

Policies, legislation and incentives to introduce ozone & climate-friendly alternative technologies in Nordic countries.



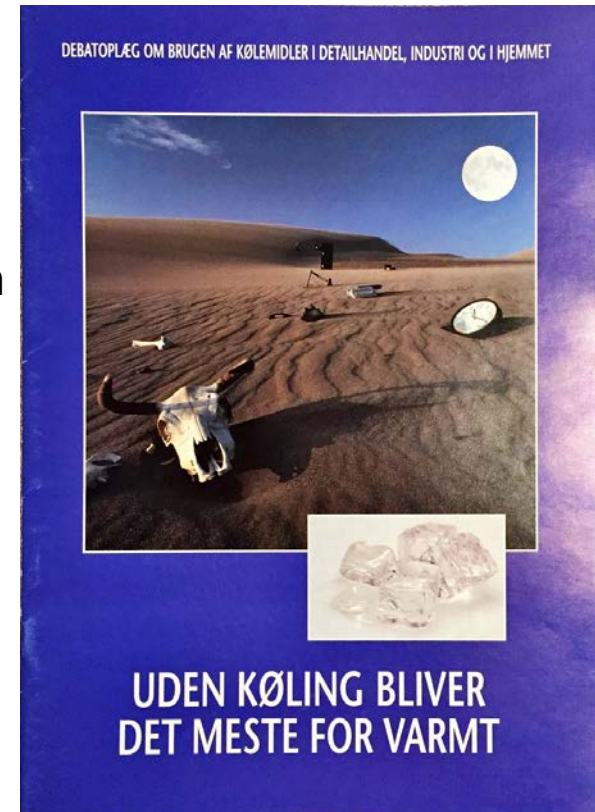
Agenda



1. The Danish situation and experience
2. The Norwegian situation and experience
3. Conclusions

Denmark

- Denmark announced a Danish HFC-phase-out at the IIR conference in Aarhus 1996
- The announcement created a strong reaction from the industry
- The announcement created a strong industry activity and lobby activity
- The industry ran a campaign under the motto Meltet butter and Warm beer
- Produced a brochure with the title Without Cooling most things become too warm
- The industry took the challenge a bit more positive
- NH₃ had big support
- From second half of the 1990's CO₂ started to move
- From 1996 HC chillers emerged the market



Political strategy



- The announcement kick started the development work/investments
- Tax came in 2001
- Charge limits were introduced 2003
- The tax has been increased several times since the start
- Today the tax is 150 DKK/TCO₂eqv (20€/TCO₂eqv)

