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# Renewable Energy Concept of Thy Region, Denmark

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President, Solar Super State Association.

Chairman, WCRE, World Council for Renewable Energy

Founding President, World Wind Energy Association,

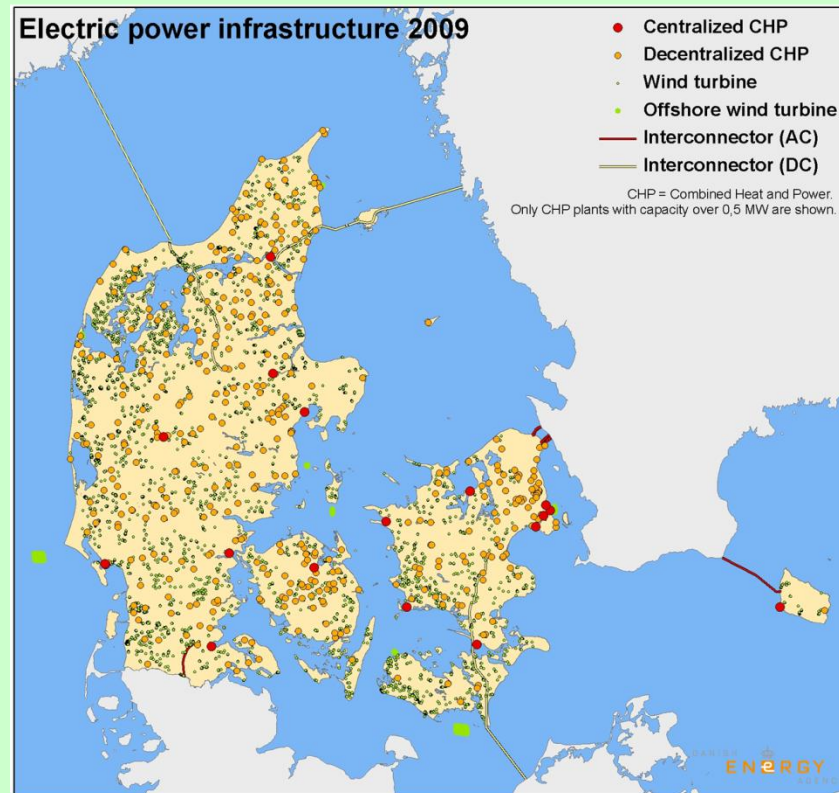
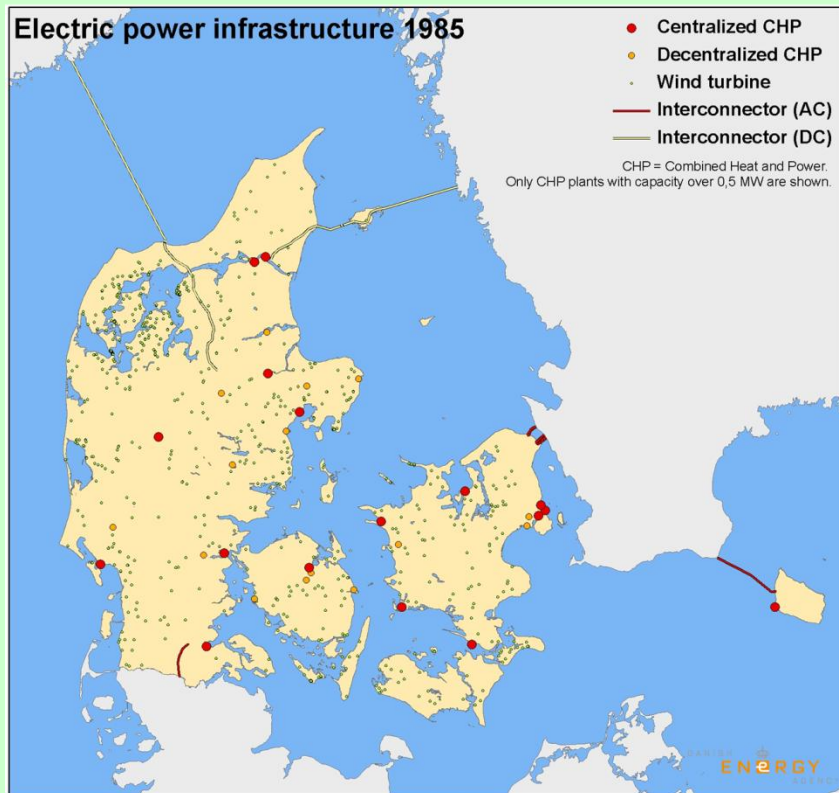


Biomass



*Pioneers of Energy Transition: Climate and Energy Pilot Regions,  
Wien, October 10, 2012*

