



**CONSULATE GENERAL
OF DENMARK**
Silicon Valley



Danish Energy
Agency

Industrial Energy Efficiency

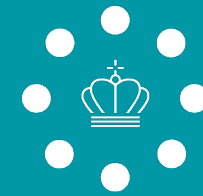
*-perspectives from
Denmark*



Bo Riisgaard Pedersen, Energy Attaché, M.Sc.Eng.
Industrial Energy Efficiency Symposium
UC Davis, 31 July, 2019



**CONSULATE GENERAL
OF DENMARK**
Silicon Valley



Danish Energy
Agency

Agenda

1. Introduction, the Danish Energy Agency and the cooperation with the California Energy Commission
2. Brief facts on Danish energy efficiency achievements
3. Some perspectives on Industrial EE policy instruments (*deployment & hard vs. soft tech*)

So, where is Denmark?



Denmark

Population: 5.7 million

Area: 16,577 square miles

Coastline: 4536 miles

Land use: 2/3 of land area used for agriculture

Water Source: 100% ground water

Government: Constitutional monarchy.

GDP per capita (2017): 56.307 USD (~5 % lower than US)

Energy Consumption per Capita:

105 million BTU (CA:199 million BTU)

One of the world's **happiest** nations according to UN, OECD



One of the most energy-efficient economies in the EU



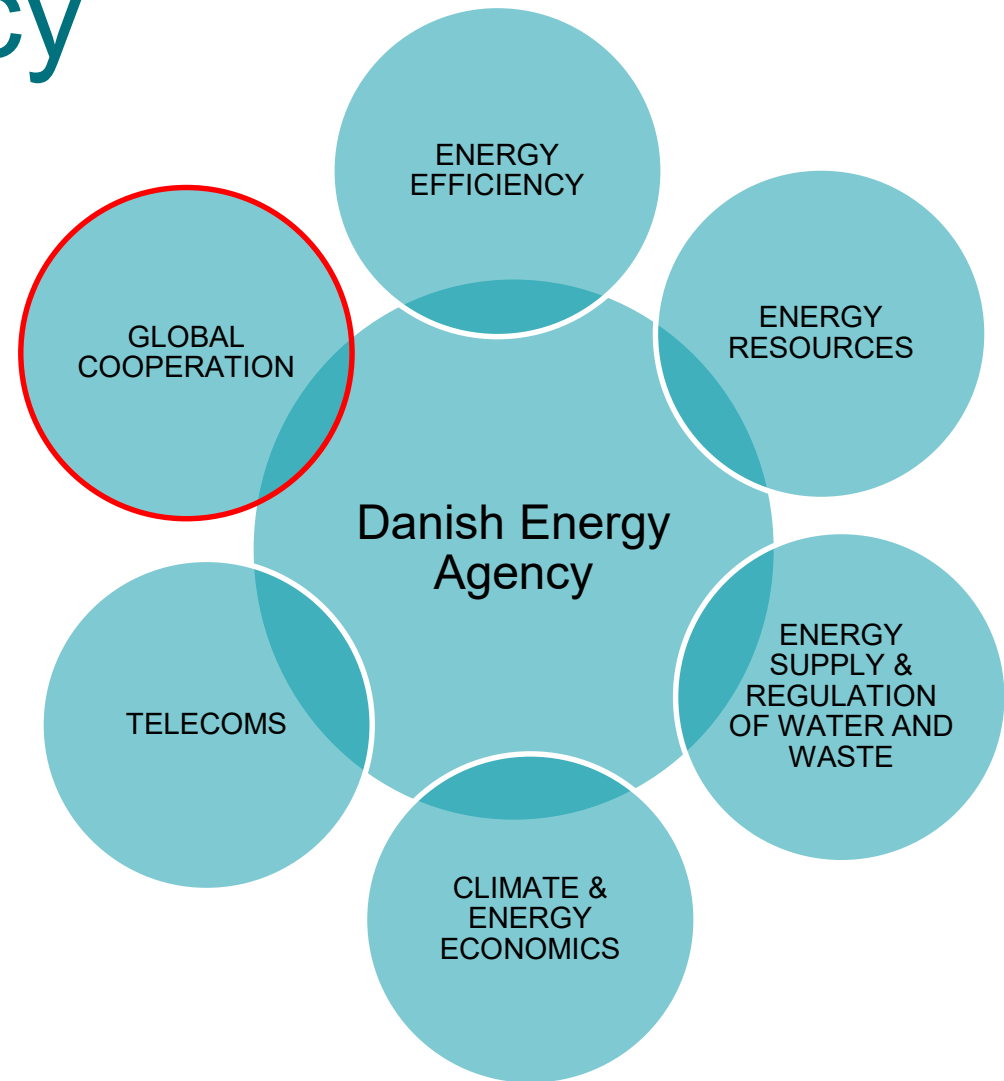
Danish Energy Agency

Established in 1976

