



Best practice guidance on the role of natural gas in increasing uptake of renewable energy

European Heat Strategies

Energy Efficiency in the Age of Renewable Energy

The EcoGenie Living Lab

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Innovation & Future Energy

70% of all homes in EU are older than 40 years!



Transforming Europe's heat sector

- Transformation of the heat sector underpins 3 aspects of European energy policy: **decarbonisation, energy efficiency, and energy security**
- The transformation requires changes to all aspects of heat supply
 - Heat consumption will need to reduce
 - Heat and fuel will need to be used more effectively
 - Heat supply will need to be decarbonised
 - The business model of heat providers will need to change
- Progress to date has been mainly in final energy efficiency
 - Progress on renewable heat and more efficient use of existing heat is slow
- The heat and power sectors are intrinsically linked
 - Policy makers must consider the interactions if long-term goals are to be met

A EUROPEAN STRATEGY FOR HEATING AND COOLING

- The July roadmap promised a strategy for heating and cooling
 - Draft strategy and 5 issue papers are circulating, final version due Q1 2016
- Aims of the strategy
 1. Reducing final consumption through **deep** refurbishment
 2. Boosting the share of **renewable** heat
- Learn from best practice from advanced member states

2050 objectives of the (draft) European heating and cooling strategy*

Share of renewable energy [45-55]%

Gas use to reduce to [XX]

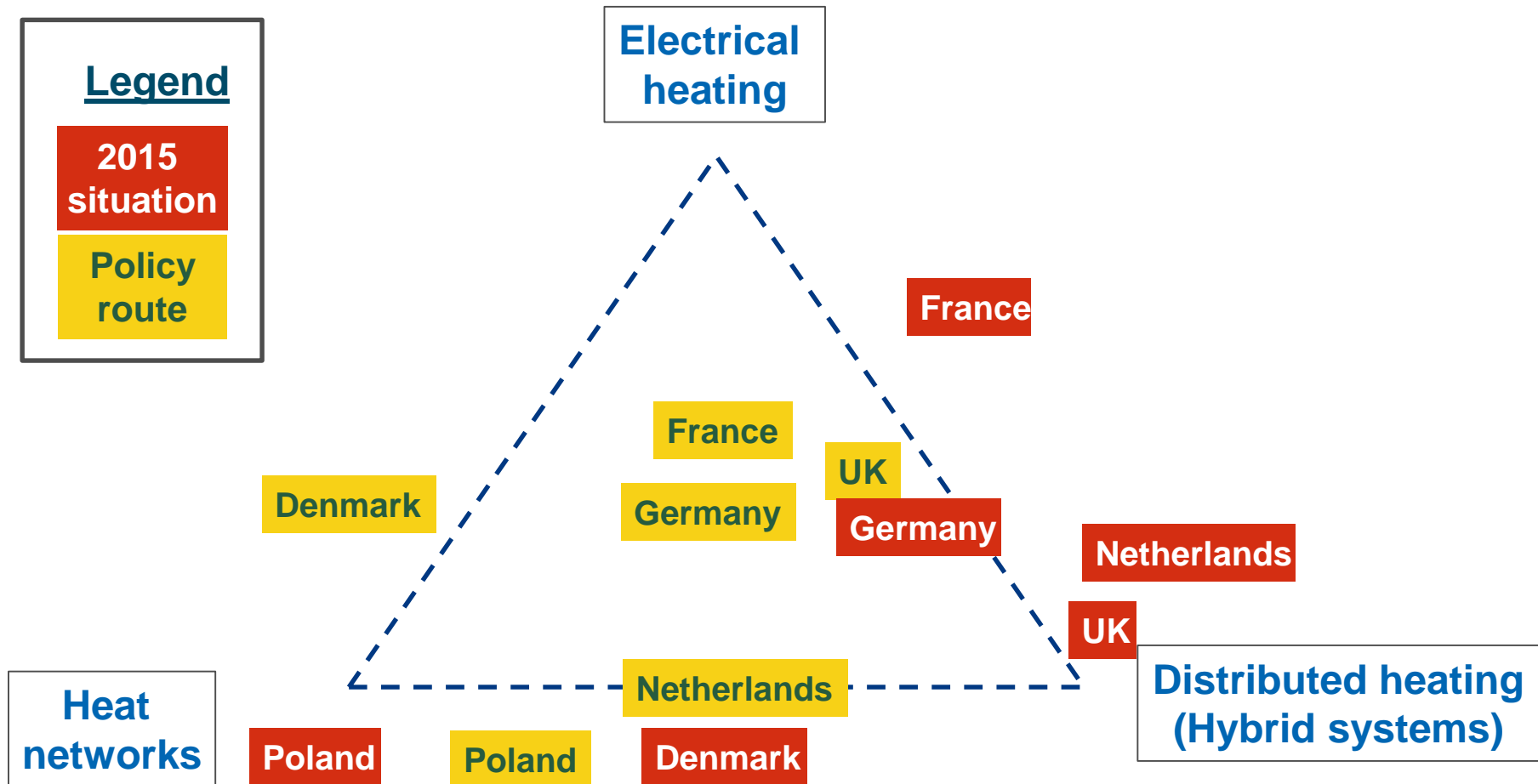
Energy consumption for heating/cooling to reduce by [40-70]%