F-gas tax in different countries

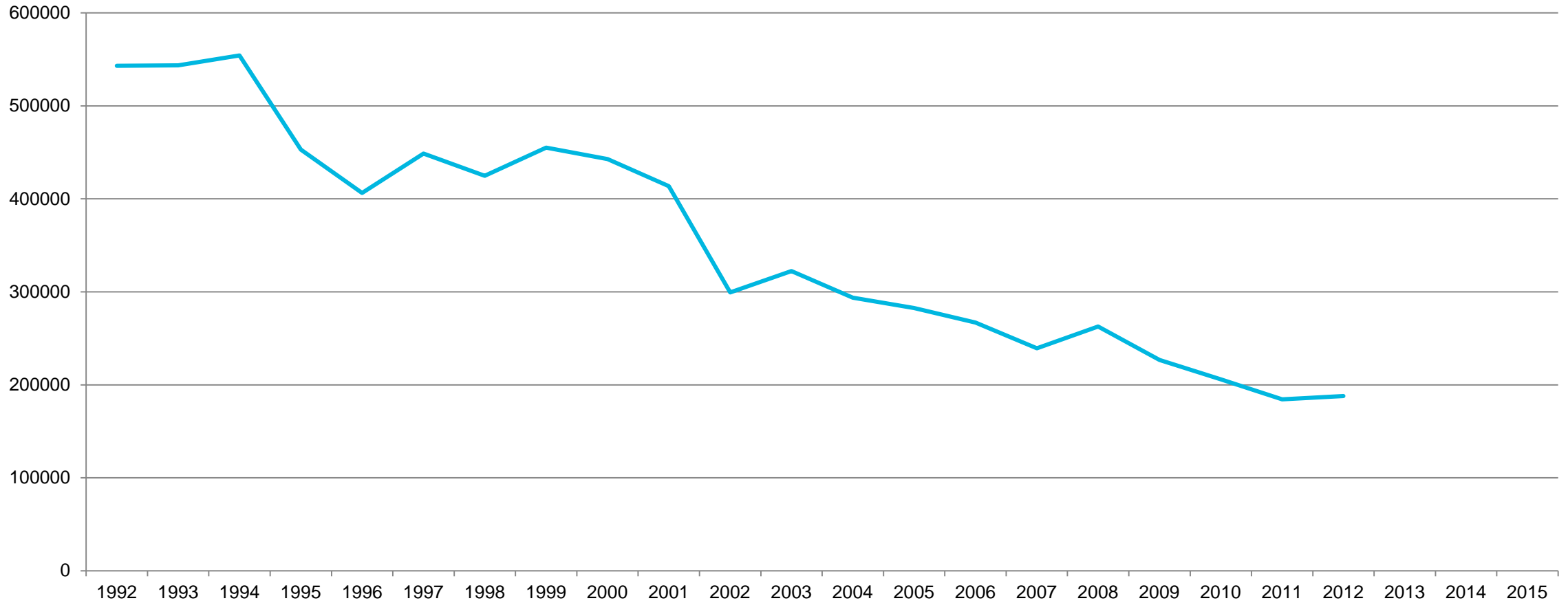
Country	Tax	Currency	EURO
Denmark	150	DKK	20.10
Norway	383	NKR	39.54
Spain	20	Euro	20.00
Poland	6.5	PZL	1.47
Slovenia	2.88	Euro	2.88

- The aim with the tax was to insure that the market would use lower GWP rather than high GWP fluids
- The market soon accepted the taxes and still R404A & R507 was widely used for refrigeration
- In Denmark you do **not** get back the tax when you send the refrigerant to incineration