# Danish Electric Power Infrastructure 1985 and 2009





# Main Energy Characteristics of the Thy Region



The  
Thy  
Region

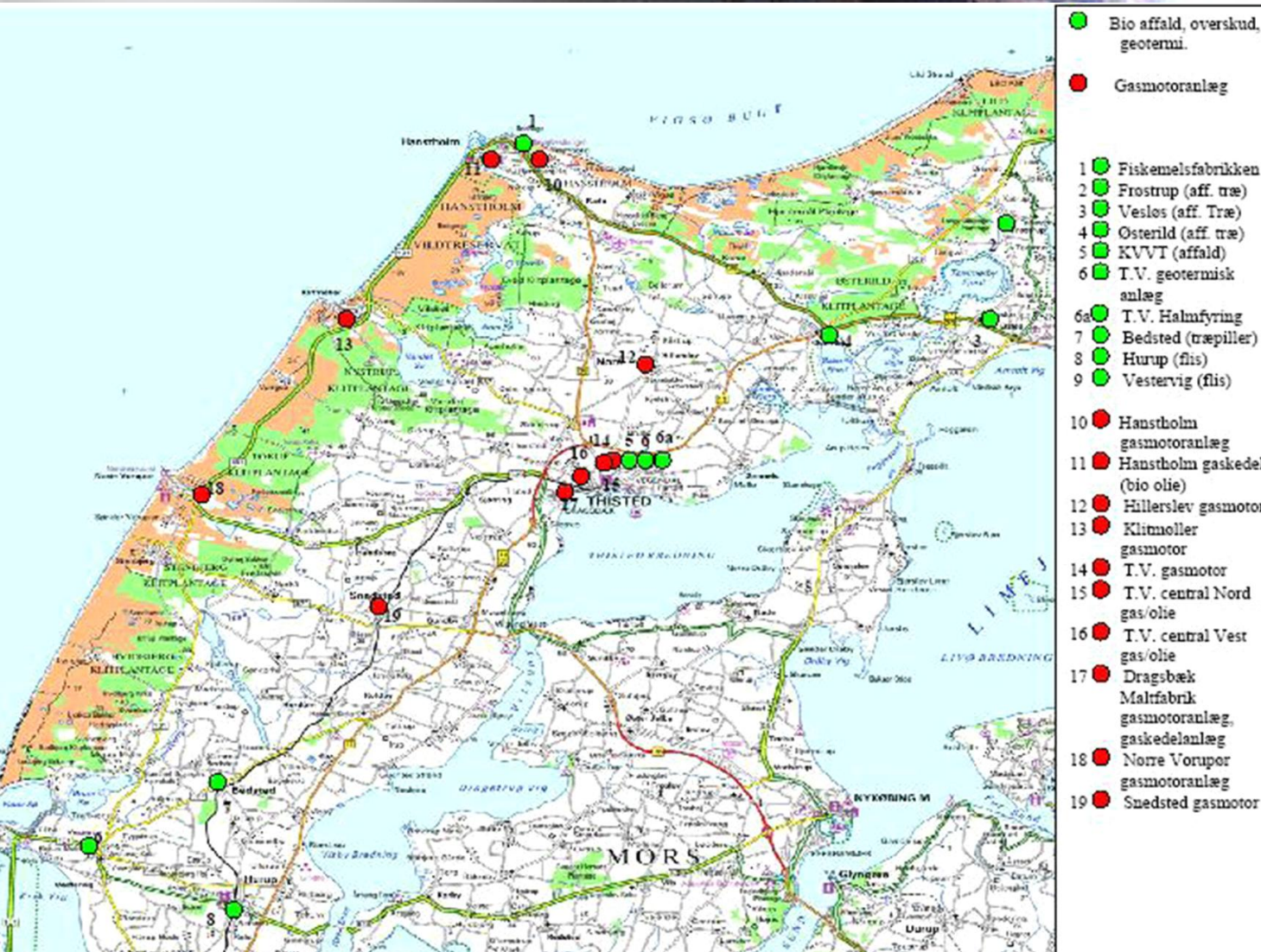


For the last 30 years, farmers, industry, utilities and cooperatives in Thy have extensively invested in and used renewable energy resources.

*“In Thy we live and breathe renewable energy. That is the essence of the Thy model where people, economics and technology come together to create clean carbon neutral energy.” Thisted Municipality*



# Heating Supply in the Thy Region: District Heating and CHP



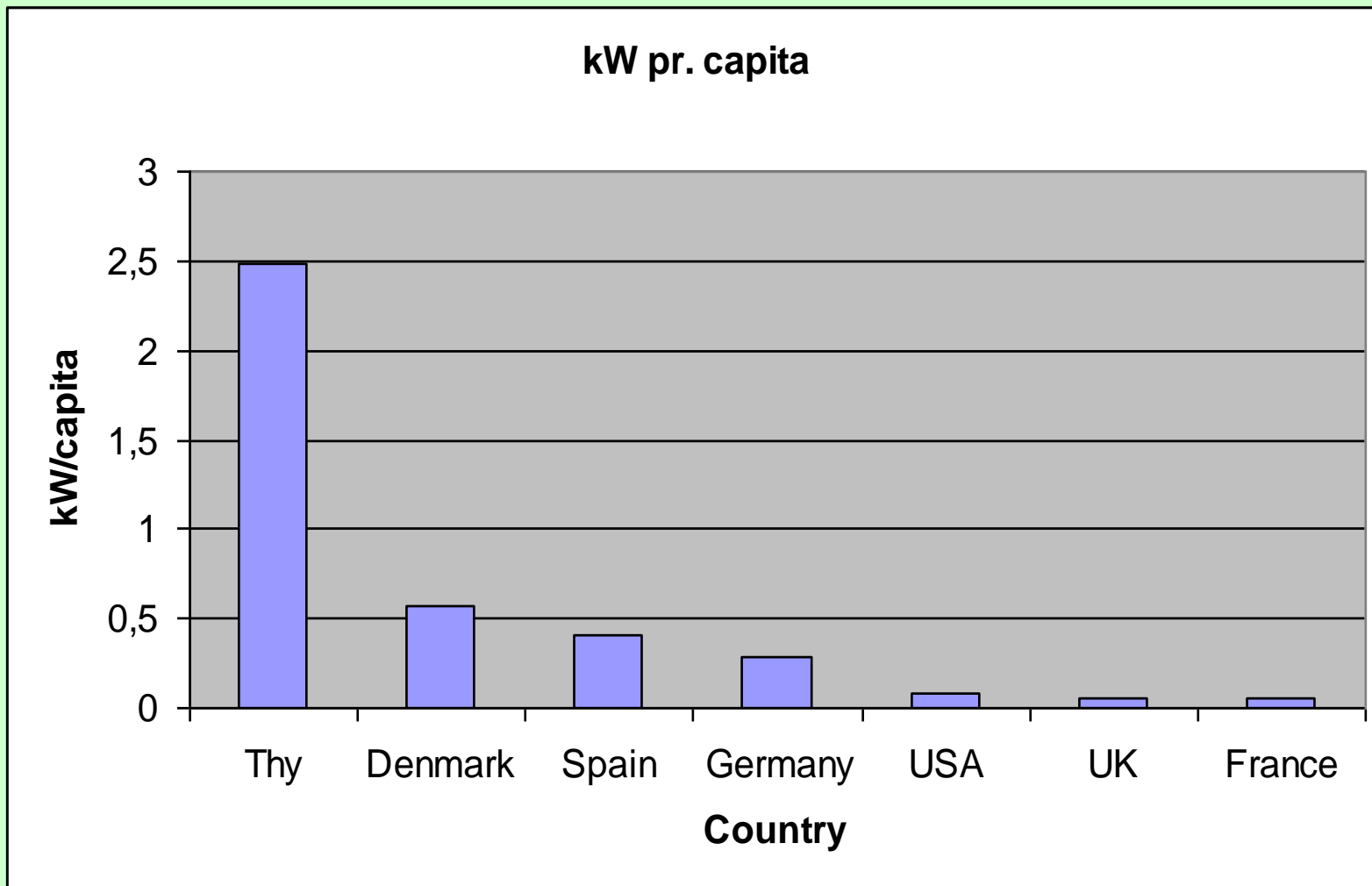
- Heat fish co.
- Waste wood
- Waste wood
- Waste wood
- CHP (waste)
- Geothermal
- Wood pellets
- Wood chips
- Wood chips
- CHP Nat Gas
- Gas oven backup
- Biofuel
- CHP Nat. Gas
- 14, 15, 16. Back up
- Malt Plant
- CHP Nat Gas
- CHP Nat Gas

