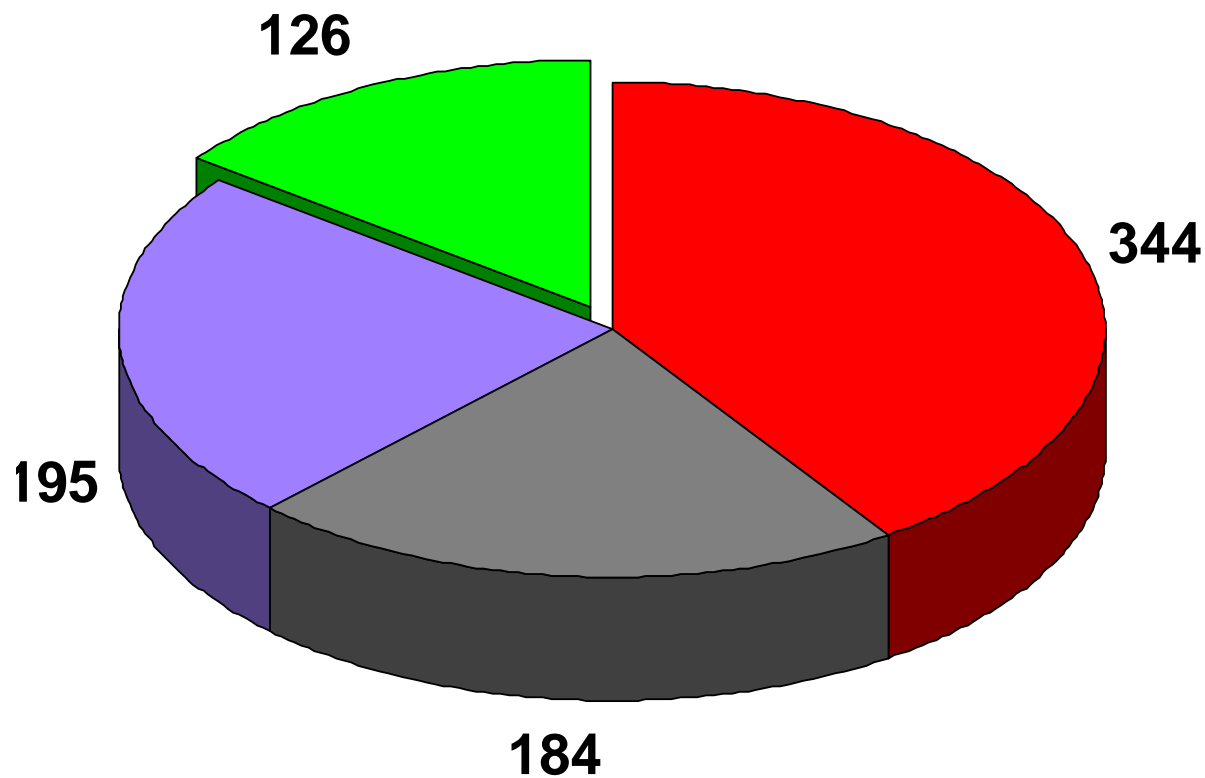
- Energy tax
- CO<sub>2</sub> tax
- SO<sub>2</sub> tax