* Figures taken from draft strategy including [] and XX

Very little on implementation
A description of the final destination, rather than a road map

COUNTRIES ARE ALREADY CHOOSING THEIR HEAT PATHS

CHOICES VARY DEPENDING ON CURRENT MARKET STRUCTURE AND POLICY GOALS



The “Beyond the Flame” scenarios

BAU (Rivalry)

- Gradual evolution of the mix of heating technologies
- Replacement of standard boilers with condensing at end of life
- Slow deployment of standalone heat pumps and hybrid systems

Mandate

- Europe wide mandate to replace standalone condensing boilers with hybrid systems from 2021
- All other assumptions as BAU

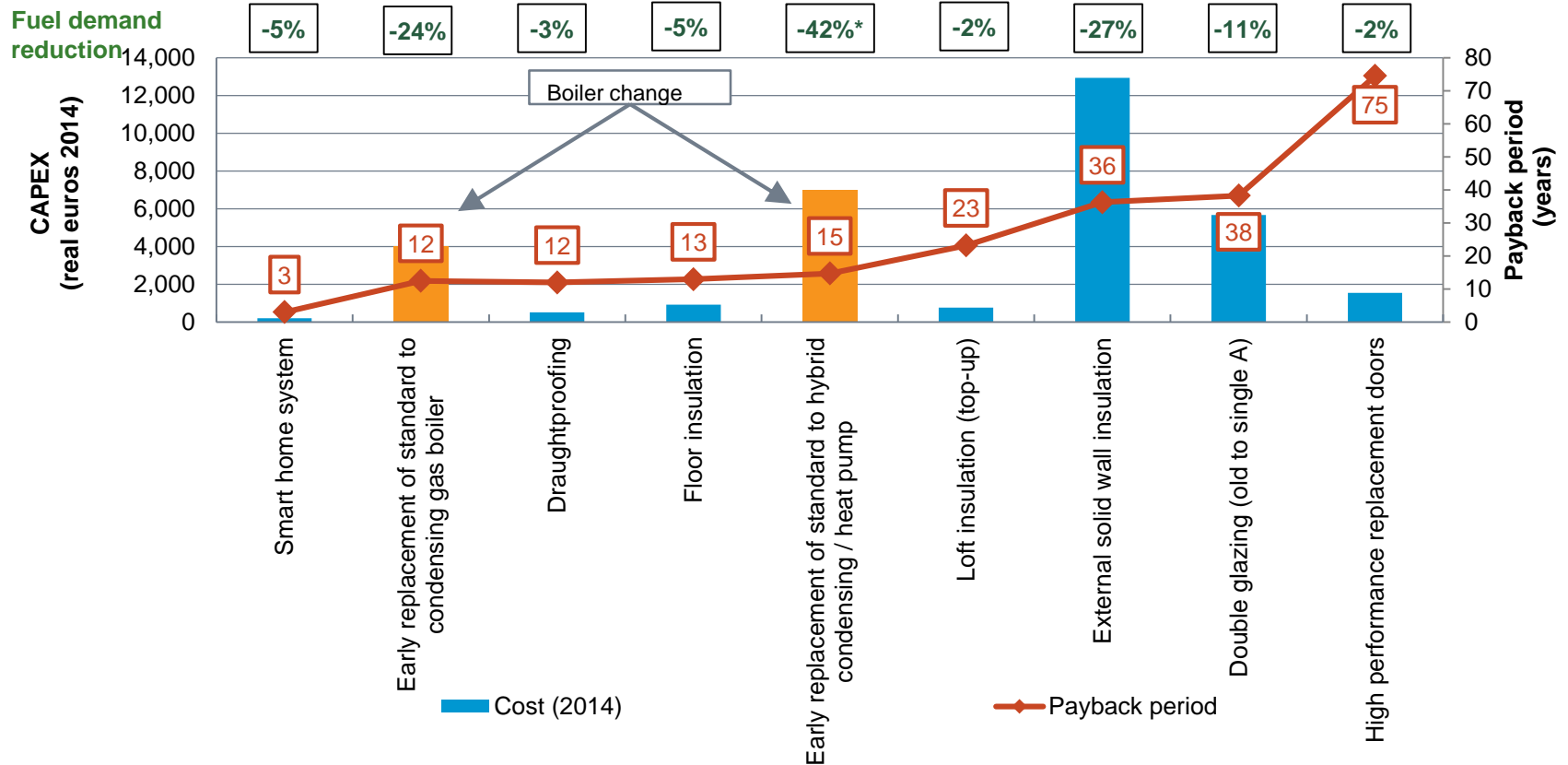
Policy

- Europe wide mandate to replace standalone condensing boilers with hybrid systems from 2021
- Early replacement of coal and oil boilers
- Faster development of heat pumps and district heating