# Renewables, especially Wind Power for Electricity and Heating



- Biomass
- Biomass for district heating
- Biogas in small and large scale facilities
- Geothermic heat
- Waste incineration for district heating
- **Wind Power**
- Wind energy management
- **CHP and Wind Heat & Power, WHP**
- Concentrated Solar for District Heating
- PV on Family Houses

# THY – 2,5 KW Wind Power per Capita





# Thy benefits from Renewable Energy



- Distinct economic benefits from locally owned wind power. Renewables create new prosperity and jobs for a considerable number of people. This foster local acceptance of wind power



# Thisted Municipality



- Thisted municipality in Thy covers an area of 1.093 km<sup>2</sup>, with approx. 46.000 inhabitants
- By area one of the largest municipalities in Denmark
- Rural region characterised by rolling hills, farmland and gentle fjord landscapes
- 100 km of unique coastline
- Important surfing '*Cold Hawaii*'
- First *National Park* in Denmark
- In 2007, Thy was awarded the *European Solar Prize* for its outstanding share of renewable energy.





## Thy Region:

- 226 windmills
- 114.600 KW installed wind capacity
- 35.800 KW installed CHP capacity
- 2011: **power production** from wind energy of **265 GWh**
- 2011: **power consumption** of **340 GWh**
- **Electricity Consumption**
- 80% from wind
- 20% from biogas and CHP waste
- a small amount of PV



## Three important parameters to remember about Thy:

- Thy region involves its citizens actively
- Thy involves local companies
- Thy uses mature technology that exists in the field
- Achieve the best result when these interact in a sensible and economical way

## Strong local support is obtained by:

- Local ownership of windmills
- Local ownership of biogas plants by several farmers
- All the Combined Heat and Power, CHP, plants and the district heating are not-for-profit consumer owned
- New Municipal Plan to own future windmills. 80 to 100 MW are in the planning process. The income may be up € 7 million/y earmarked for local energy initiatives. Change from investor policy to local supply.



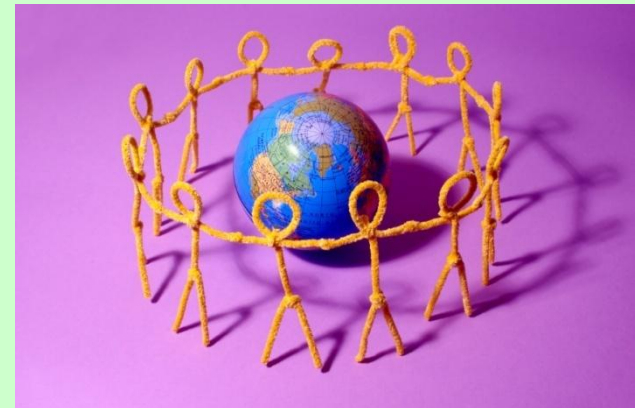
Windmills in barley field.



# Thy Region was pioneer within community power since 1981



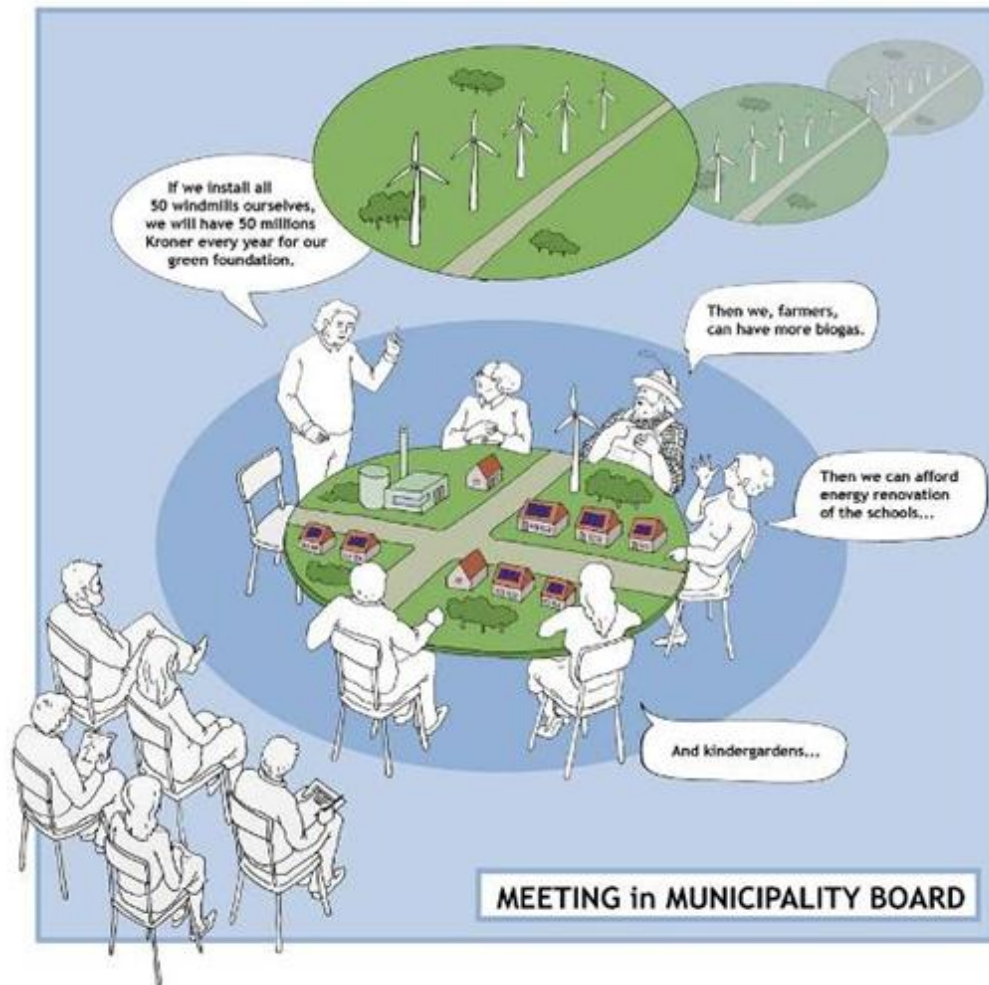
- Community power is typically owned and operated by the community
- Community power primarily takes the form of decentralised green power generation
- Wind power, solar power, biogas, biomass, and combined heat and power are examples of such infrastructure
- Financial benefits are returned to the community
- Community has a choice and may choose what infrastructure fits best with their needs and is efficient.