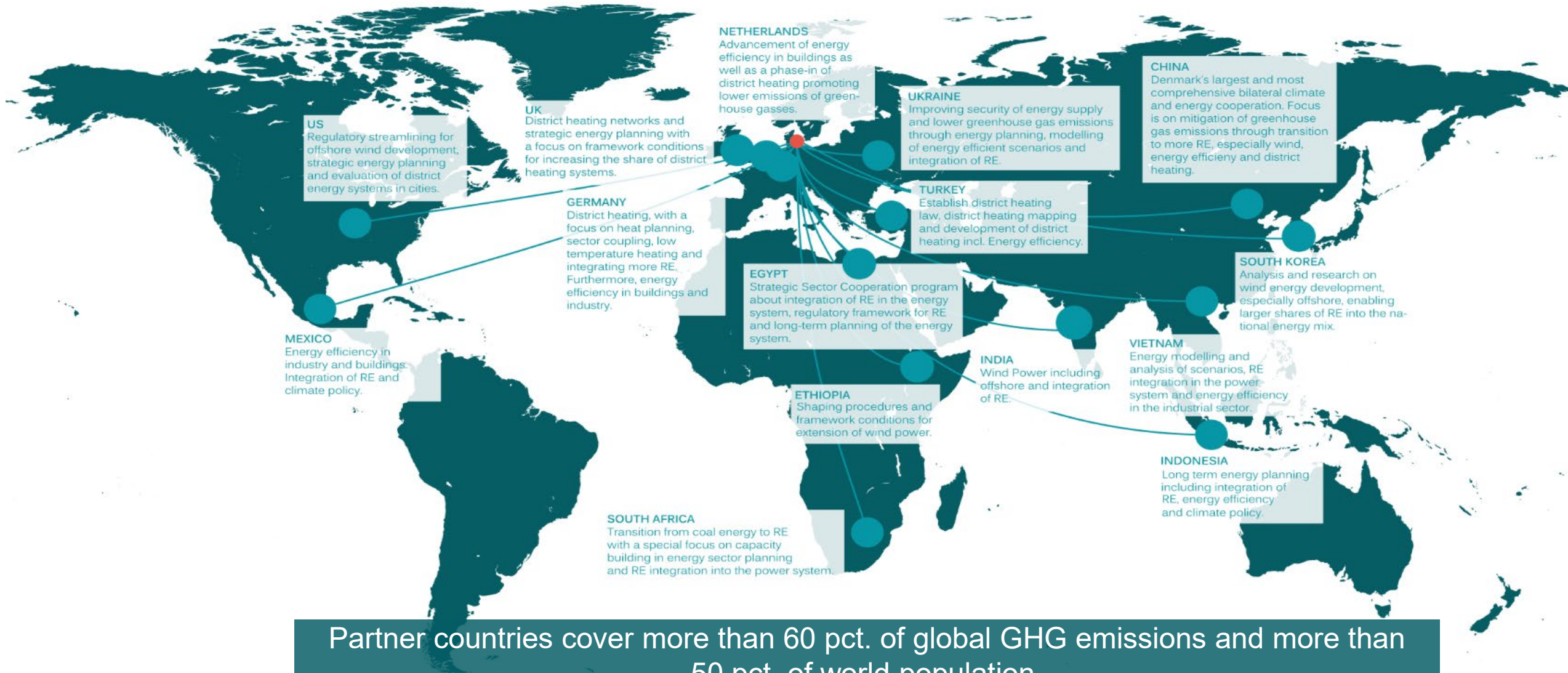
Agency under the Ministry of Climate,
Energy and Utilities

Responsibilities:

Responsible for tasks linked to energy planning, production, supply and consumption, as well as Danish efforts to reduce carbon emissions. The Agency engages both domestically and internationally.



Global Cooperation



Partner countries cover more than 60 pct. of global GHG emissions and more than 50 pct. of world population.

Cooperation is done through posted advisors/attachés backed by experts at DEA

The energy cooperation with California

Existing cooperation agreement on offshore wind with CEC and lately also cooperation within energy efficiency.

EE pilot:

Industrial EE in the dairy processing industry focusing on re-use of heat, process optimization etc. to reduce GHG emissions and improve economic competitiveness through new EE technologies.

Free specialized in-depth 2-day audit with resulting proposed projects to apply for CECs' FPIP funding (not a requirement).

Still open for participating dairy processing plants!



Energy efficiency has delivered in Denmark

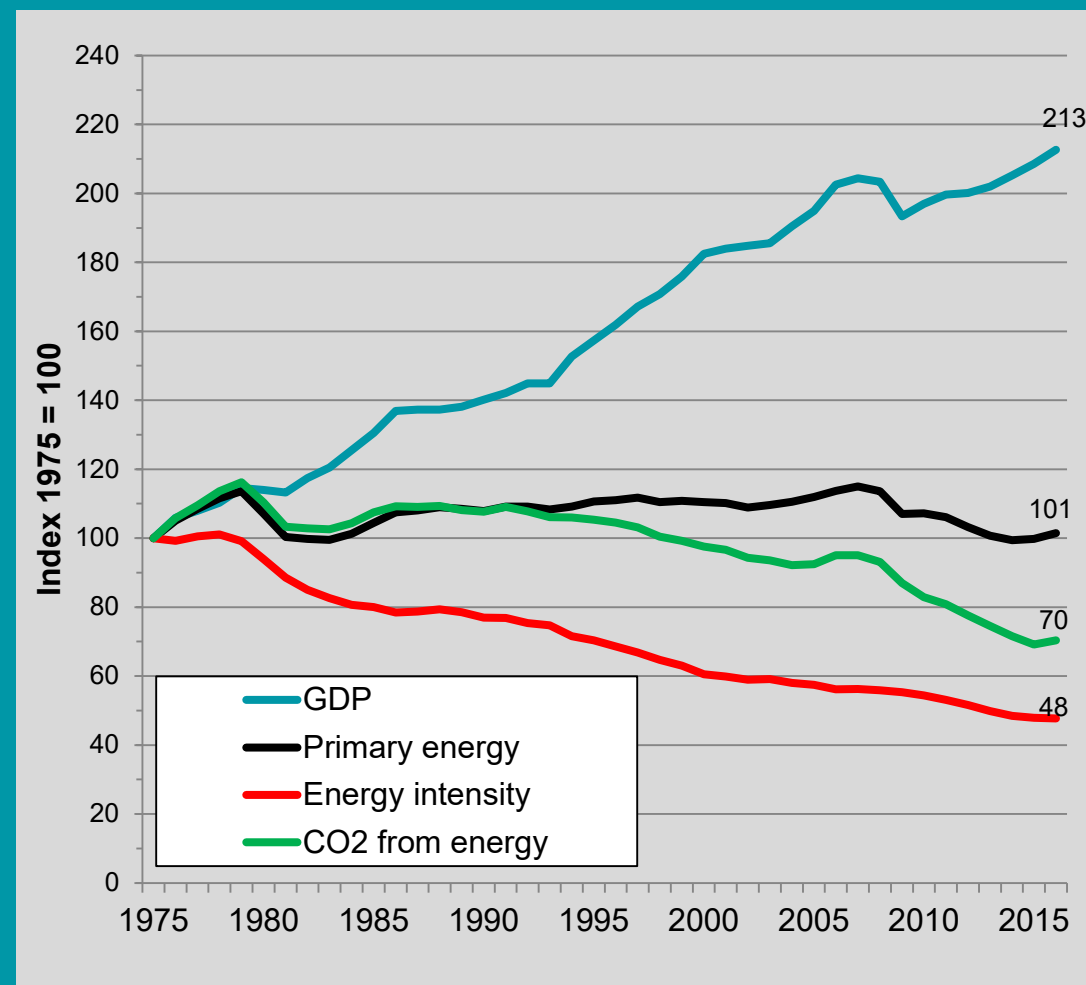
The Danish de-coupling is closely linked to increased energy efficiency