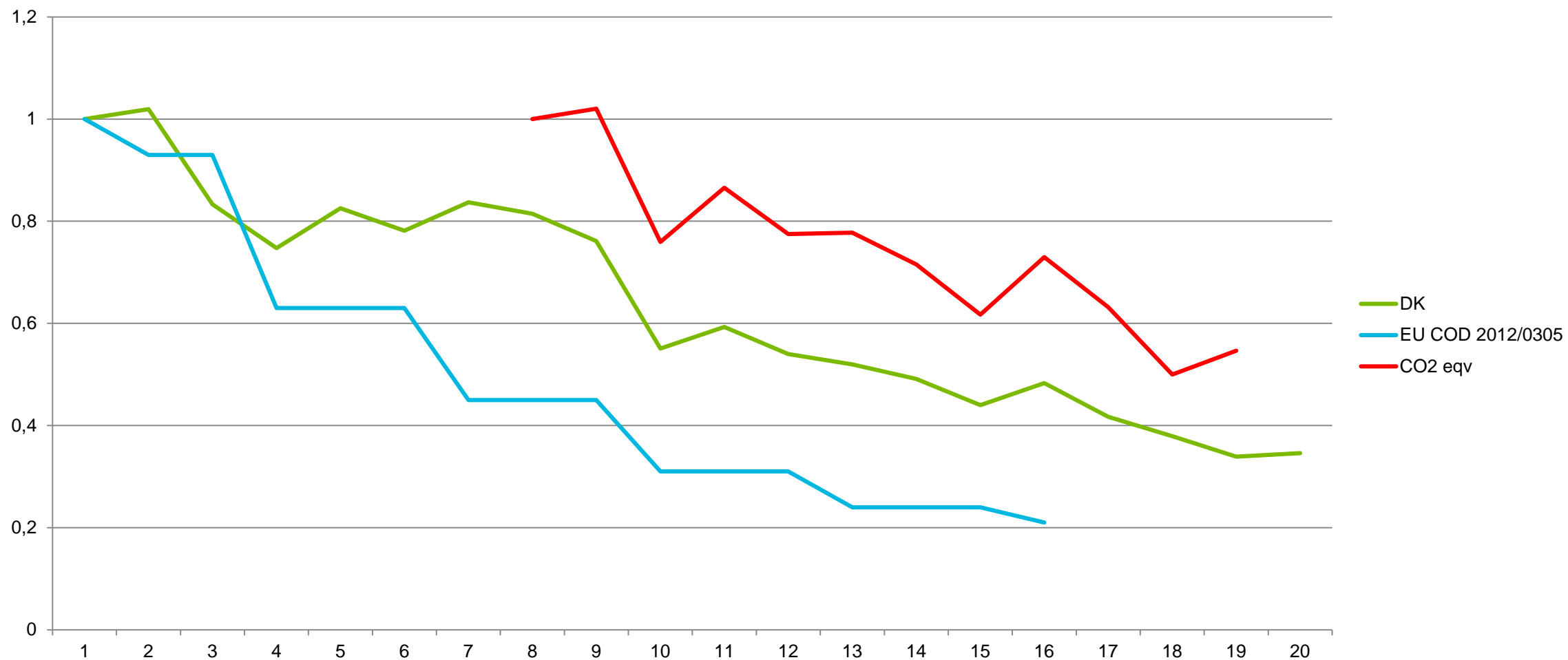
HFC sales in Denmark



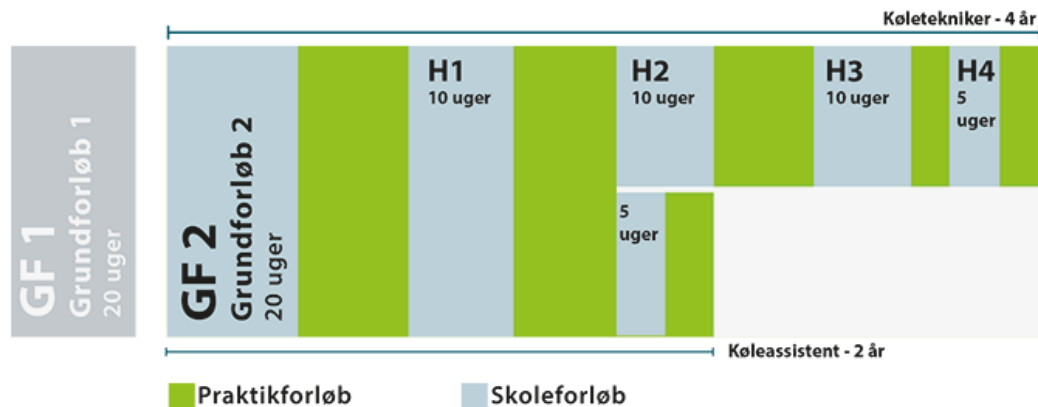
Sold HFC in kg



How does it compare?



Education of technicians



Education in two levels:

Refrigeration Assistant 2½ years

Refrigeration Technician 4½ years

Refrigeration Assistant: Can work independently on smaller systems, service them as well

Refrigeration Technician: Can work independently on any size system with any refrigerant, sell, consultant for the customers, design and build systems etc.