PAYBACK PERIODS FOR SUPPLY-SIDE MEASURES GENERALLY SHORTER THAN THOSE FOR INSULATION MEASURES

UK Green Deal energy efficiency measures cost and demand savings



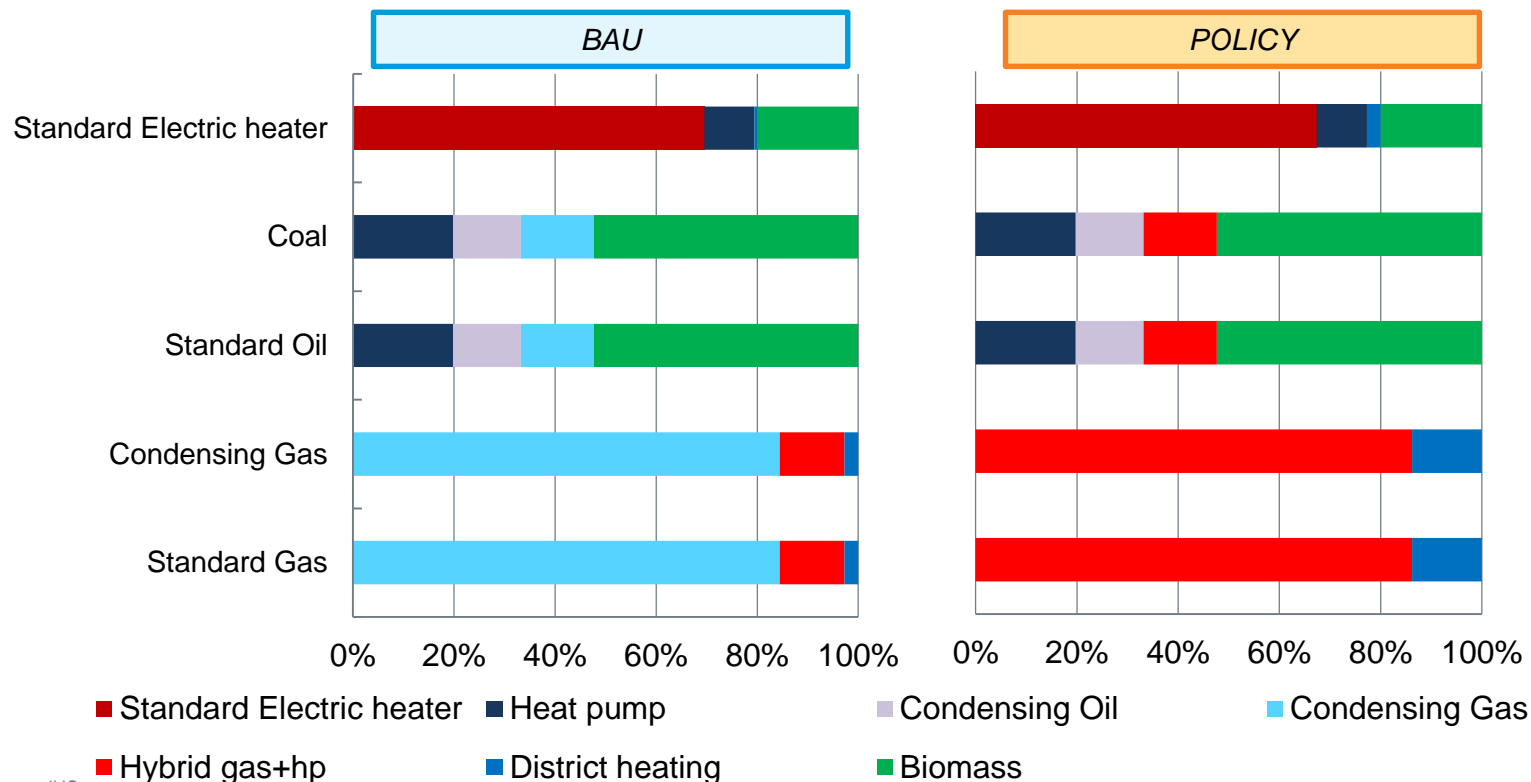
Note: Based on a typical old house in the UK with natural gas water and space heating consumption of 230 kWh per square meter per year. The electricity is generated by a 45% efficiency CCGT. Smart home systems yield 5 to 10% savings according to manufacturers.

Source: IHS Energy, UK Green Deal, Vaillant

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EXISTING HOMES: HYBRID SYSTEMS* DOMINANT FORM OF NEW HEATING SYSTEM FOR HOMES WITH GAS IN *POLICY*

Replacement of existing heating systems



Source: IHS

© 2015 IHS

14% of existing gas systems are replaced by district heating in *Policy*. Growth in district heat limited by need for power. Biomass grows strongly in rural areas

* Hybrid systems considered in the modelling are ASHP combined with high efficiency, condensing gas boilers

MEETING THE 2050 TARGET: WITH MORE AND DEEPER REFURBISHMENT *POLICY* WOULD MEET THE EC'S 2050 GOALS

2050 objectives of the (draft) European heating strategy

Share of renewable energy [45-55]%

Gas use to reduce to [XX]

Energy consumption for heating/cooling to reduce by [40-70]%

Policy (2040)

