NORSK (()) ENERGI

Norwegian experiences energy efficieny and energy management in industry according to ISO 50001

International training conference on energy efficiency, Krakow 30-31 March 2016

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Norsk Energi



- Industry association established in 1916
- 65 energy and environment experts with BSc, MSc and PhD degrees
- Consultancy, engineering services, analysis and training
- Independent from equipment suppliers and manufactures





Norsk Energi helps reducing your energy costs

ISO 50001 Enery Management

The EU energy efficiency directive

Article 8:

- Mandatory for large enterprises to do energy audits every 4. year.
- The definition of large enterprises are > 250 employees or > 50 mill EUR annual turnover.
- Detailed review of the energy consumption based on up-to-date, measured and traceable data.
- Energy audits shall allow detailed and validated calculations for the proposed
- measures based, whenever possible, on life-cycle cost analysis instead of Simple Payback Periods.
- Energy auditor suitably qualified and experienced, according to local guidelines.
- Energy auditor accreditation schemes.





Why Norwegian companies establish energy management?

1) Establishment of energy management systems according to ISO-50001 is a requirement in the emission permits for large companies.

2) Industry may get state support for energy management

- Simplified energy management
- Ambitious energy management

1-10 GWh/year > 10 GWh/year

< 200.000 NOK

< 1 mill NOK



- Grants from Enova < 50 % of approved costs</p>
- Ambition to save more than 10 %
- Several other requirements



Project portfolio (2013-2016) – 99 companies



ISO 50001:2011

Energy Management – Requirements with guidance for use

- ISO 50001 is a useful reference in order to document the quality of the energy efficiency
- A tool for continuously and systematic improvement of the energy performance
- A tool for identification, implementation and monitoring of to profitable energy saving measures
- Conformity with ISO 14001 and ISO 9001
- Establishment of energy management in accordance with standard is required in the new emission permits
- Manufacturing companies with annual energy consumption over 1 GWh, can apply financial support by Enova for implementing energy management





Energy Savings Potential

National studies have identified a significant energy saving potential in industry. In addition, there is a great potential for conversion to renewable energy and the utilization of waste heat.

Large investment projects:10 % energy savingSmaller investment projects identified by energy management:10 % energy savingTraining, motivation, systematic day to day work:10 % energy saving

30 % energy saving



Total potential



Energy Ma Step by Ste	anagement -	Implementation Implementation Check - Act Do Plan	Certification
Description	Insight and motivation seminars focusing on the benefits of Energy Management	Implementation process with 3 - 6 work shops, individual work tasks and guidance between work shops	Certification process with revision and close gaps
Objective	Insight in NS-EN ISO 50001 and how this can be applied as a useful tool to improve energy performance	Guide the company through the requirements in the standard for Energy Management (NS-EN ISO 50001)	Certification in accordance with the requirements in the standard for Energy Management (NS-EN ISO 50001)
Target Group	Energy Managers and other interested stakeholders	Individually or a group of 5-8 companies	Companies aiming for certification
Duration	1 day	6 - 12 months	2 - 6 months



Energy Management in Polish Industry - EMPI

- The aim of the proposed project Energy Management in Polish Industry (EMPI) is to enable Polish pilot industry companies to implement Energy Management systems in accordance with the EN-ISO 50001 standard.
- Through implementation of Energy Management systems the pilot companies will get a better overview of their energy consumption and the potential for energy savings, and be equipped with tools to improve their energy performance and ultimately save costs.
- The pilot companies will serve as examples for other Polish industry



Example large energy efficiency project: Industrial waste heat utilization at Finnfjord ferroalloy company, Norway



Finnfjord appears now as worlds most energy efficient ferroalloy company

Waste heat recovery power plant at Finnfjord recovers 340 GWh

Spesific electricity comsumption reduced by 30 %

Investment 650 mill NOK

Enova support 175 mill NOK (27 %)





Example: Elkem Carbon Fiskaa





Production: 80.000 ton/year calcined anthracite and electrode mass

Energy use: 110 GWh/year (el)

First Elkem company with Energy Management in harmony with ISO 50001

Objective: 35% reduction of specific energy consumption within 2016

Installed 42 new energy meters and webbased monitoring system

Identified 12 new energy measures with a saving potential of 40 GWh/year

Awarded The Energy and Environment Prize in 2014

https://www.youtube.com/watch?v=uGHarDZL2sA



Energy consumption in industry



Reference project – Finnfjord smelteverk, Norway

- Heat recovery from 3 FeSi-furnaces
- Steam producing cooled ducts close to the furnace
- 2 boilers for heat recovery from the flue gas
- Total heat recovery 115 MW
- Supply 40 bar and 440 °C steam.
- Steam turbine size: 40 MW
- Start up October 2012.







Establishment of energy management systems according to ISO 50001 is a requirement in the emission permits for large companies.