The education only includes general talk about safety but not “real” life training with PHE

Engineers



Engineer: 3 years Training firefighting and chemicals

Bachelor: 3 years

Master of science: 5 years PhD: +2 years

A strong industry has been able to provide student jobs for a number of students both from Denmark and from abroad

The education does not included training in safety and risk management with refrigerants

Danish regulations conclusions



The 10 kg limit of HFC had an impact

The tax made an impact on the habits

Education on all levels was supported with money from the taxation of the unwanted refrigerants

Voluntary agreements do not work. Trust is good; enforcement is twice as good

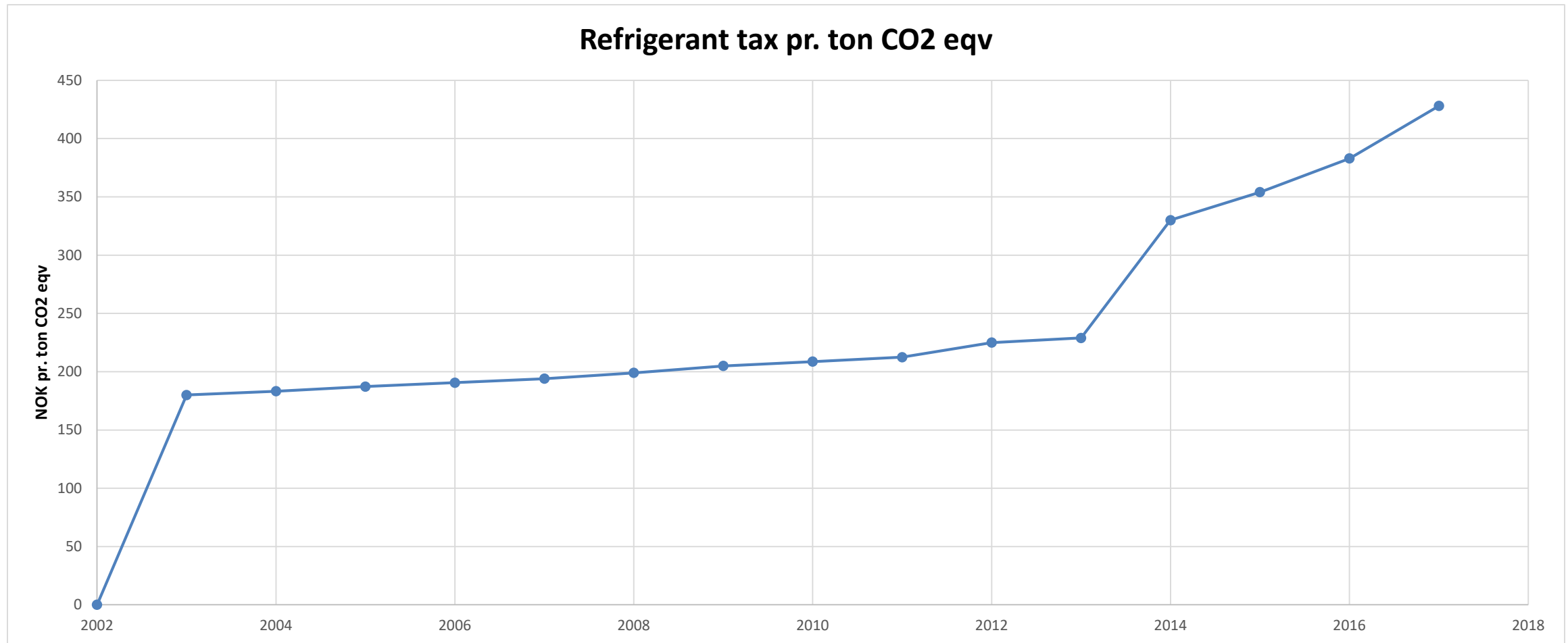
All phase down plans copy what was achieved 15 years before, just not with the same methods

Don't ask: will it work?