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# The Mayor presents the Energy Plan in the Municipality Board



## The transformation to renewable energy led to the emergence of several new local industries:

- ❑ Bach composite, main supplier of nacelles for Vestas
- ❑ Cimbria SKET, leading producer of presses for treatment of oil seeds
- ❑ Several additional sub-suppliers for the wind mill industry
- ❑ Thy Wind Energy Aps, 6 kW,
- ❑ Ideal Combi making energy-efficient windows







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The windmills are positive and  
natural elements of the  
landscape

# Production one 2 MW/windmill: 7 Mio. kWh/y



# Shaping the landscape



Folkecenter for Renewable  
Energy



# Windmills in farmland with barley fields









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# Family Windpower and Solar







# BIOMASS AND WIND WORKING TOGETHER



## Biomass –

a CO<sub>2</sub> neutral local energy resource

# Biomass District Heating



## 100% biomass district in:

- Hurup
  - wood chips
- Vestervig
  - wood chips
- Bedsted
  - wood pellets
- Øsløs
  - wood chips
- Frøstrup
  - wood chips
- Sennels
  - wood pellets



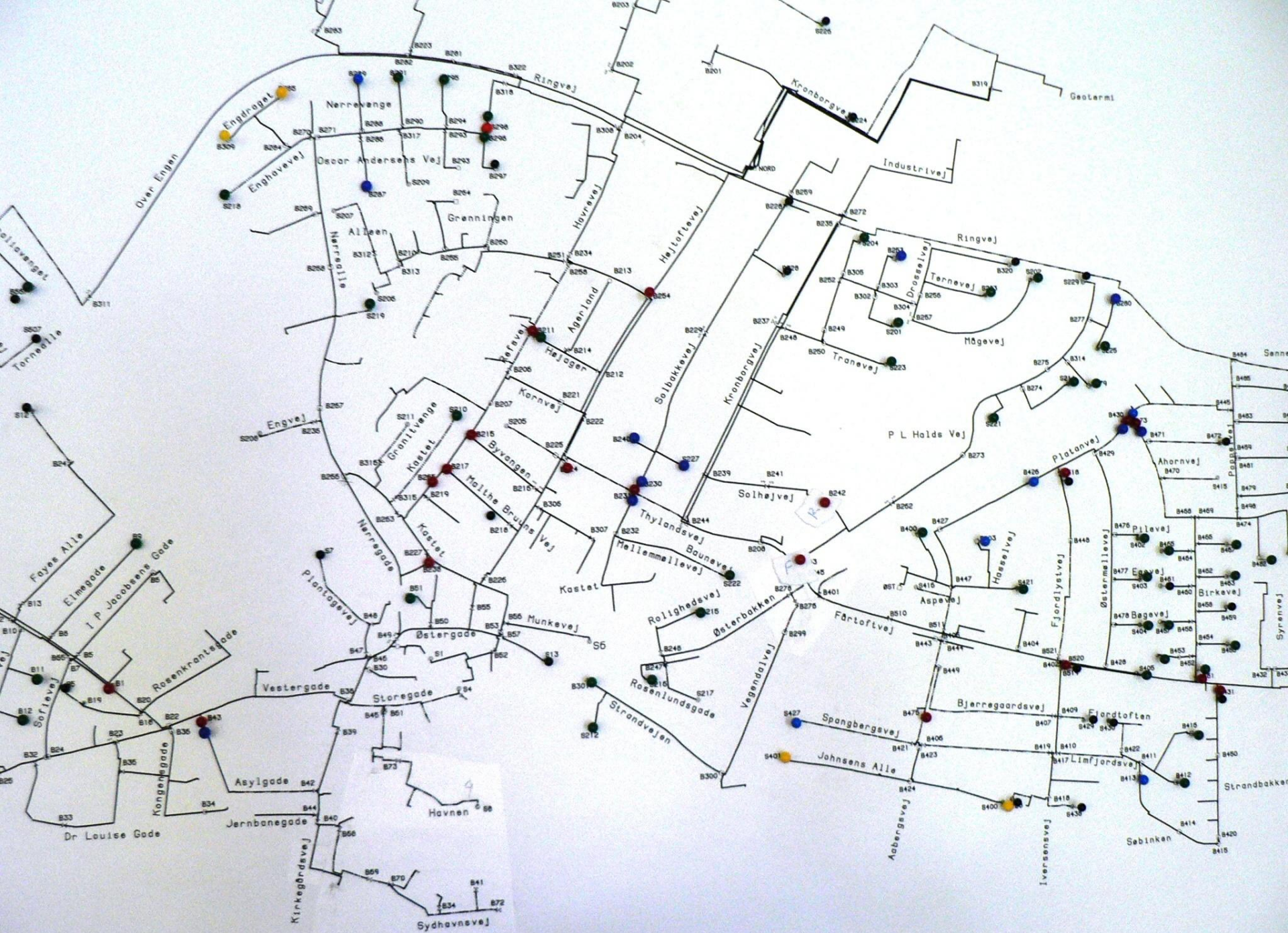