Share of renewable energy 49%

Residential end use of gas 57 Bcm from 124 Bcm today

Final energy consumption reduced by ~14%

Policy + deeper refurbishment

46% reduction in consumption by 2050

* Figures taken from draft strategy including [] and XX

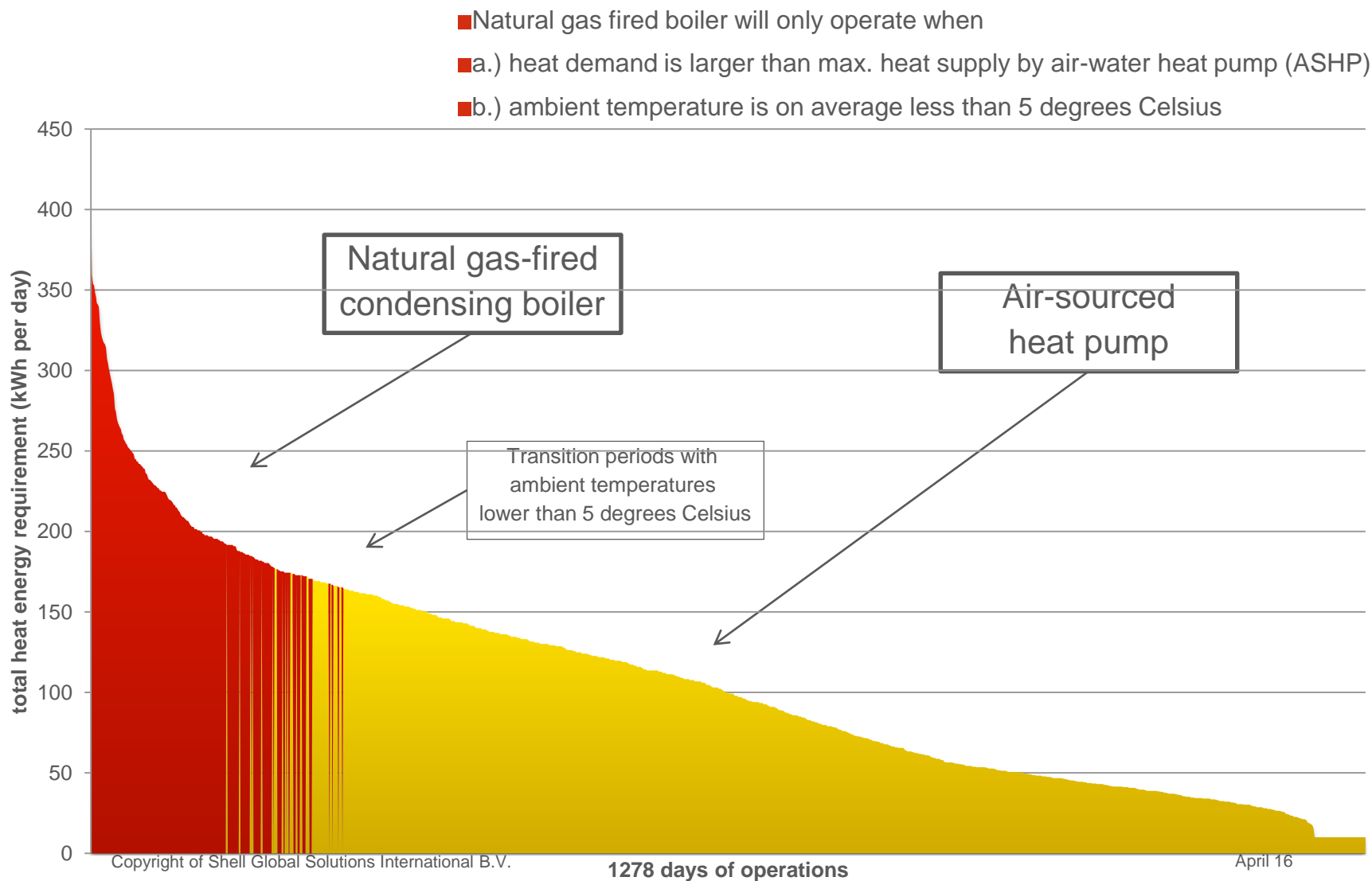
"learning by doing" leads to hybrid heating concept