End-use efficiency

- Better insulation of buildings
- More efficient appliances etc.
- Higher efficiency in industry

Efficiency of energy supply

- Especially increased use of combined heat and power production – CHP
- More efficient power plants and individual boilers
- More renewable energy (wind)

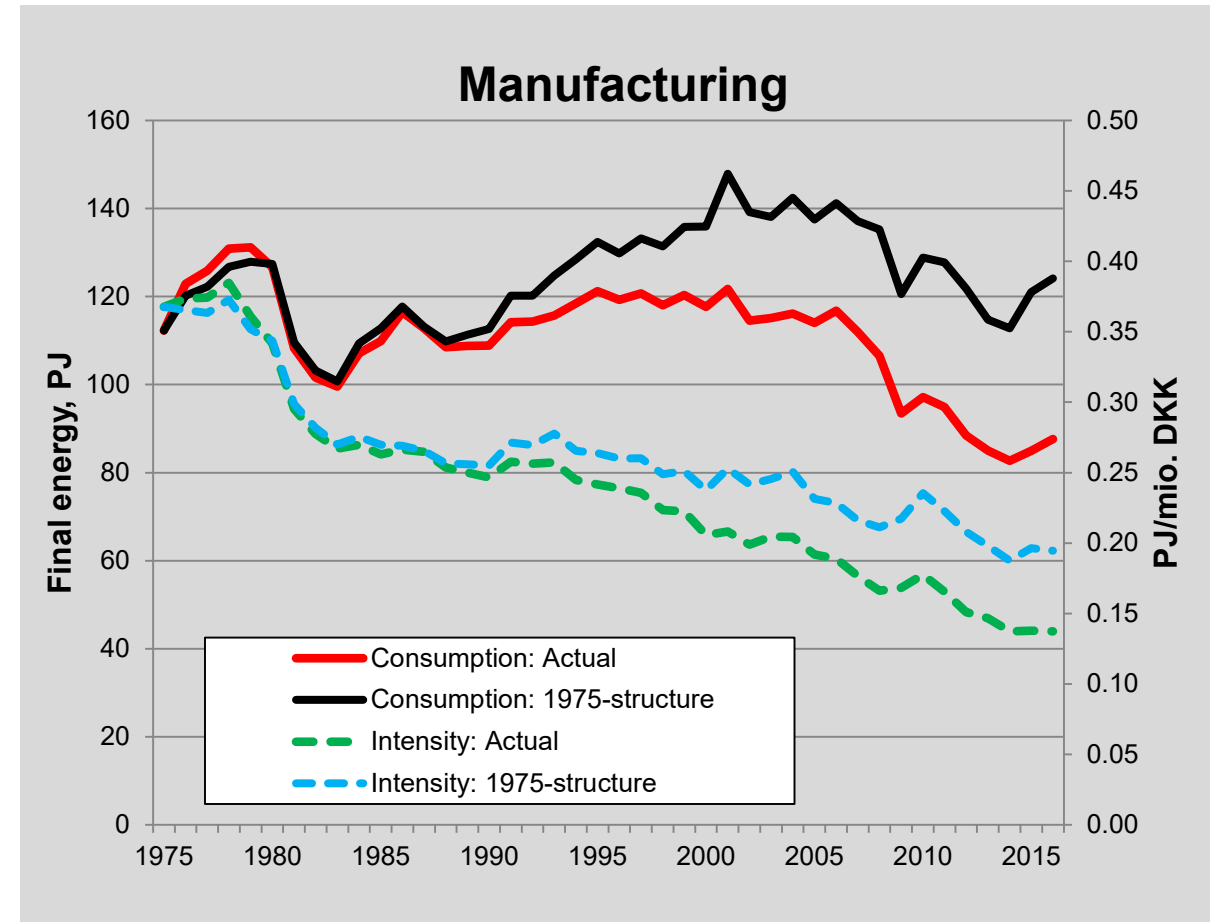


Efficiency improvements in industry

- Strong EE improvements
 - Especially 1979-1983 and 1993-2016
 - A part of this is due to structural changes and energy prices