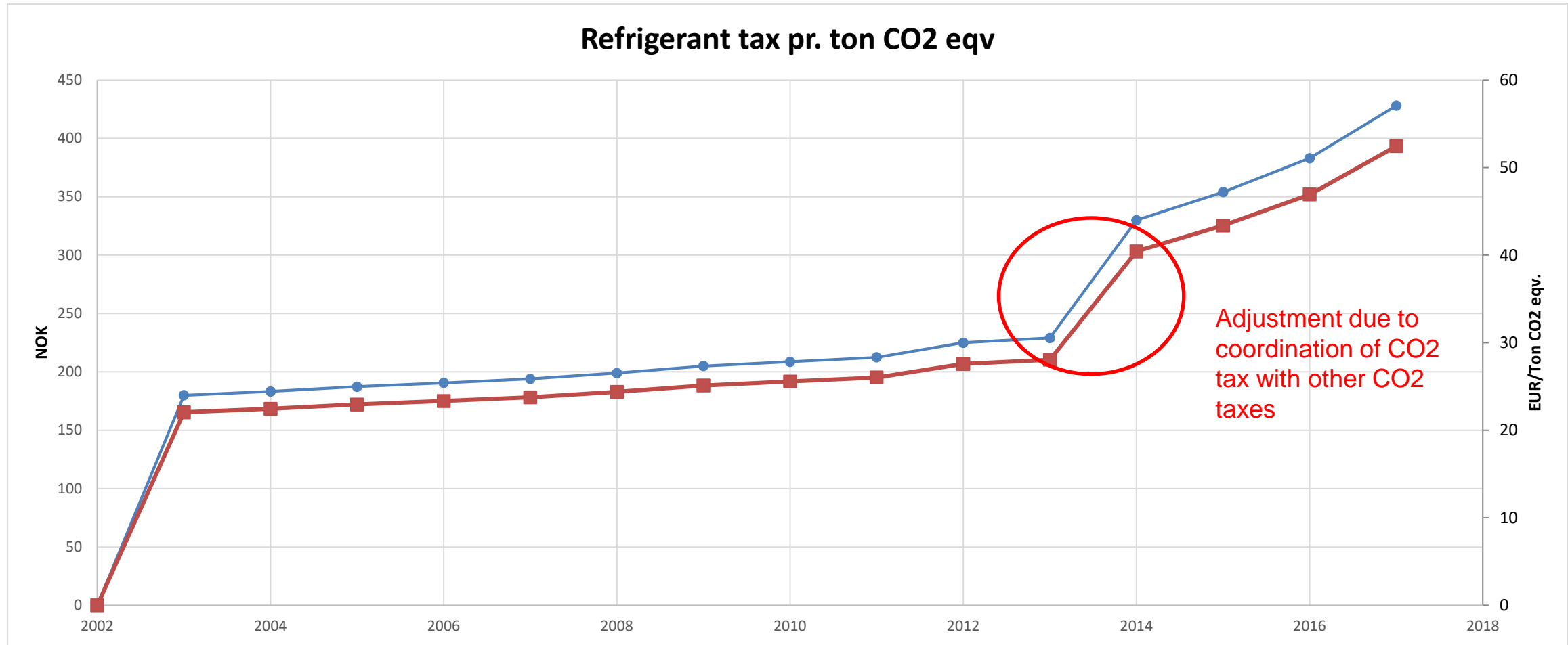
Norwegian incentives for conversion to natural refrigerants

- Taxation
- Building codes
- Statsbygg (Norwegian Directorate of Public Construction and Property) policies