### ■ Renewable energy

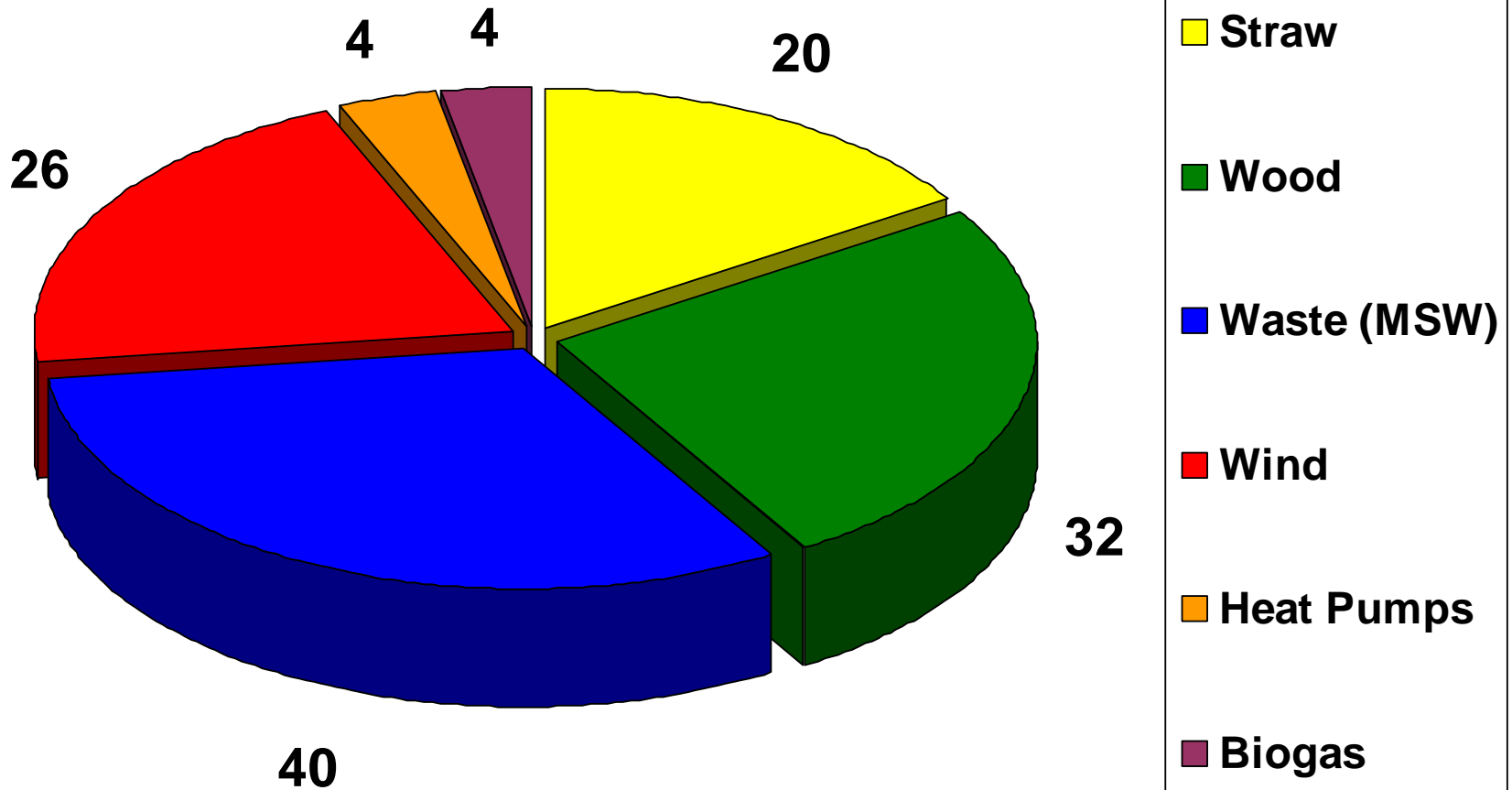
- Subsidies: 5 to 8 €-cent / kWh

### ■ Biomass agreement

# Gross Energy Consumption in Denmark 2004 (PJ)

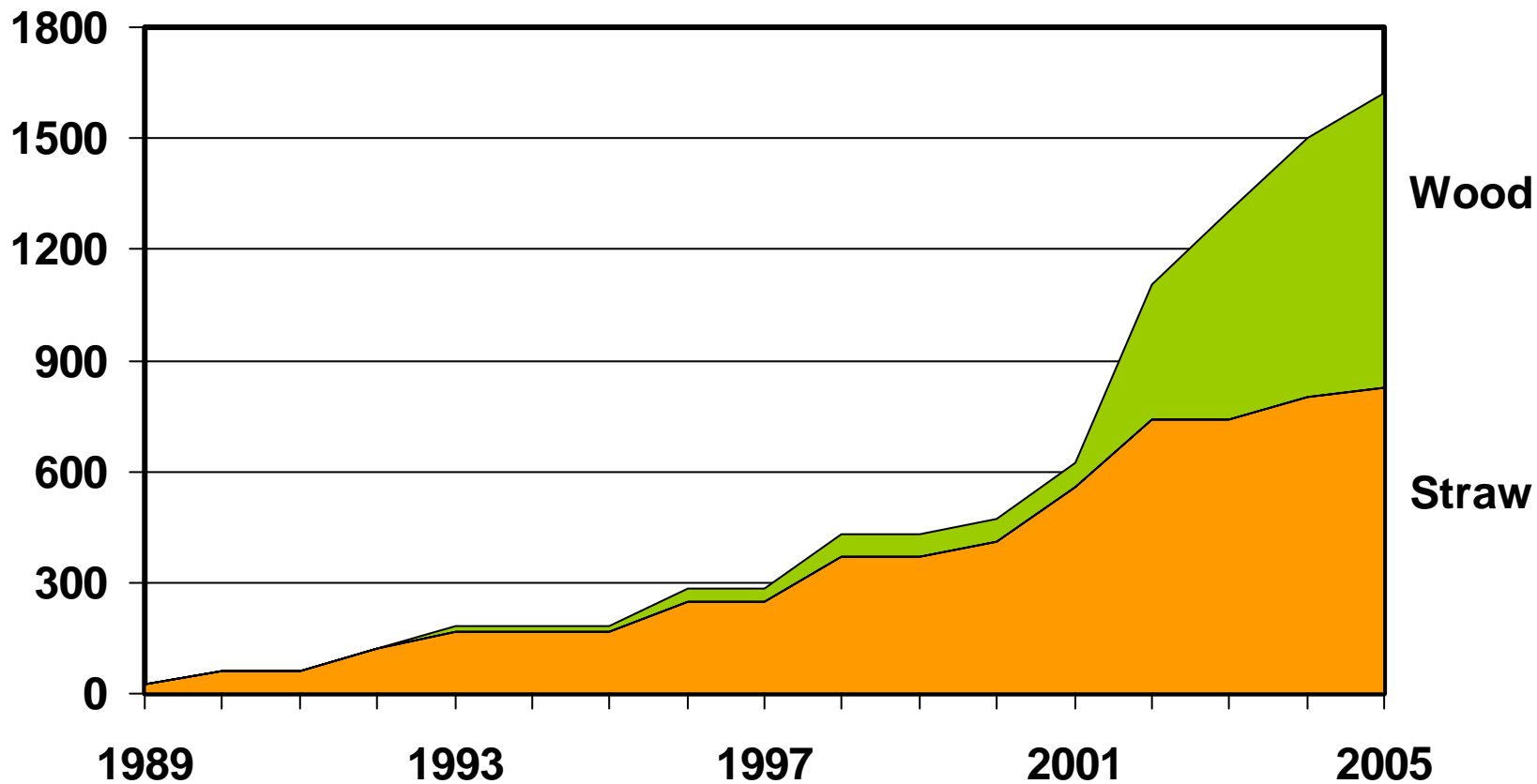


# Renewable Energy Consumption Denmark 2004 (PJ)



# Use of Biomass in Danish power plants

1000 tons





# Biomass-fired power plants in Denmark

|                    | Location  | Wood<br>Tons/year | Straw<br>Tons/year | Total<br>Tons/year |
|--------------------|-----------|-------------------|--------------------|--------------------|
| <b>Status 2000</b> | 10        | 70,000            | 360,000            | <b>430,000</b>     |
| <b>New plants:</b> |           |                   |                    |                    |
| 2001               | Avedoere  |                   | 150,000            |                    |
| <b>Rebuilding:</b> |           |                   |                    |                    |
| 2002               | Avedoere  | 300,000           |                    |                    |
| 2002               | Studstrup |                   | 250,000            |                    |
| 2003               | Amager 2  |                   | 150,000            |                    |
| 2003               | Herning   | 200,000           |                    |                    |
| <b>2000-2006</b>   | 6         | 500,000           | 550,000            | <b>1,050,000</b>   |
| <b>Status 2006</b> | <b>15</b> | <b>570,000</b>    | <b>910,000</b>     | <b>1,480,000</b>   |
| 2008               | Fyn       |                   | 150,000            |                    |
| 2008               | Amager 1  | 250,000           |                    |                    |

# Modern biomass utilisation

| Biomass       | LHV   | Density           | Ash    |
|---------------|-------|-------------------|--------|
|               | MJ/kg | kg/m <sup>3</sup> | % d.m. |
| Straw         | 14,5  | 130               | 5      |
| Straw pellets | 15,0  | 600               | 5      |
| Wood chips    | 10,5  | 300               | 0,5    |
| Wood pellets  | 17,5  | 650               | 0,5    |
| Coal          | 25    | 1000              | 13     |