	Actual	1975-structure
1975-2016	-2,4%	-1,5%
1993-2016	-2,7%	-1,5%

- But also due to effective policies and regulatory measures



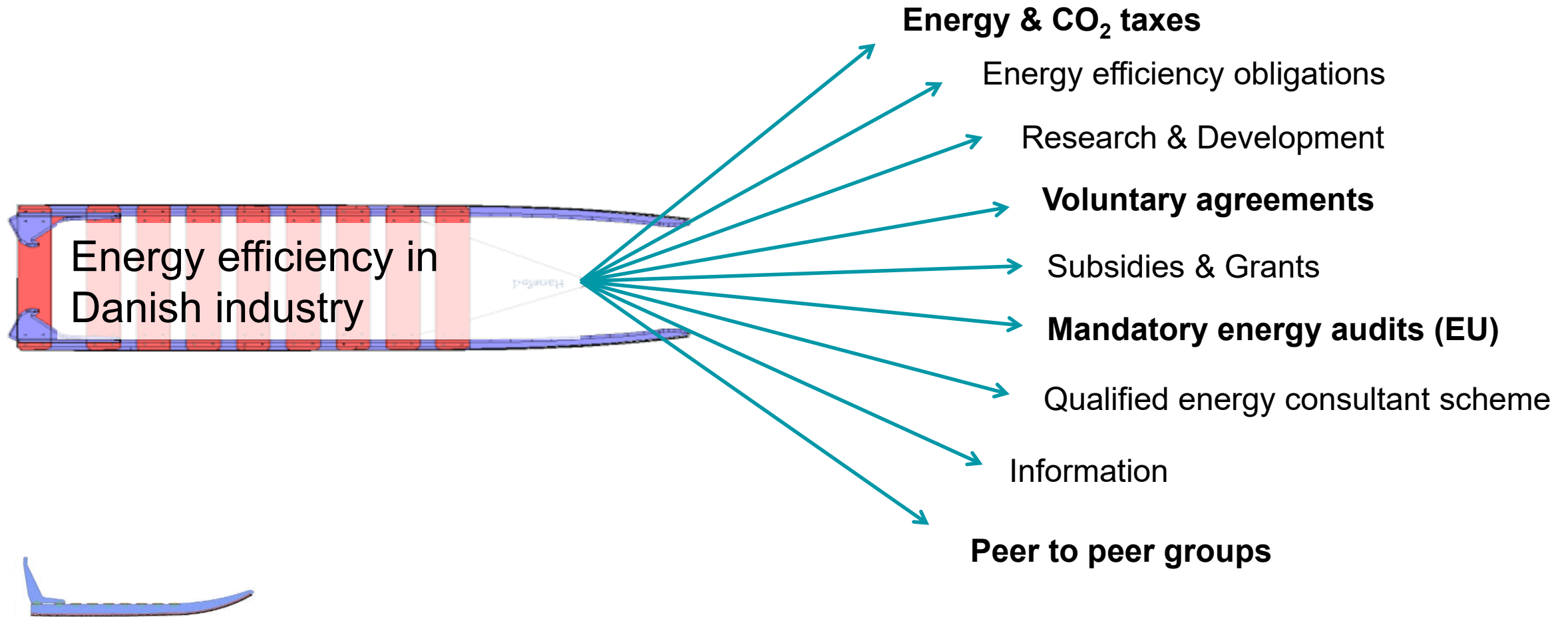
Not the result of a single strong policy driver

- it is more like a dog team:

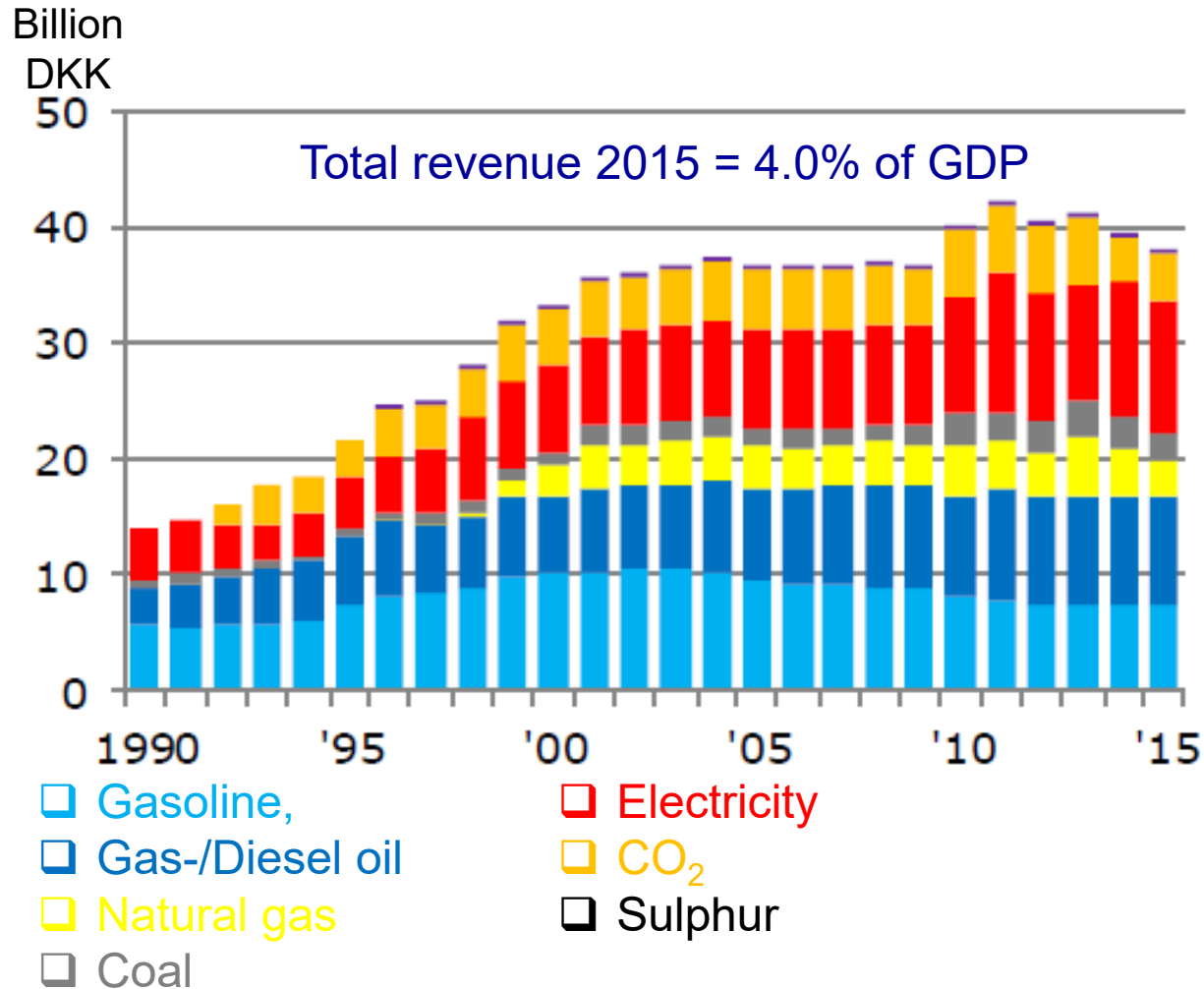


- One dog cannot not pull the load on its own
- A pack of dogs will not necessarily pull in the same direction
- However the joint result gets the sled and load in the right direction
- ... and usually there is a whip involved to assist with the steering.

The suite of policy instruments:



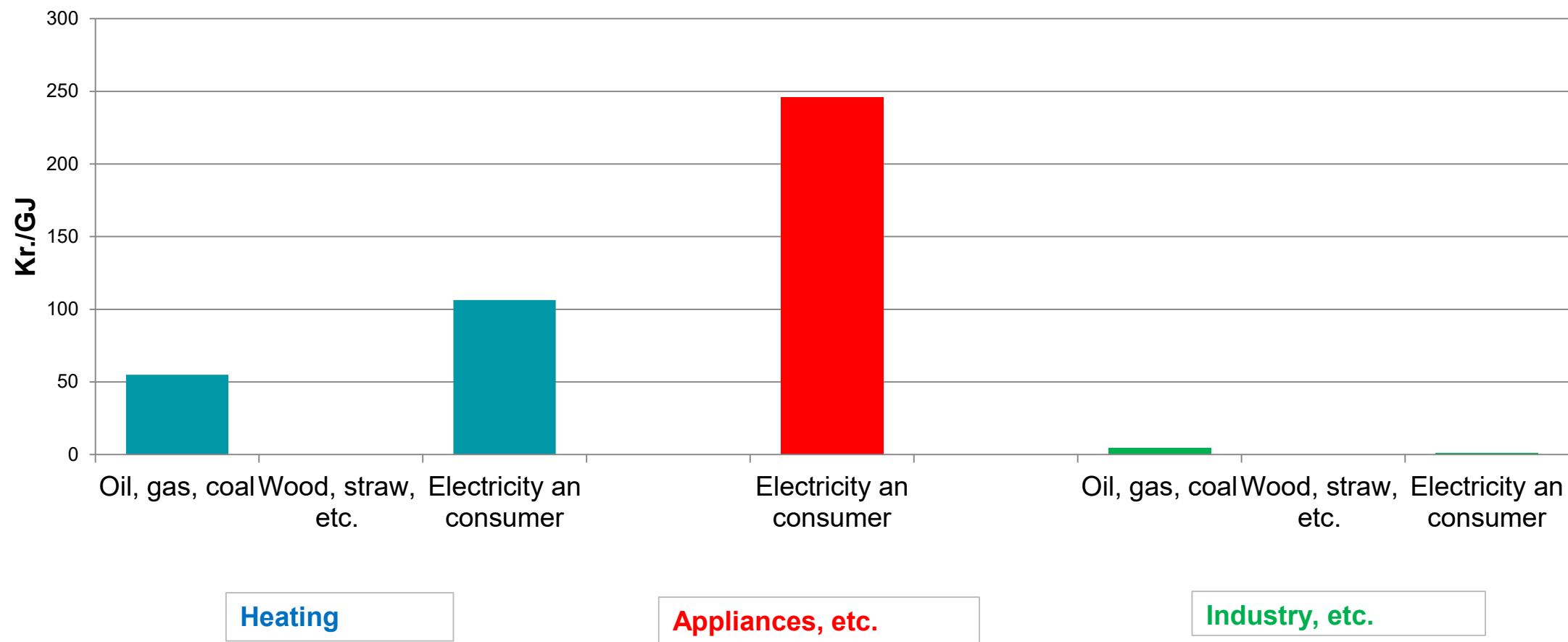
Energy taxes



- Taxes on energy increase the value of energy savings and the incentive for energy efficiency
- Energy prices do not reflect the long-term costs of pollution and CO₂-emissions: Energy taxes may compensate for this.
- Energy taxes may also ease the acceptance of more stringent energy efficiency regulation
- **Denmark introduced a CO₂ tax in 1992**