and @Shell's EcoGenie Living Lab



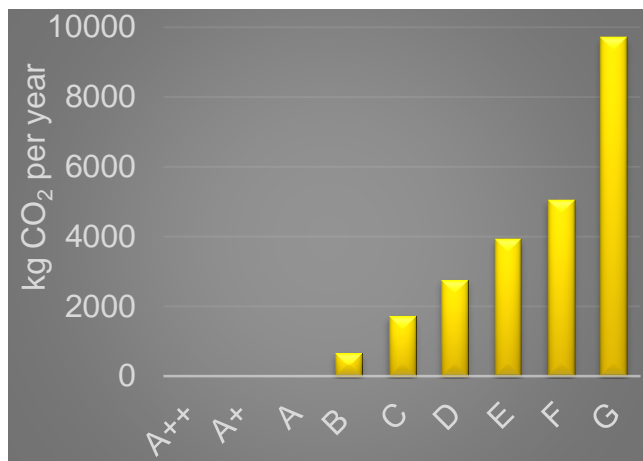
ECOGENIE DATA ANALYSIS: HYBRID SYSTEMS WILL REDUCE NATURAL GAS DEMAND BY 66% AND THUS CONTRIBUTE TO CO₂ SAVINGS AND PROLONG LIFE TIME OF BOILER APPLIANCES



CO2 ABATEMENT COSTS ARE 2-5 TIMES HIGHER FOR REFURBISHMENT (INSULATION ONLY) TO DELIVER SUBSTANTIAL EMISSION REDUCTIONS

Dutch Energy Label and CO2 savings

- Accurate calculation of CO2 savings and Energy Label categorization difficult



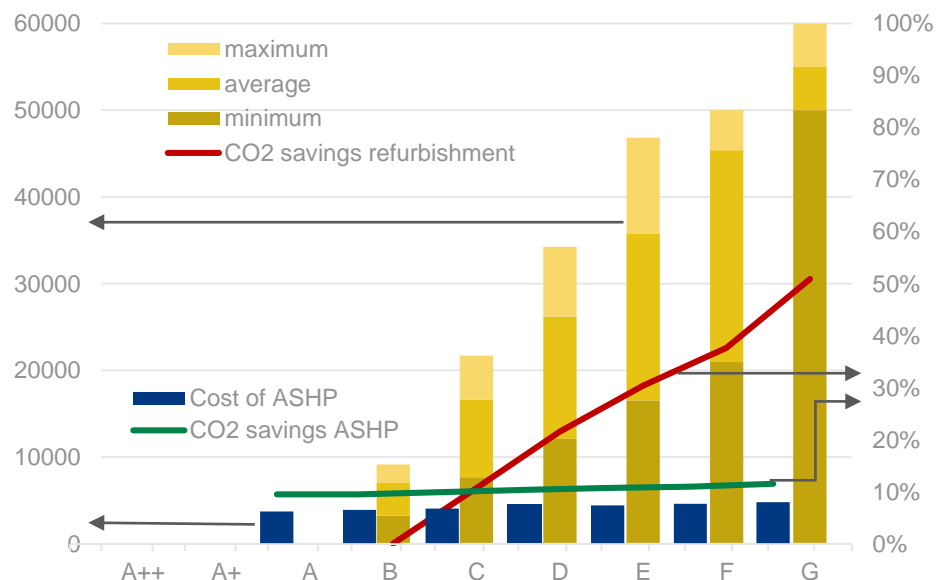
Note that CO2 savings beyond energy label A are generally achieved by adding renewable energy generation appliances and/or passive-house new-build

Sources of information

- Milieucentraal & RvO Nederland
 - <http://www.verbeteruwhuis.nl/>
 - <http://www.energielabelvoorwoningen.nl/>

Abatement Costs of refurbishments and air-source heat pumps

- Refurbishment costs vary from €7000 (B to A) to €55,000 (G to A)
- Air-source heat pump (ASHP) retrofit costs vary from €3,500 to €4,500
- CO2 savings for refurbishment are higher for D to G houses
- CO2 abatement costs are 2-5 times higher for refurbishment when compared with ASHP retrofit



