# Lessons learned and best practices: Climate change policy measures in industry Swedish experience

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# Industrial energy systems – a Swedish context

- Swedish industrial energy use is about 155 TWh/year.
- Swedish industrial electricity use is about 55 TWh/year.
- For Swedish industry, significant energy price increases, not the least electricity price increases has taken place the last decade due to the EU market deregulation.
- The historically low electricity prices in Sweden has, in general, made the Swedish industry use more electricity than its European competitors.
- The Swedish industry is using exceptionally high levels of bioenergy.

*Swedish Energy Agency (2014)*

# Major energy end-use efficiency policies in Sweden[1]

- ***The electricity certificate system (ECS).***
- ***Energy and carbon dioxide taxes.***
- ***The European Emission Trading Scheme (EU ETS).***
- ***The Programme For improving Energy efficiency in energy-intensive industries (PFE).***
- ***The energy audit program.***
- ***The Swedish Environmental Code.***

[1] *According to the Swedish Energy Agency (2013)*

# Other policies of interest - regional and local policies affecting industry

- ***KLIMP (Climate Investment Program)***
- => Example Xylem's excess heat bore hole storage, the world's first high temperature excess heat bore hole storage was enabled through KLIMP. Klimp was a governmental investment subsidy. Company has reduced bought heat to 29 kWh/m2.
- ***Local Authority Energy Consultants***
- => Every municipality receives funding to have a local authority energy consultant to support companies and citizens with advices regarding climate mitigation- and energy conservation issues.

# Programme for Energy Efficiency in Energy Intensive Industry (PFE)

- Voluntary agreement since 2004
- Aims to increase energy efficiency in industry
- Tax reduction 0,5 € / $MWh_{el}$
- Commitment: *"Programme for Improving Energy Efficiency Act"* (2004:1196)

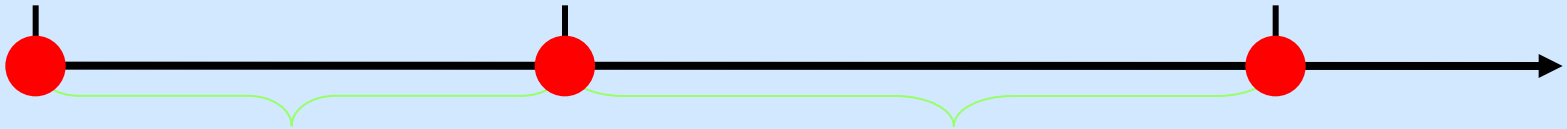
Swedish Energy Agency

# *A five year program for participating companies*

***Program start***

***2 years***
*Report to the Swedish Energy Agency*

***5 years***
*Final report to the Swedish Energy Agency*



- *Energy audit and analysis*
- *Implement and certify an Energy Mgmt System*
- *Find measures*
- *Implement routines for procurement & planning*

- *Continuously improve the Energy Mgmt System*
- *Realize measures*
- *Apply routines*
- *Effects of routines*

*We measure and follow-up*

*"Programme for Improving Energy Efficiency Act" (2004:1196)*

Swedish Energy Agency

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# The programme for improving energy efficiency in energy-intensive industries (PFE)

**Impact evaluation[1]:**

- Gross electricity savings (end-use, not primary): The about 100 participating companies saved 1.45 TWh/year of electricity.
- Additionally, 950 GWh/year was saved from other energy carriers (heat and fuel).
- Free-rider co-efficient is 0-0.5.
- Total investments: 70.8 MEUR.
- Administrative cost, companies: 13 MEUR.
- Administrative cost, government: 4.2 MEUR.
- Annual tax rebate: 15 MEUR/year.