Energy taxes (2017) (Horizontal measure)



Energy Efficiency Obligations

Supporting implementation of EE

- Savings in existing buildings and industry are complicated
- Energy companies are close to the consumers and cover all part of a country

Has been a secure and stable way to finance energy savings activities

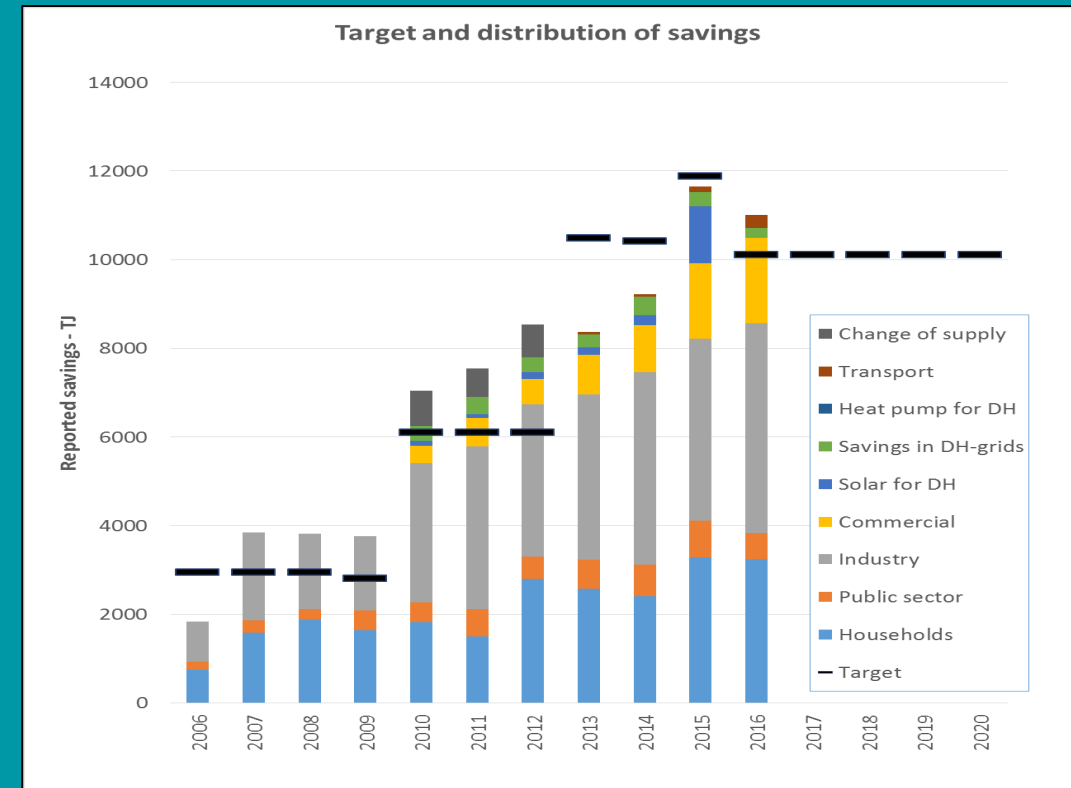
- Difficult to get funding on the national budget

Transformation of the utilities to energy service providers

- Provides energy services to the costumers in a cheap way
- Strong and effective measure but some issues with compliance

The current Danish program will end by 2020

- A new competitive tendering scheme will take over



Voluntary Agreements (VA)