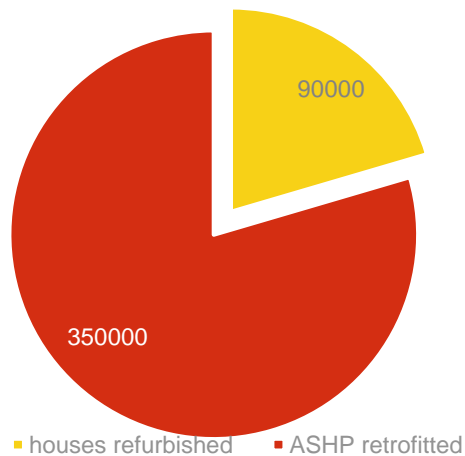
DEPLOYMENT OF HEATPUMPS IS 25% CHEAPER AND DOUBLES CO2 SAVINGS IN THE BUILD ENVIRONMENT BY 2030 – POTENTIALLY ENABLING UP TO 25% CO2 EMISSION REDUCTIONS

REDUCTIONS

Retrofit heating appliances 4 times faster

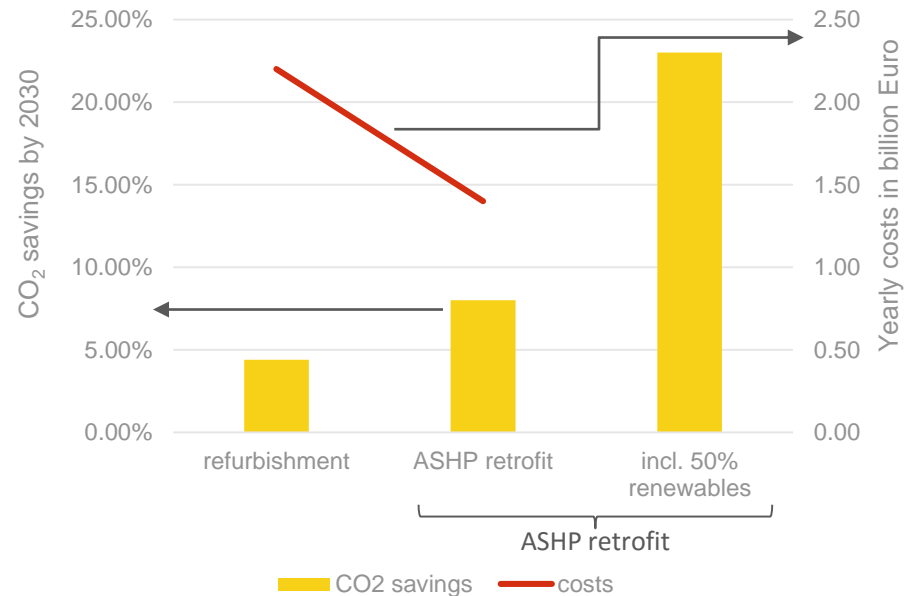
- More than 400,000 new heating appliances sold in The Netherlands per year.
- Installers retrofit more than 380,000 appliances in residential space.
- Building contractors capacity to refurbish homes limited to less than 100k dwellings per year.

Yearly capacity refurbishment & retrofit



Rapid rollout of ASHP delivers higher CO2 savings at lower costs

- By the year 2030
 - ca. 20% of dwellings will be refurbished
 - ca. 80% of heating appliances will be retrofitted
- Yearly costs of retrofitting is 25% cheaper compared to refurbishment and will deliver more than 80% higher CO2 emission savings
- Note that growth of renewable energy generation (offshore wind and solar) will significantly reduce CO2 emissions from residential dwellings when heat pumps are installed.



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THE SECRETS OF THE ECOGENIE

An experimental house in the Netherlands reveals how renewable technology can cut energy bills and carbon emissions from old homes. Inside Energy writer Dan Fineren spent the night there.