# Avedoere Power Station



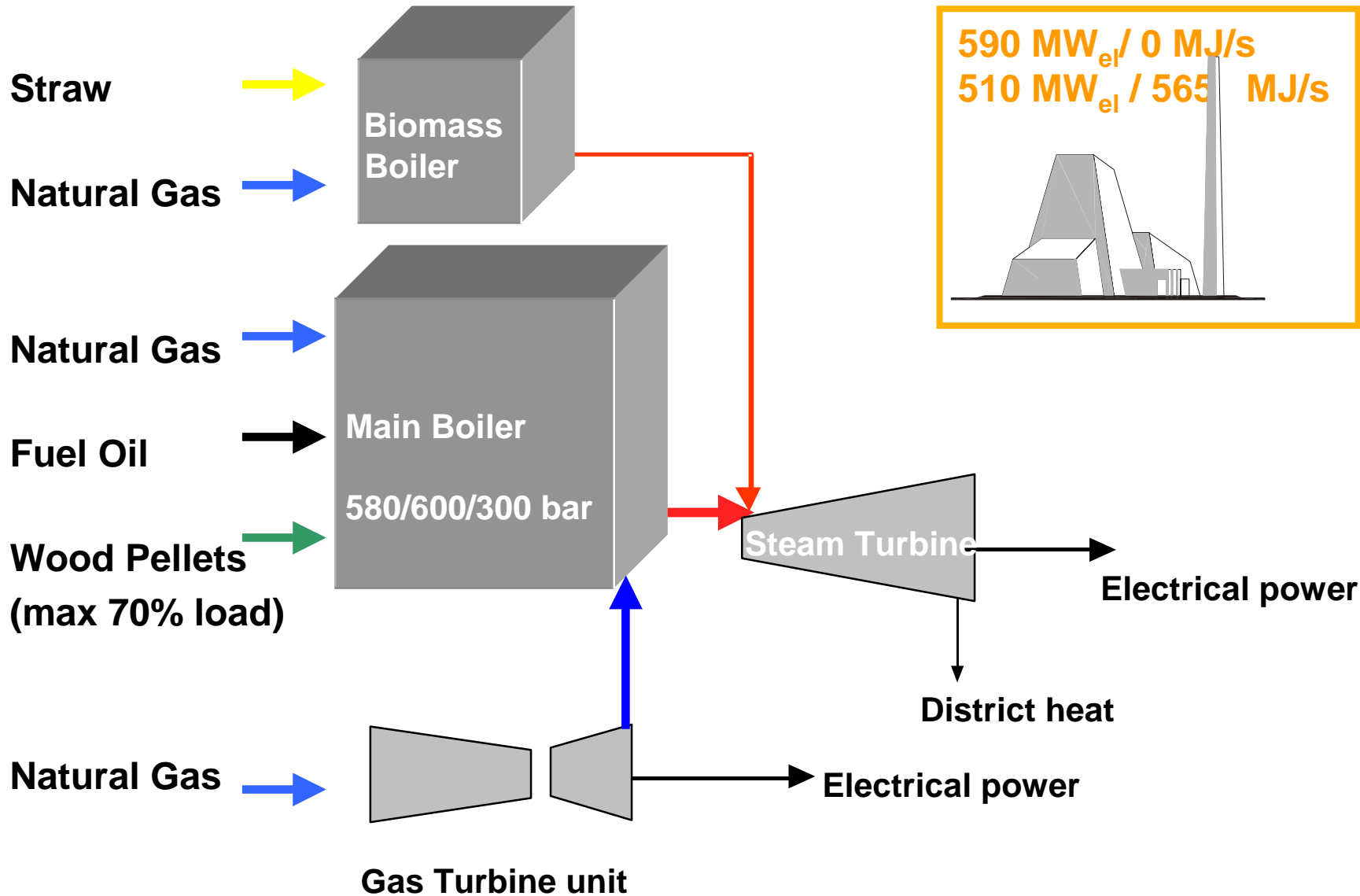
**1990**

**Unit 1: 214 MW el + 330 MJ/sec heat**  
**Coal: 700,000 tons**  
**+ Fuel Oil**

**2001**

**Unit 2: 510 MW el + 565 MJ/sec heat**  
**Wood pellets: 300,000 tons**  
**Straw: 150,000 tons**  
**+ Natural Gas + Fuel Oil**