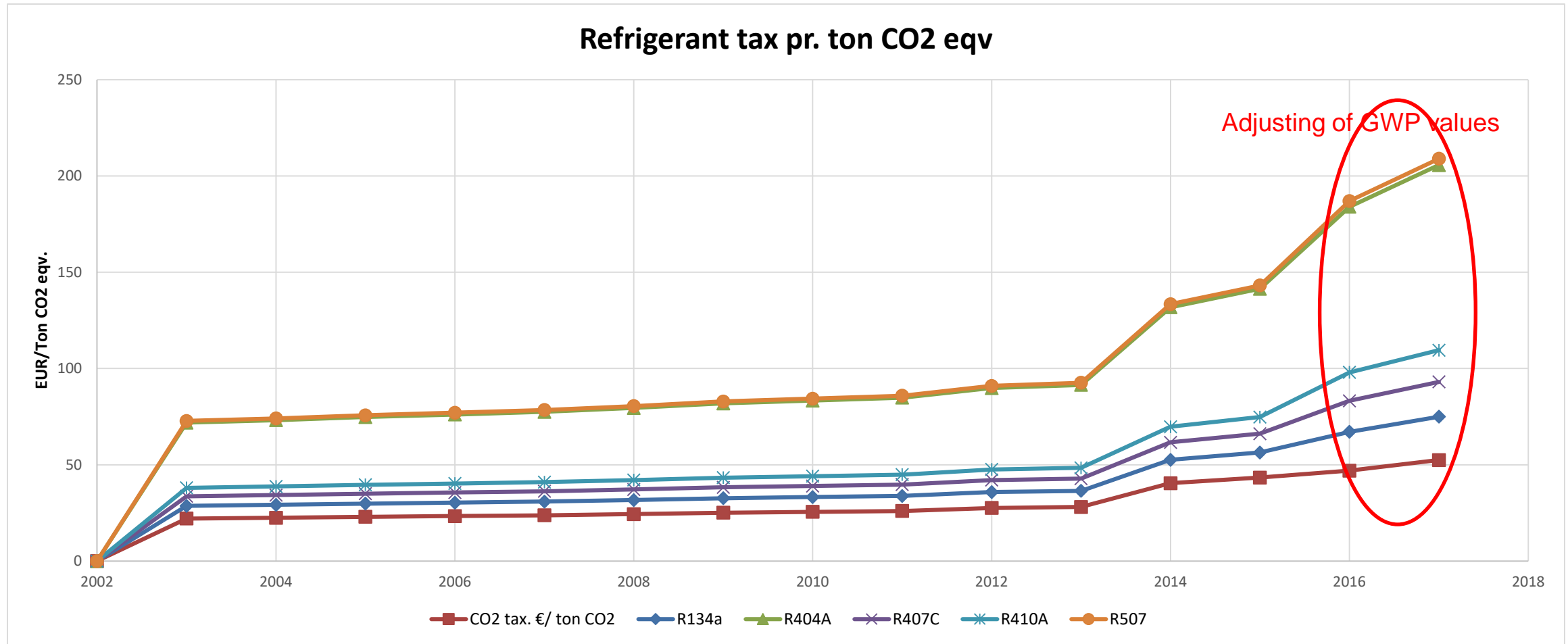
Development of taxation



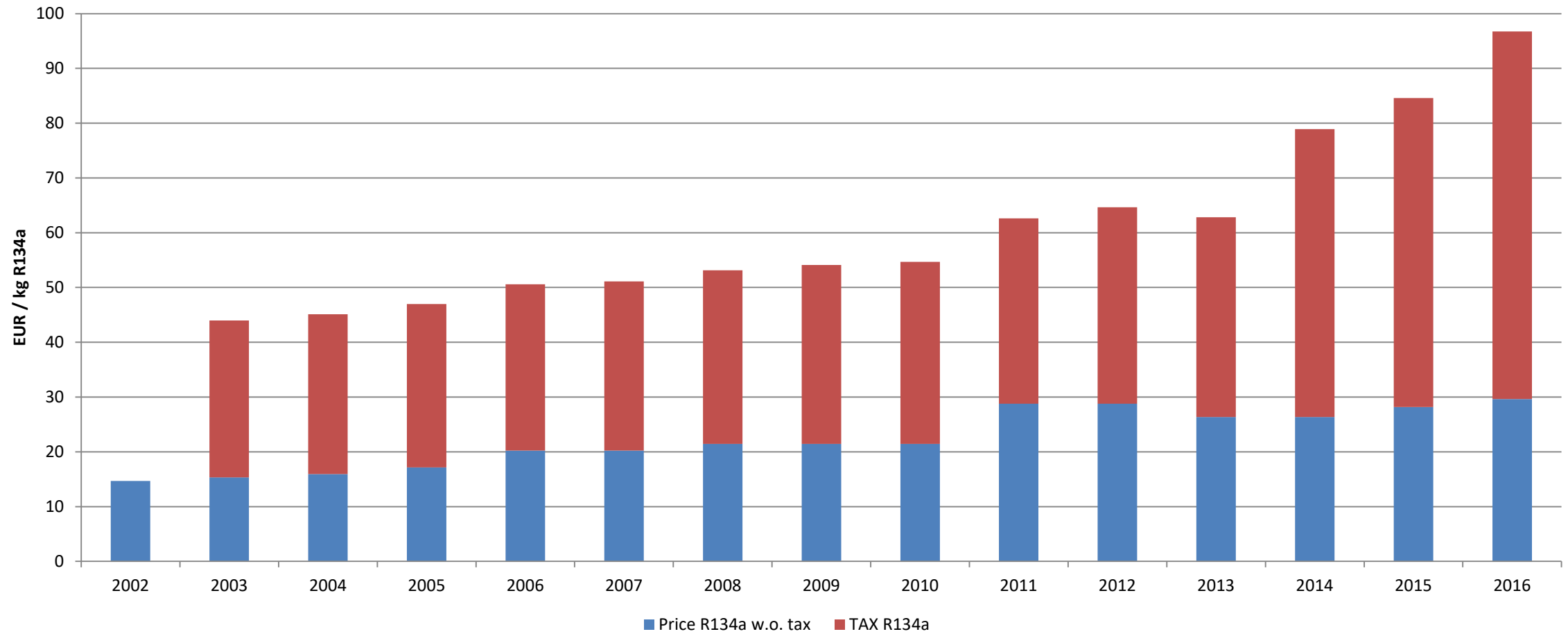
Development of taxation



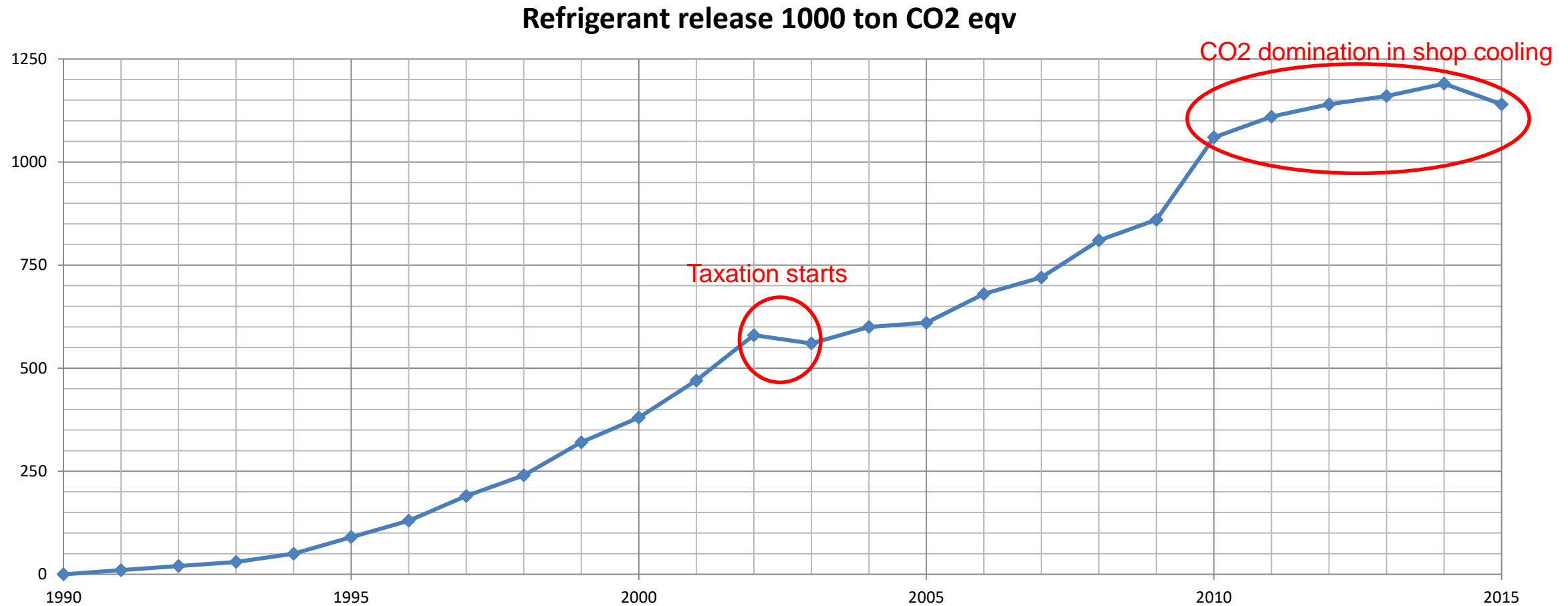
Development of taxation



Impact of taxation. Example R134a



Impact of taxation. Refrigerant released.



Building codes

- New Building Technical Regulations (TEK10) is setting a requirement of 60% renewables in building heating
- This requirement paves the way for hydronic systems
- Renewables
 - Bio fuels
 - Geothermal energy
 - Heat pumps (SPF > 2,63)
- Focus of attention from policy makers
 - Bio fuels
 - District heating systems
 - Carbon Capture and Storage (CCS)
- Despite this the number of installed heat pumps is rapidly increasing

Implementation of heat pumps

- Subsidies are primarily given to project not able to deliver a satisfactory economy.
- The government wants bio fuels. The market will go for heat pumps
- Through the last 10 years energy prices have risen sufficiently to make heat pump projects profitable in their own right.
- Therefore virtually no heat pump projects will be able to receive subsidies.