Background

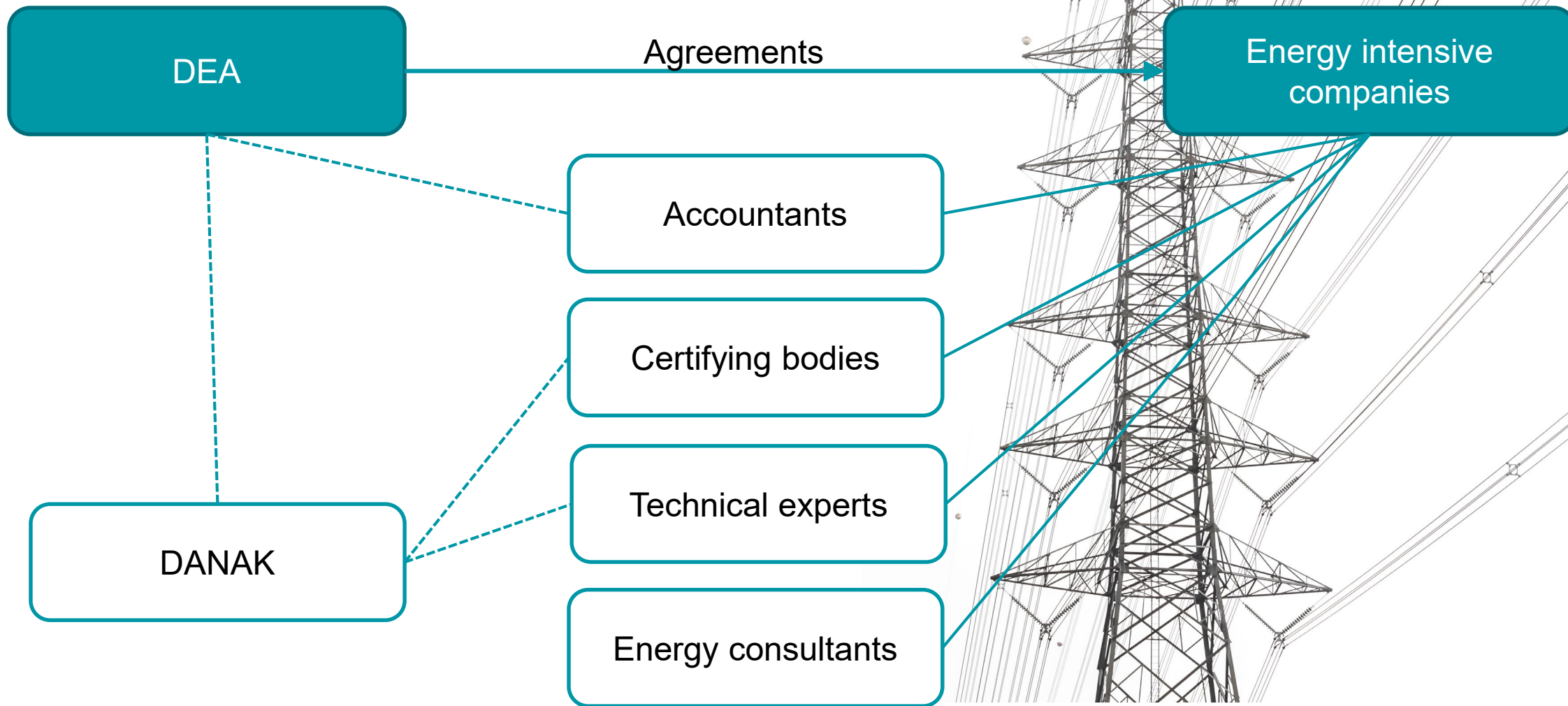
- The goal of the political national energy plan "Energy 2000" (1990) was to reduce the CO₂ emission by 20% in 2005 (1988-level).
- To reach the goal a tax on CO₂ was introduced in 1991/92.
- Energy intensive companies got a subsidy to the CO₂ tax, if they carried out an energy audit and carried out some energy efficiency projects.
- This subsidy scheme was the first outline of the voluntary agreement scheme.



Voluntary Agreement Scheme

- The basics of the VA-Scheme (economic incentive → Energy efficiency)
- A company enter into a 3 year-agreement with DEA on energy efficiency obligations:
 - Implement and maintain a certified energy management system (ISO 50001) with annually energy reviews and audits.
 - Complete energy efficiency projects with a time of payback under 5 year.
 - (all obligations have to be verified by external technical expert/certifying body)
- A company gets a refund on their electricity tax (30-50 %).
- Sanctions: Claim for repayment if the requirements are not met.
- The role of the DEA
 - Agreements are administered by the DEA.
 - Inform and guide the companies
 - Continuously control fulfillments of the requirements.
 - Continuously maintain/develop the framework of the VA-scheme

Central stakeholders



Voluntary Agreement Scheme

- 120 companies in different sectors have entered into agreements
 - covering **around 10 % of the Danish energy consumption**.
- **650** energy efficiency **projects completed within a 3-year** agreement period
 - 320.000 MWh energy savings a year primarily on natural gas and electricity reduction.
 - Around 62.000 ton CO_{2-eq} and around **1.4 % of the total energy consumption** in the Danish manufacturing industry or 2.2 % of the energy consumption in companies in the agreement scheme.
 - Project with primarily focus on LED-lighting (148 projects – 21 GWh), pressurized air (64 projects – 7 GWh), melting/casting (38 projects – 28 GWh) etc.
- Experiences with the VA-scheme
 - Cost-effective and well-functioning scheme to promote energy efficiency
 - Stakeholder involvement important in scheme development process
 - Balance between economic incentive vs. energy efficiency requirements
 - Prioritizing guidance important to reduce misinterpretations/defaults
 - Develop and use templates to systematize data and standardize reporting.
 - Continuously improve the framework of the VA-scheme

Mandatory Energy Audits in large companies (EU)

- Energy Efficiency Directive (EED)
 - Article 8: all companies that are not a SME have to make an energy audit every 4 years
 - Non SME's: More than 250 persons or an annual turnover over EUR 50 million and an annual balance sheet over EUR 43 million.
 - Energy audit includes
 - Buildings - Processes - Transport
 - ISO 50001 and DS/EN 16247 1-4 as standard for energy audit
 - Main objective is to identify energy saving potentials

Peer to peer groups (Learning networks)

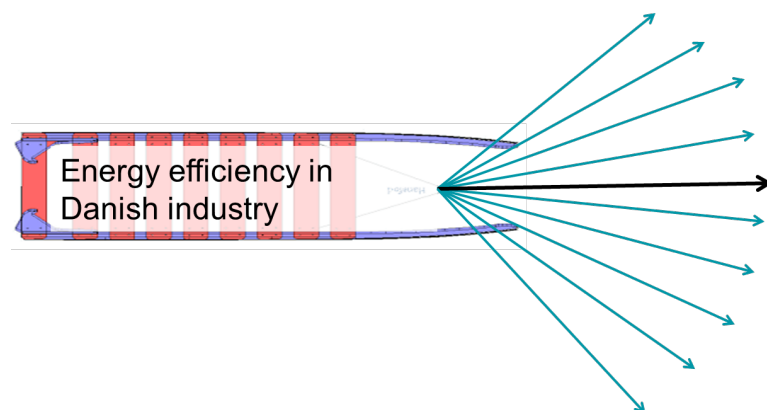
- Instrument for promoting energy efficiency in the Danish Industrial sector.
- A network consists of approximately 15 companies - oldest network from 1992 still exist
- 2 annual meetings in different companies with political/technical topics followed by company review and discussions
- No consultants allowed (except for the “secretary”)
- The Danish Energy Agency mostly participates to inform on new and upcoming regulations

Experiences:

- Exchange know-how and energy efficiency solutions.
- Getting inspiration and keeping energy efficiency on the agenda.
- DEA gets feedback on instruments, policies etc.
- Maximum 15-20 active companies in a network
- Permanent coordinator for the planning of the network



Other drivers that might deliver industrial EE ?