Companies may receive grants from the Norwegian state (Enova)



Criteria for successful energy management

- 1. Good support from top management
- 2. Well defined target that is easy to understand
- 3. Sufficient resources (time and money)
- 4. Energy management group with the right composition
- 5. Project plan with regular meetings
- 6. Show concrete results at an early stage
- 7. Establish a culture for improvement
- 8. External assistance from a good advisor



Energy management in district heating companies

Hafslund 🖏



Hafslund is Norways largest district heating company (1400 GWh/year) Norsk Energi has assisted Hafslund to establish energy management according to ISO-50001, carried out energy audit, identified energy saving measures, installed energy monitoring equipment and implemented several measures, like: Reduced el consumption in pumps Het recovery and optimisation of compressors Reduction of internal heat comsumption Insulation of various components



Wood processing industry





Hunton produce fibreboard products for building construction, roofs, floors, walls and insulation.

Norsk Energi has assisted Hunton with energy saving since 1980. Hunton has established energy managment system in accordance with ISO-50001, and was sertified in 2014.



Food processing industry



EWOS has 3 factories for production of food pellets for fish farms. EWOS is sertified according to ISO 9001. ISO 14001. Norsk Energi has assisted EWOS in the establishment of energy management system according to ISO 50001, including energy audit, establishment of energy consumption baseline, energy performance indicators, quality assurance of measuring data, establishment of automatic monitoring of data for consumption of el, gas, oil and water.



Pulp and paper industry

high focus on utilisation of own wood resources





195

4274

4,6

100

Fossil fuels

Sum





Cement Industry

Example: Norcem Brevik High focus on CO2 reduction

Energy balance (%):

Bioenergy	3
Hydropower	9
Waste	40
Oil	3
Gas	3
Coal	42
Renewable	52
Fossil	48



Ferroalloy industry

High focus on waste heat recovery



	GWh	%
Renewable energy	5196	54,8
Fossil fuels	4284	45,2
Sum	9480	100,0





Energy consumption in district heating



District heating in Europe

Total district heat delivery - TJ (Austria 2006, Slovakia 2005) 450.000 400,000 350,000 300,000 250,000 200,000 150,000 100,000 50,000 τJ 0 Switzerland AUSTIC OATS DEMORSH DEMORSH FOR FINIS FOR FINIS CERTAR OF A LEAR SPAT OF A LITHUANS AND POLARD AND SOUTH STORES sweden Slovenia



Primary energy supply to district heating in Norway and Poland





Share of renewable energy (%)

Depend on energy prices and weather conditions





Primary energy supply for district heating in 2014

The diagram shows country average. But every city choose local solutions.



City: Oslo Waste incineration, bio, heat pumps, El



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Klemetsrud Waste Management Plant

- Combustion of
 - household waste
 - industrial waste
 - landfill gas
- Built in 1983/1986/2010







- Annual capacity: 155.000 tonnes of waste
- Annual production:
 - 70 GWh_{el}
 - 300 GWh_t



City: Drammen Heat pump take heat from the sea



City: Porsgrunn Industrial waste heat

99,9 % Waste heat from fertilizer production 0,1 % Gas





City: Tønsberg 45 MW woodchip boiler El, oil and gas as peak load





City: Lillestrøm Bioenergy, Solar heat & heat pump 100 % renewable energy





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City: Bodø fuel: Demolition wood



- 23000 ton demolition wood fuel / year
- 2x10 MW gas boilers (LPG) as peak load NORSK DENERGI
- Heat production = 73 GWh / year

Low temperature district heating is important for max utilisation of renewable resourses

Development of district heating technology:

1880 First district heating systems introduced in the USA used steam

- 1930-1970 water > 100 degrees Centigrade
- 1980Water 80 degrees Centigrade
- 2015 Water 40-50 degrees Centigrade

Advantages of low temperature systems:

- **1.** Reduced heat loss in distribution networks
- 2. Possible to utilise low temperature heat sources, like waste heat from industry and buildings, surplus heat from cooling and freezing, solar heating, heat pumps that take heat from the sea, rivers, ground etc.



CONCLUSION

Norway has the highest share of renewable energy in Europe.

Why:

- 1. The electricity sector is almost 100 % based on hydropower
- 2. CO2 tax
- 3. EU emission trading scheme
- 4. Waste policy: Prohibited to put organic waste on landfills (EU waste directive 2009)
- 5. DH policy 1: Reduced electricity tax if renewables > 50 %
- 6. DH policy 2: Heat consumers may only chose DH or a more environmental friendly alternative.
- 7. State investment support to energy efficiency and renewable energy:
 - A. Investment support only to environmental friendly projects
 - B. Size of investment support is about 1 NOK/kWh RES (105 EUR/GWh)

Another reason is also the general public opinion: People <u>WANT</u> to be environmental friendly. The companies <u>WANT</u> to be better than the state regulations require to be attractive to customers.