- Energy prices are rising => even less demand for subsidies.
- Energy prices are rising => high efficiency solutions using ammonia are coming into the market.
- Awareness on the subject heat pumps is very high.
- **Competence, alas, is not.**

Low competence in the refrigeration field

- The Norwegian University of Technology (NTNU) is among the top universities in the field of refrigeration.
- The most prestigious award in this field is named after professor Gustav Lorentzen.

- **Consultants**
- The overall level of competence among consultants is the ability to sketch a process in a logp,h diagram.
- No knowledge of components, and their operating characteristics.

- **Craftsmen**
- It is NOT necessary with any kind of certificate to set up shop as refrigeration / heat pump contractor except f-gas certification.
- Only one level of education as a skilled craftsman. Most were never near ammonia or hydrocarbons during training, so they will shy away from working with it.
- The best craftsmen disappear into the oil industry, and never return. Working conditions and salaries can't be matched by onshore contractors.

- All this leads to people only doing what they are used to.

Statsbygg policies.

- As responsible for the development and maintenance of public buildings, Statsbygg issued a policy document stating that all refrigeration equipment in new buildings above 1 000 m², should use natural refrigerants.
- Amazingly this did not trigger the industry to move towards natural refrigerants
- It just left Statsbygg exasperated with the lack of innovative willing in the building industry.
- For us that actually WANT to work with naturals it was gold lying in the street.
- We do see a small change as younger, more dedicated people move into the business.

The Norwegian experience

- Conclusions
- Policies should drive the industry towards naturals, but it is not effective
- The reason for this is primarily lack of competence in the entire industry.
- Resulting in end-users receiving poor advise.
- This combined with a very rich society the cost of refrigerants is just a nuisance and not really a problem.