**Renewable.**

**Carbon-neutral.**

**A domestic resource.**

**New economic  
development and job  
creation.**









Thisted, 10 Mw<sub>el</sub>,  
22.000 Inhabitants





# Biomass – Heat from Straw



# District Heating and CHP in the Villages and Towns (1)





# District Heating and CHP in the Villages and Towns (2)



# Vorupör, 1,8 MW<sub>el</sub>, 800 Inhabitants



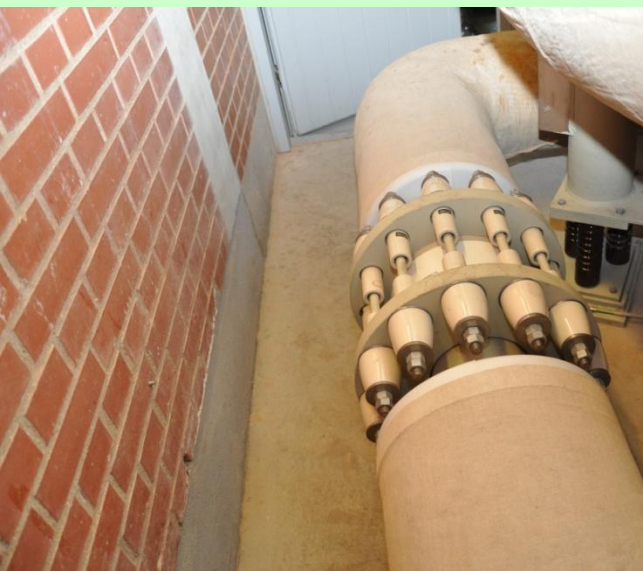
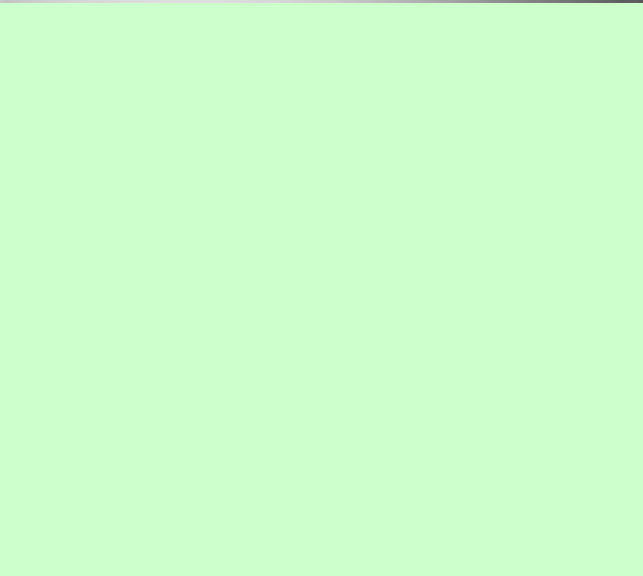


# CHP and Wind Power for Heating in Hanstholm





# 6 MW Electric Boiler in Snedsted





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Consumption of power is predictable –  
Solar- and windpower fluctuates

**INTEGRATION OF WIND POWER AND  
COMBINED HEAT AND POWER, CHP**



# The Supply Doctrine

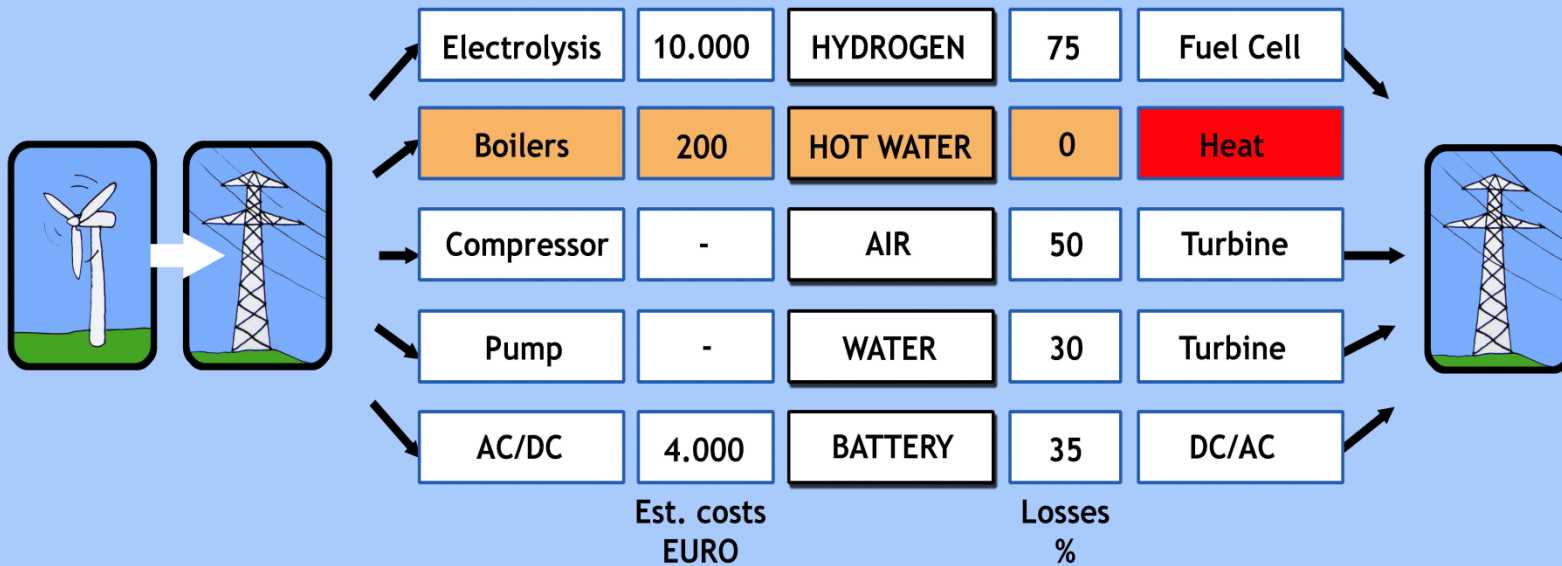


1. In Thy development is making wind power the primary source for electricity and heating
2. When there is a local surplus of wind electricity it is used in local CHP plants and replace biomass and natural gas.
3. Biomass and natural gas will in this way be back-up storage when wind- and solar energy is not sufficient to cover the need for electricity and heating.
4. Biomass and NG are limited resources and should not be used when sufficient solar and wind is available.

