Hybrid Heat Pumps - a key appliance for an affordable, reliable, (near) future low carbon Dutch residential heat supply

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How Hybrid Heat Pumps, due to their dual energy use can enhance the speed of the Dutch energy transition, by accessing unprecedented numbers of domestic housing with a heat pump device. And relieve electricity grid load, by smart use of 2 energy carriers.
Gasunie - A gas infrastructure company

- High pressure gas grid, LNG terminal, storage facility
- Annual gas transport NL 100 BCM = 1000 TWh energy
- Guarantee transport capacity (=comfort) up to -17°C
- Balance the gas grid, both national and regional

The Gasunie strategic pillars
The Netherlands - Fuel Mix - Volume

- **Share renewables very low**
- **NL a gas intensive country**

- **Total Primary Energy demand**
  - Oil: 50%
  - Gas: 31%
  - Coal: 11%

- **Volume**
  - Waste: 4%
  - Biomass: 4%
  - Heat: 4%
  - Nuclear: 4%
  - Hydro: 4%
  - Renewables*: 4%

- **Total Power mix**
  - Gas: 48%
  - Nuclear: 5%
  - Other: 12%
  - Wind & Solar: 5%
  - Oil: 2%

- **Power generation**
  - 42%

- **Industry**
  - 23%

- **Residential and commercial sector**
  - 35%

- **Data 2014**

- **Source**: IHS CERA 2015

- **Natural gas**: 0,18 kg CO2 p kWh
- **Electricity**: 0,50 kg CO2 p KWh

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1 bcm = ~ 11 TWh
* Wind, solar
** incl. heat & power

Data 2014
The Netherlands - Energy Networks - Capacity

- **Volume**
  - Large difference in energy amount
  - Gas = 400 TWh
  - Electricity = 100 TWh

- **Capacity**
  - Seasonal vs flat pattern
  - Gas peak = 117 GW
  - Electricity peak = 16 GW

The hourly demand of gas and electricity in the Netherlands

Data: Gasunie and TenneT
The challenge faced in Dutch residential heat supply (existing houses)

- >95% of Dutch houses heated with natural gas and a gas-condensing boiler
- Residential heat demand ≈ 110 TWh (11 BCM)
- Current capacity available is 90 GW, to guarantee level of comfort up to -17°C

The hourly demand of gas and electricity in the residential sector in the Netherlands

-13,2°C daily effective temp.

- Blue line = heat = gas
- Red line = electricity
The Netherlands – Full electrification of Dutch residential heat supply is not (by far) yet an option
(existing housing stock only, conclusions do not relate to new build houses)

- Demand is far too high
- Electricity network not equipped
- Not enough renewable electricity available at the right moment

It is necessary to invest in: networks, insulation/appliances and renewable electricity

It is necessary to keep a balance between: demand, supply and network capacity

If not well balanced, the result is not enough heat and/or limited to no CO2 reduction, for a very high price!

Conclusions based on assessments by ECN, Ecofys, Berenschot, BDH, DNVGL
Full electrification heat supply - not (by far) an option

Full electrification of Dutch residential energy demand should not be our ambition, but an affordable, reliable, (near) future low carbon Dutch residential heat supply is

Partly electrification of Dutch residential heat supply should start A.S.A.P, the technique exists: Hybrid Heat Pumps are the solution
What is a Hybrid Heat Pump?
An electric heat pump, combined with a gas-condensing boiler

- Outdoor temperature and heat demand determine electricity demand

- Price range: (1500) 3000-7000 euros excl subsidies: up to 2300 euro

- Space heating ≈ 80% time - heat pump
  ≈ 20% time - gas boiler

- Hot water = gas boiler

- Space heating ≈ 80% time - heat pump
  ≈ 20% time - gas boiler
Both SMART energy use AND SMART grid use made available by Hybrid Heat Pumps

Hybrid Heat Pumps combine the strengths of condensing boilers and heat pumps to overcome the weaknesses of both gas and (the) electricity (network)

Use of a Hybrid Heat Pump can result in:
- Lowest CO2 emissions (as electricity emission fluctuates)
- Optimal use of network capacity (avoid congestion)
- Lowest energy prices (as electricity prices may fluctuate)
Hybrid Heat Pumps - the technique to replace stand alone condensing boilers

3 million Dutch houses Hybrid Heat Pump ready
Positive total cost of ownership
No external restrictions

- Available network capacity not a restriction
- Only basic insulation required
- No low temperature floor heating required

No lock-in-effect:
- Incentives for further CO2 emission reduction
- Incentives for further lowering energy bill
  - insulation, storage, add-on techniques, solar PV, use of green electricity and/or green gas
- All future techniques remain an option: full electric, micro CHP, fuel cell, etc
Thank you for your attention

Enjoy your conference!

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