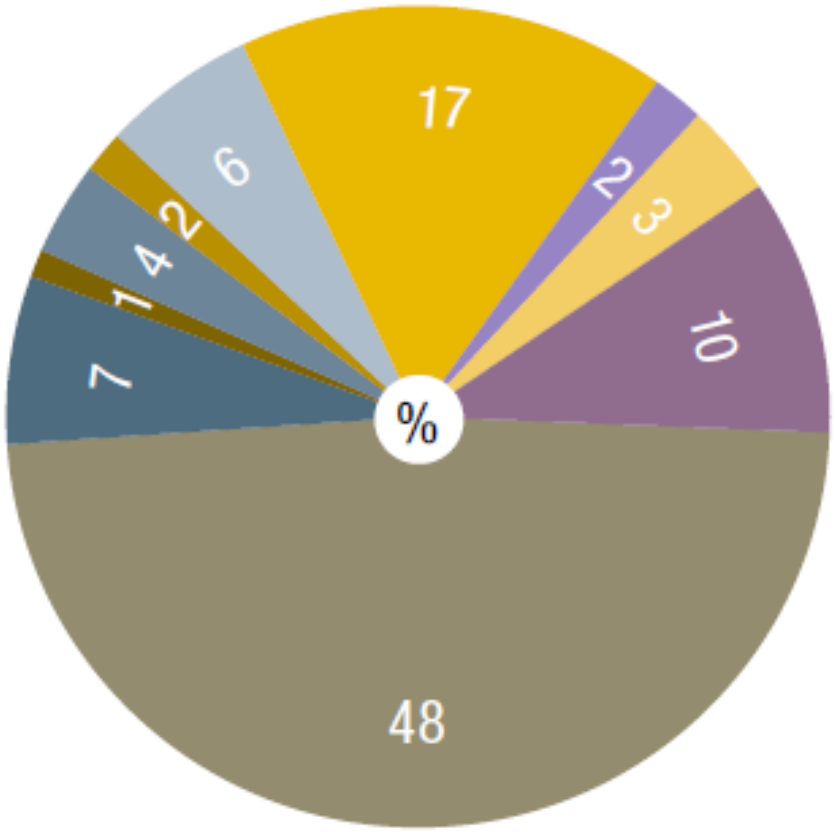
Results of the PFE exceeded ex-ante estimations by about 2.5 !



[1] *Swedish Energy Agency (2011;2014) and Stenqvist and Nilsson (2012)*

# The programme for improving energy efficiency in energy-intensive industries (PFE)[1]

*Savings of implemented measures per process type in percent (%)*




- *Production processes*
- *Compressors and comp. air systems*
- *Lighting*
- *Fans*
- *Cooling systems*
- *Electrict motors*
- *Pumping*
- *Premise and ventilation*
- *Vaccum systems*
- *Others*



[1] *Swedish Energy Agency (2011)*

# Energy audit program 2010-2014

- Companies with an energy use of more than 500 MWh/year can apply, maximun 30 000 SEK.
- Approx 1 000 companies have applied.
- Approx 700 GWh/year of energy efficiency improvements.

# The Swedish Environmental Code

- Came in 1988 and address improved energy efficiency as a key aspect, BAT (Best Available Technologies) or BP (Best Practice) should be implemented.
- The Code has newly received increased attention when environmental permits to industrial companies are issued.
- The Country Administrative Board have legal rights to use the Code both when issuing permits, but also when monitoring the companies.
- It has so far been slow, and only in recent years started to be practiced.
- No impact evaluation of the effects has been done.

(Johansson et al., 2007).

# Policy measures in theory

*Thollander P, Palm J, 2013. Improving energy efficiency in industrial energy systems - an interdisciplinary perspective on barriers, energy audits, energy management, policies & programs. Springer. ISBN 978-1-4471-4161-7.*

# A roadmap for 2020 for Swedish industry

# *Psychiatry and communication – Transactional Analysis*

- Three roles: Adult, Parent, Child.
- Successful relation is adult to adult communication.
- Boosting the industrial energy efficiency potential means moving from Parent –to- Child-relationship to Adult-to-Adult between the government and industry.

*Thollander P, Palm J, 2013. Improving energy efficiency in industrial energy systems - an interdisciplinary perspective on barriers, energy audits, energy management, policies & programs. Springer. ISBN 978-1-4471-4161-7.*

# *Thanks for your attention*

Linköping University
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For further reading, please see e.g.:
Swedish Energy Agency, www.energimyndigheten.se
Peterson and Ottosson, 2007's paper at ECEEE Summer Study
Stenqvist and Nilsson, 2012'spaper in Springer's Energy Efficiency
Stenqvist, 2014's dissertation: https://lup.lub.lu.se/search/publication/4220512

www.liu.se