# Avedøre Power Station unit 2



# Straw pellets at Amager Power Station unit 2



**82 MW el or 56 MW el + 180 MJ/sec heat**  
**150,000 tons straw pellets**

# Studstrup Power Station



**700 MW el or 520 MW + 910 MJ/sec heat**

**Coal: 1,000,000 tons**

**Straw: 250,000 tons**

**Other biomass: 100,000 tons**

**+ Fuel Oil**

# Ensted Power Plant – Straw & Wood chips



**Straw: 120,000 tons**

**Wood chips: 30,000 tons**

# Herning Power Plant



**89 MW**

**Wood chips: 200,000 tons**

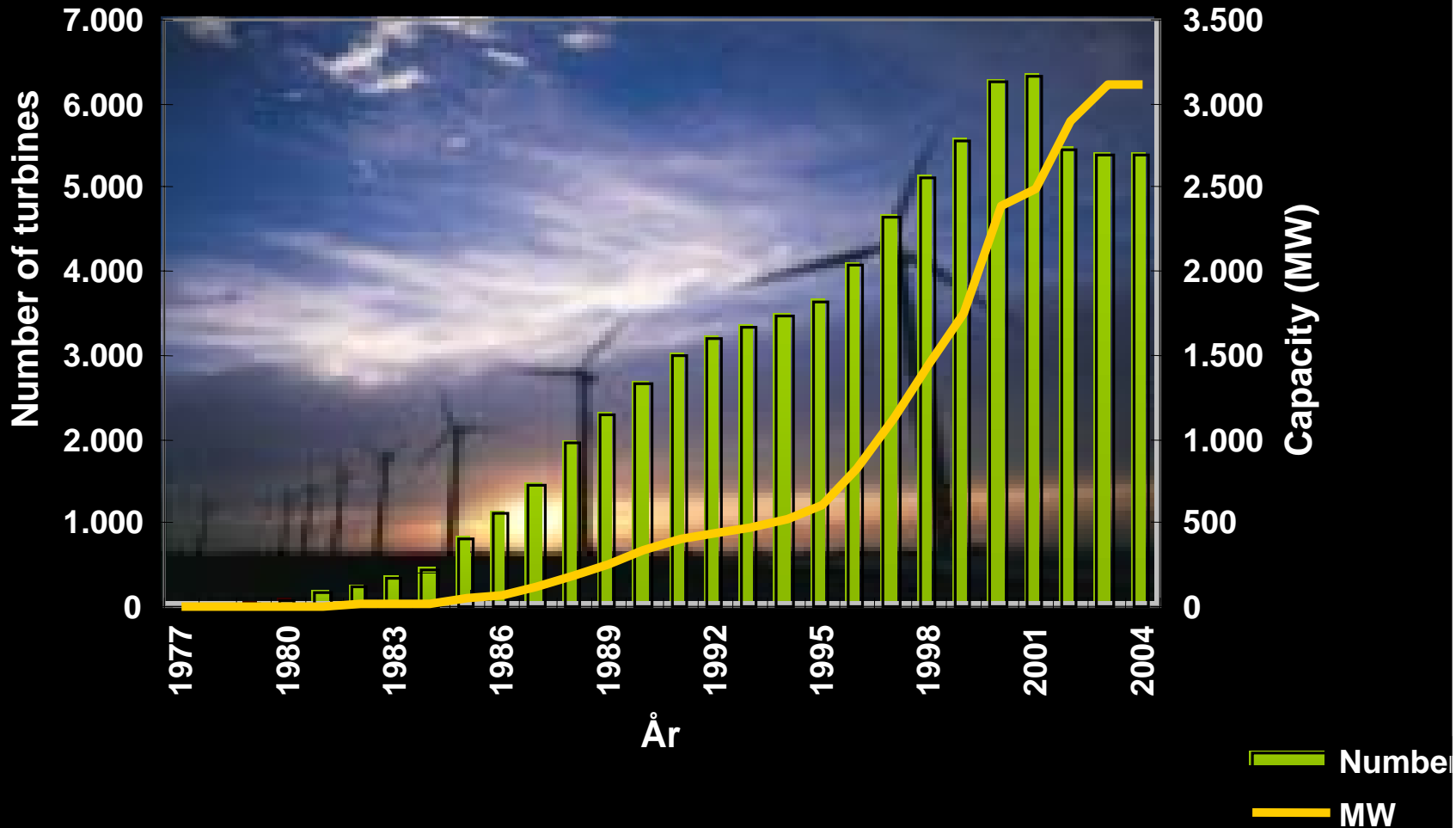


# Køge Pellet Factory

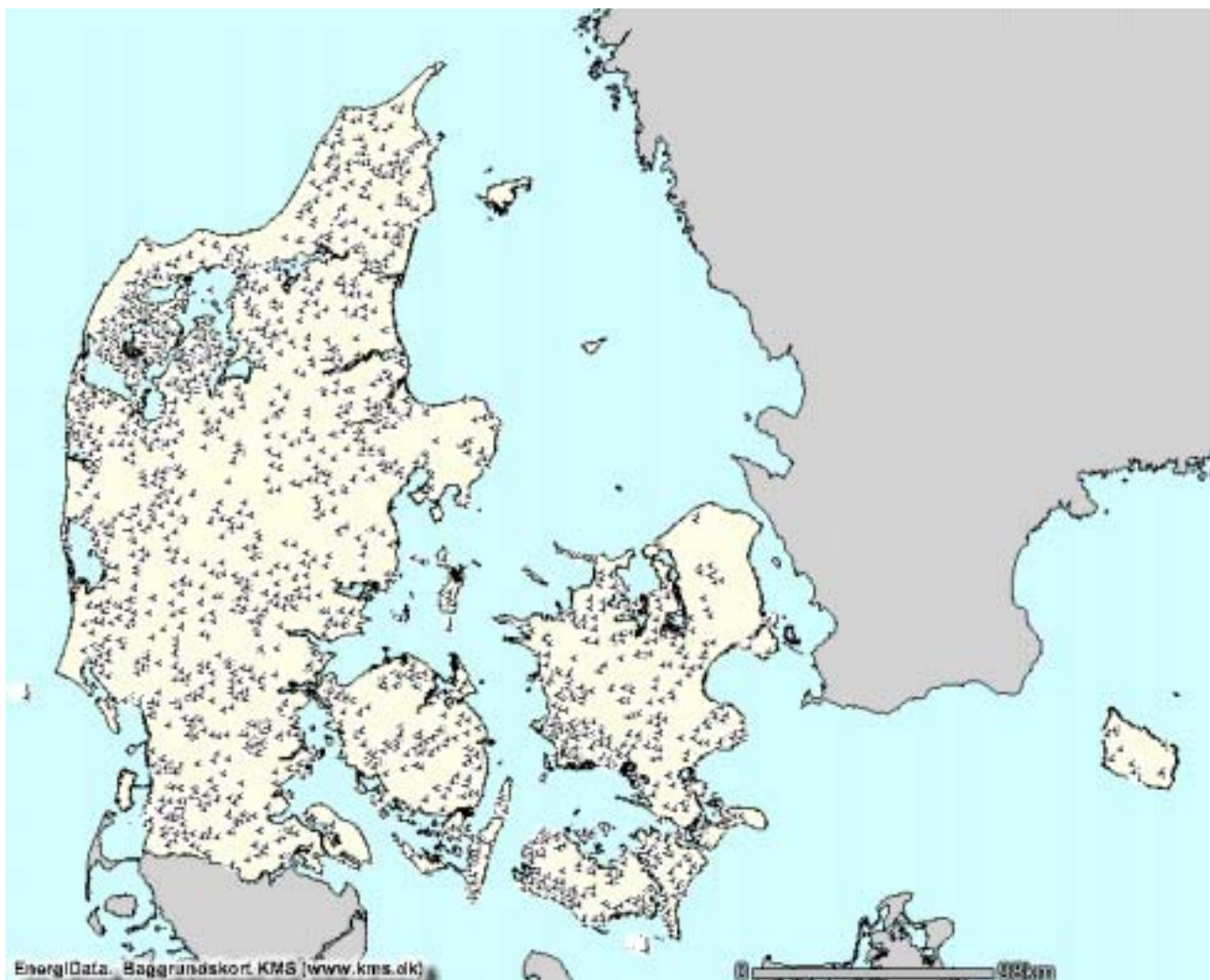
- 1) Raw wood chips
- 2) Wood and straw pellets plant
- 3) Storage for straw bales
- 4) Power plant
- 5) Power plant
- 6) Pipe conveyor for straw and wood pellets
- 7) Straw pellets store
- 8) Wood pellets store
- 9) Harbour
- 10) Wood floor factory



# Wind turbines – Numbers and capacity



# Wind turbines in Denmark



# Biogas



**Production: 4 PJ  
CO<sub>2</sub> reduction**

**Units: 145**

**Potential: 40 PJ  
CH<sub>4</sub> reduction**

# 1 million tons straw per year in big bales



**+600,000 tons wood chips and round logs per year**



# Pellet factory – 180,000 tons wood pellets / year



**+ 120,000 tons import**

# Pellet factory – 150,000 tons straw pellets / year





**Thank you for your attention**



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