# Wind Heat and Power, WHP



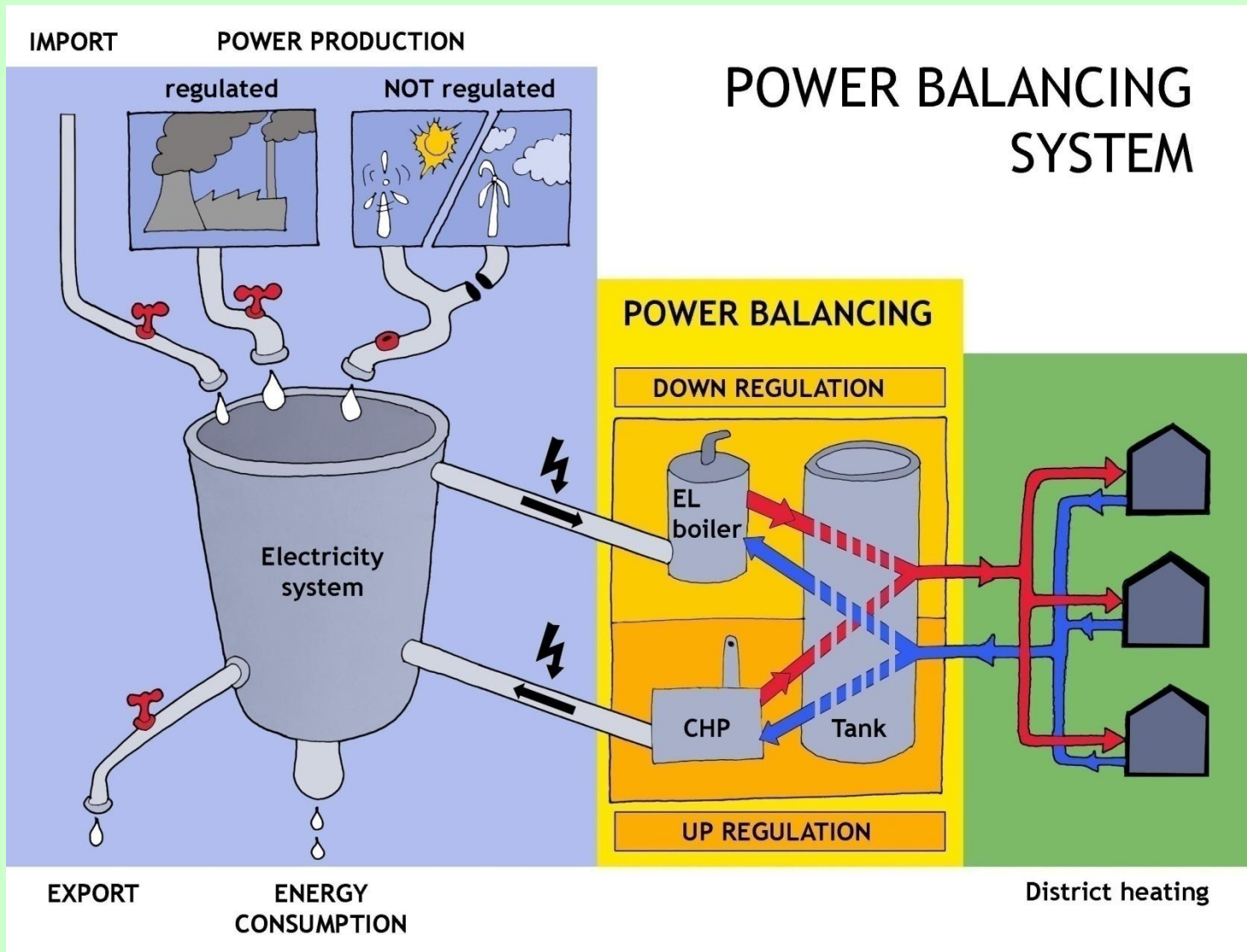
ELECTRICITY → STORAGE → ELECTRICITY



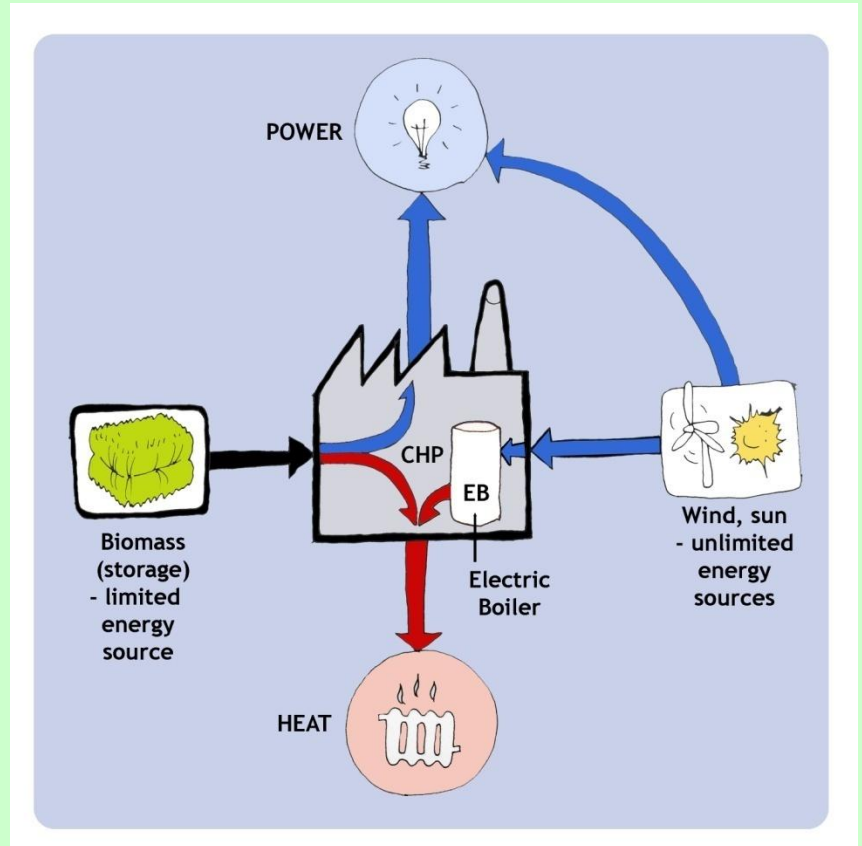
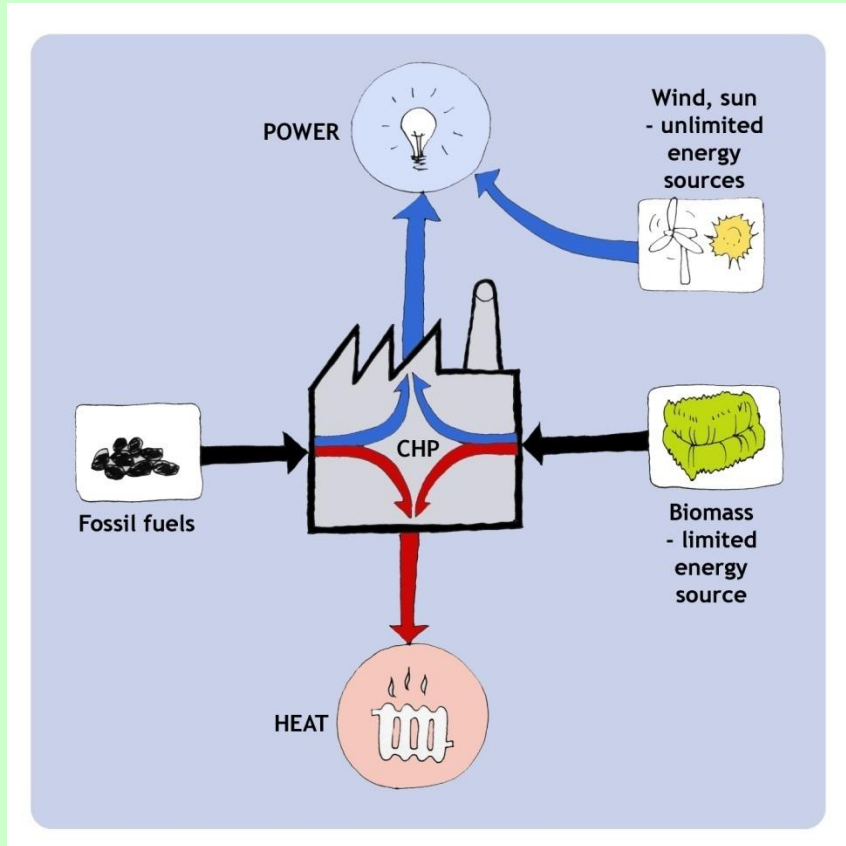




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# Replacement of Fossil Fuels by stored Biomass





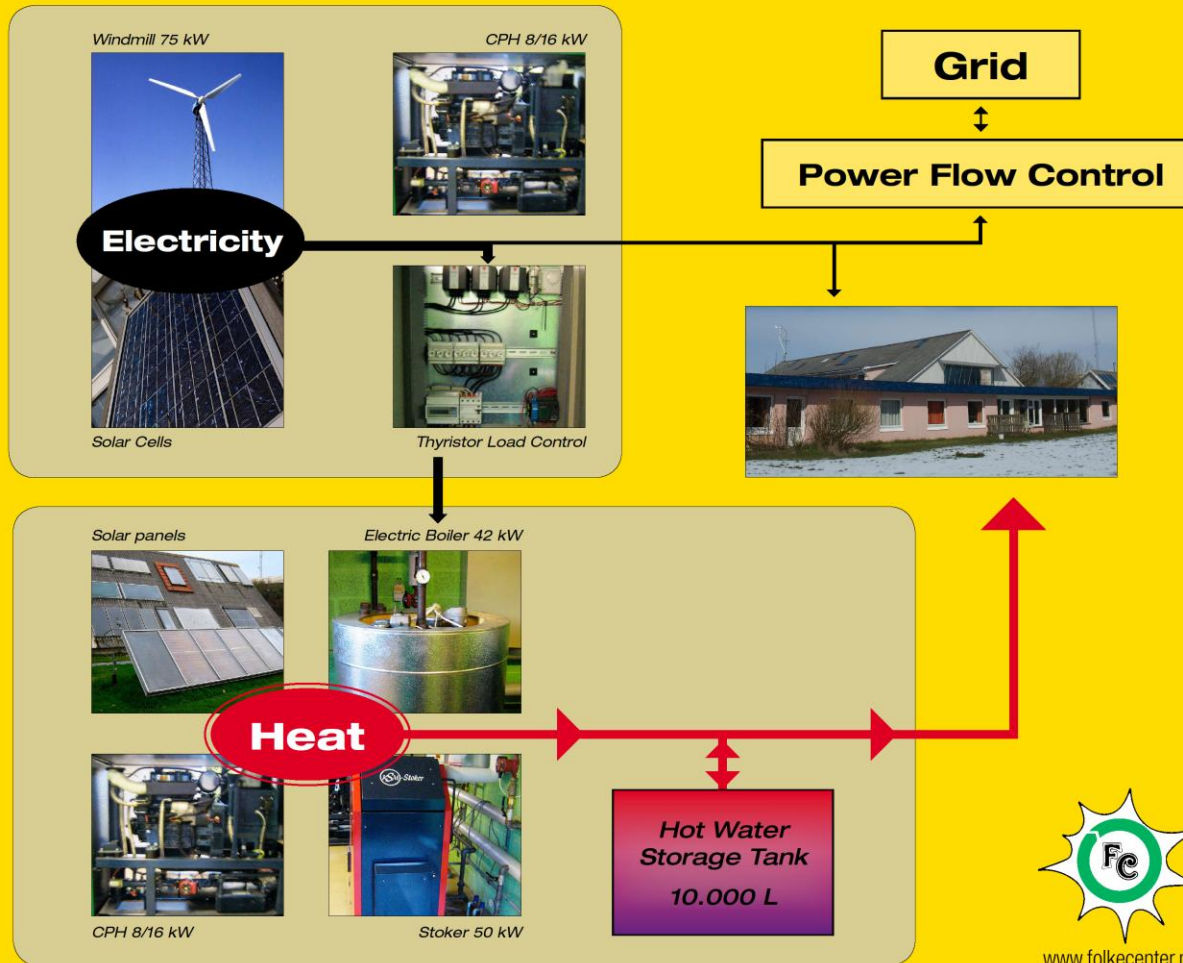


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# Next Step: Autonomous Energy Supply



## Folkecenter Autonomous Energy System



## Strategi for det autonome vedvarende energisystem

- Vind- og solenergi udgør den primære forsyning af el og varme. Træpiller og planteolie kan lagres og bruges kun som back-up.
- Overskud af møllestrøm afsættes det til varmesystemet gennem tyristorerne og elkedlen.
- Mangler der kun varme kobler stokeren ind, som bruger træpiller.
- Er det vindstille og der er behov for både el og varme, kobles kraftvarmeeenheden ind. Produktionen af el og varme dækker udgiften til rapsolie og drift.
- Overskudsvarme fra vindmølle og solfangere afsættes i varmelagertanken på 10.000 liter. Der tappes efterfølgende fra denne tank til forsyning af varme og varmt vand.