- Indications that the awareness raising caused by EE measures might have a high(-er) impact on energy efficiency than just the economic incentive.
- Nudging, awareness and behavioral changes are important drivers but can be hard to grasp.
- LEAN, Six Sigma, Overall Equipment Effectiveness (OEE) etc. also effects energy performance and intensity.
- Looking beyond the boundaries of each sector and plant through “Industrial symbiosis” can further increase energy (and resource) efficiency.

So, there are plenty of RD&D opportunities for EE beyond the “traditional” hardware technologies – there are also “softer” solutions that can deliver impact that transcends the individual industrial sectors.

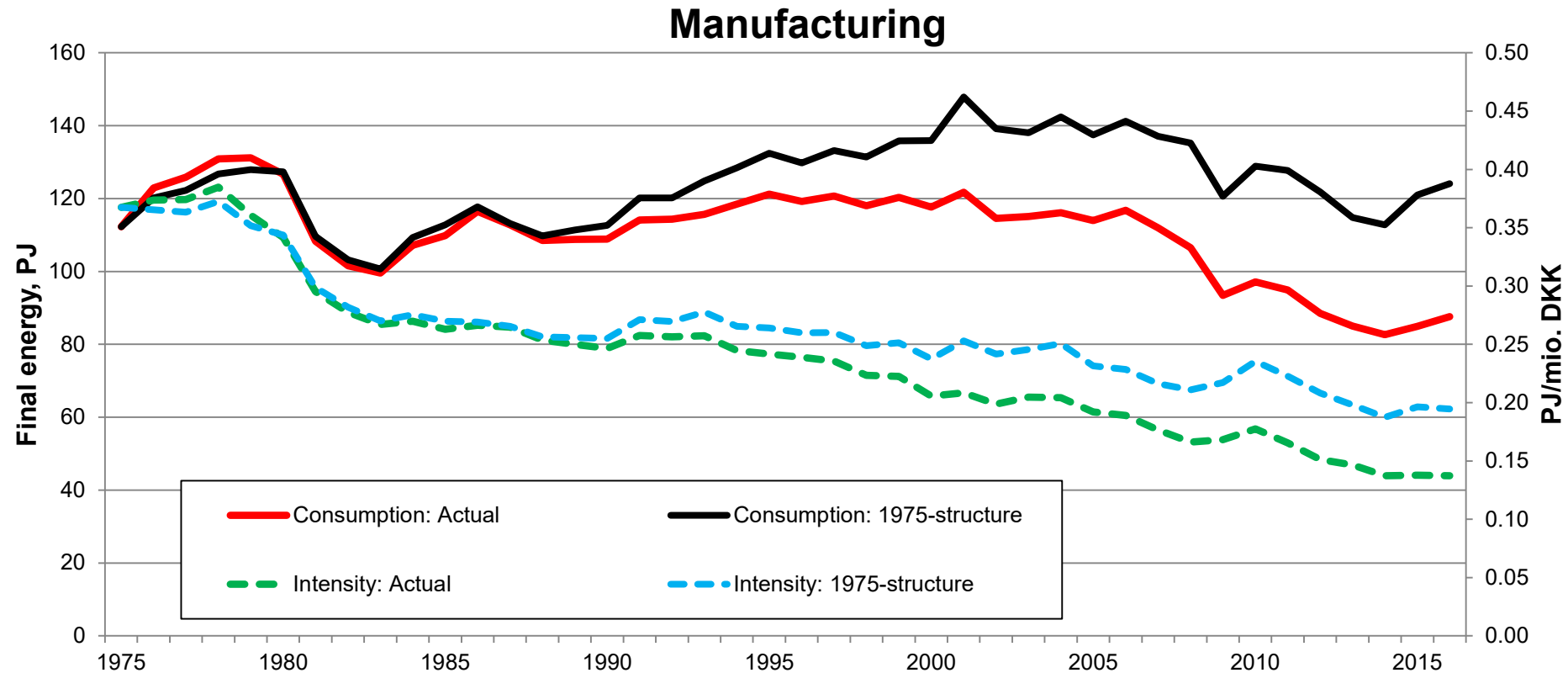


**Thank you for
your attention**

Bo Riisgaard Pedersen
borped@um.dk

Additional slides

EE in Danish Industry - overview



Measures related to industry

Former programs:

- CO2-packages in 1993 and 1996
 - CO2-tax
 - Voluntary agreements scheme
 - Subsidy scheme
- Energy efficiency obligation scheme from 2006
 - Involvement of energy utilities since 1993
- Subsidies for renewable energy to industrial processes
- Information etc. to SME's

Current programs:

- Taxes on energy – very low (EU minimum level)
- Energy Efficiency obligation scheme
- Voluntary agreement scheme
 - Energy Management – ISO 50001
 - Special investigations
 - Implement all project \leq 5 year payback period
 - Subsidy to reduce PSO
- Mandatory energy audits for large companies
- RD&D