## Strategy of the autonomous renewable energy system

- Wind and solar energy are the primary sources for heat and electricity. Biomass is used for back up.
- The power flow control directs surplus electricity through the thyristors to the electric boiler.
- When the electric boiler does not supply sufficient wind generated heat, the wood pellet stoker is activated.
- In case of no wind, and a need for heat and electricity, the combined heat and power unit, CHP, running on plant oil, is activated. The combined production of heat and electricity covers the cost of vegetable oil and operation.
- Over production of wind and solar generated heat is pumped into the 10.000 litres hot water storage tank to be used at a later time.



www.folkecenter.net

# Transportation:



- There are 17.000 private vehicles in Thy region, driving 16.000 km at 10l/100 km at 10 kWh/l. Replaced by electric cars which are 3 times as efficient, will require 90 GWh electricity from 15 additional 2 MW turbines. Should be compared with the existing 252 windmills in the region.



1. Wind, local biomass and waste are the primary resources
2. Wind now delivers 80 % of the electricity; biomass, waste 20 %
3. New municipal plan increases wind from 265 GWh/year to 445 GWh/year
4. Wind energy is a cheap resource; down to € 0,04/kWh
5. Tariffs: Some power producers get market prices some feed-in
6. District heating is the norm in the villages and towns
7. Combined heat and power, CHP, in most of the towns (total 30 MWe)
8. Hot water for district heating, liquid and solid biomass are used for storage
9. Power up- and down-regulating balances the system (new)

## SUMMARY continued

1. Community ownership of all district heating and CHP
2. Municipal energy foundation to own future wind power
3. Capitalization of renewable energy resources is basically avoided.
4. Local ownership leads to local acceptance of wind power.
5. Local renewables pave the way for new industries and jobs
6. Institutional framework: The Municipality; Thy-Mors Energi; Nordic Folkecenter for Renewable Energy (since 1983); Nisum Bredning Test Station for Wave Energy (since 2000); The National Wind Power Test Station (2010).
7. Special Event: Thisted in 2007 received the European Solar Prize for its outstanding achievements.



“The surprise is why isn't everyone else doing what Thisted is doing? They are a lighthouse but this should be going on now all over the world”

***Jeremy Rifkin**, founder and president,  
Foundation on Economic Trends*



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# Thy attracts International Media and Politicians



**Energy Autonomy film:  
*The 4th Revolution***



**Minister Smitherman,  
Canada**



**Suzuki Diaries,  
CBC, Canada**



**CCTV10 FROM CHINA**



- Thy in December 2007 got the esteemed EUROPEAN SOLAR PRIZE due to its outstanding share of renewable energy in the municipality.
- The mayor of Thisted gave a speech and said that Thisted would like to have even more renewable energy.

From the EUROSOLAR *award* ceremony at KfW in Berlin.



- Mayor Erik Hove Olesen states:

*"I am very proud and grateful that we today receive this award. Not us as authorities have the honour. Our 46.000 citizens, the Folkecenter and our 1700 local companies made the change. The many windmill owners, the farmers that have biogas plants and the community utilities, they have together made Thy self-sufficient with energy."*

Dr. Hermann Scheer gives the Award to the Mayor





# Wind is a natural ressource!





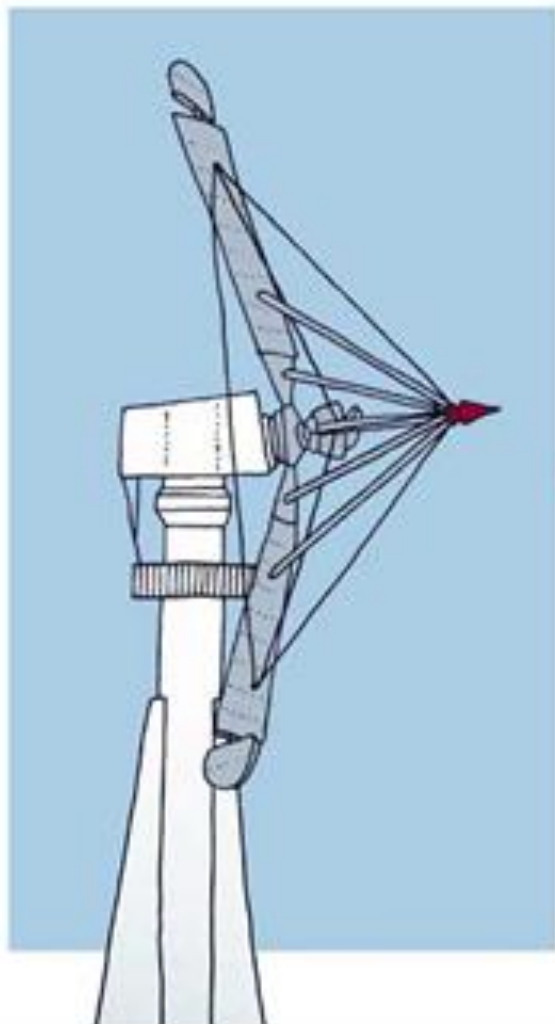
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New Book in 2013:

# The Emergence of Modern Wind Power



A hybrid of J. Juul's turbine with U. Hütter's blades is the **DANISH CONCEPT**



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**Thank you very much for your  
attention!**

**For further information please visit**

[www.folkecenter.net](http://www.folkecenter.net)

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