UKpassivhaus conference 2020

A HEALTHY & GREEN FUTURE

CHRIS TWINN

Twinn Sustainability Innovation

PASSIVHAUS AND NET ZERO

Can hydrogen help us?

#UKPHC20

WWW.UKPHC.ORG.UK

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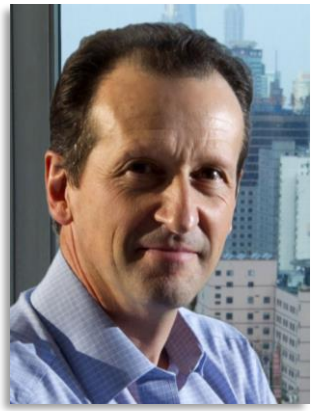
ATTMA The Air Tightness Testing & Measurement Association

green building store

Kingspan.

LETI Hydrogen primer

https://www.leti.london/hydrogen



Chris Twinn

FRSA HonFRIBA FCIBSE MEI CEng BSc(Hons)

Principal of TwinnSustainabilityInnovation

Arup Fellow

Member of the EDGE think-tank

Design Council (CABE) Design Review Panel

CIBSE HVAC & NV special interest group committees

Sustainable Development Foundation: Board member

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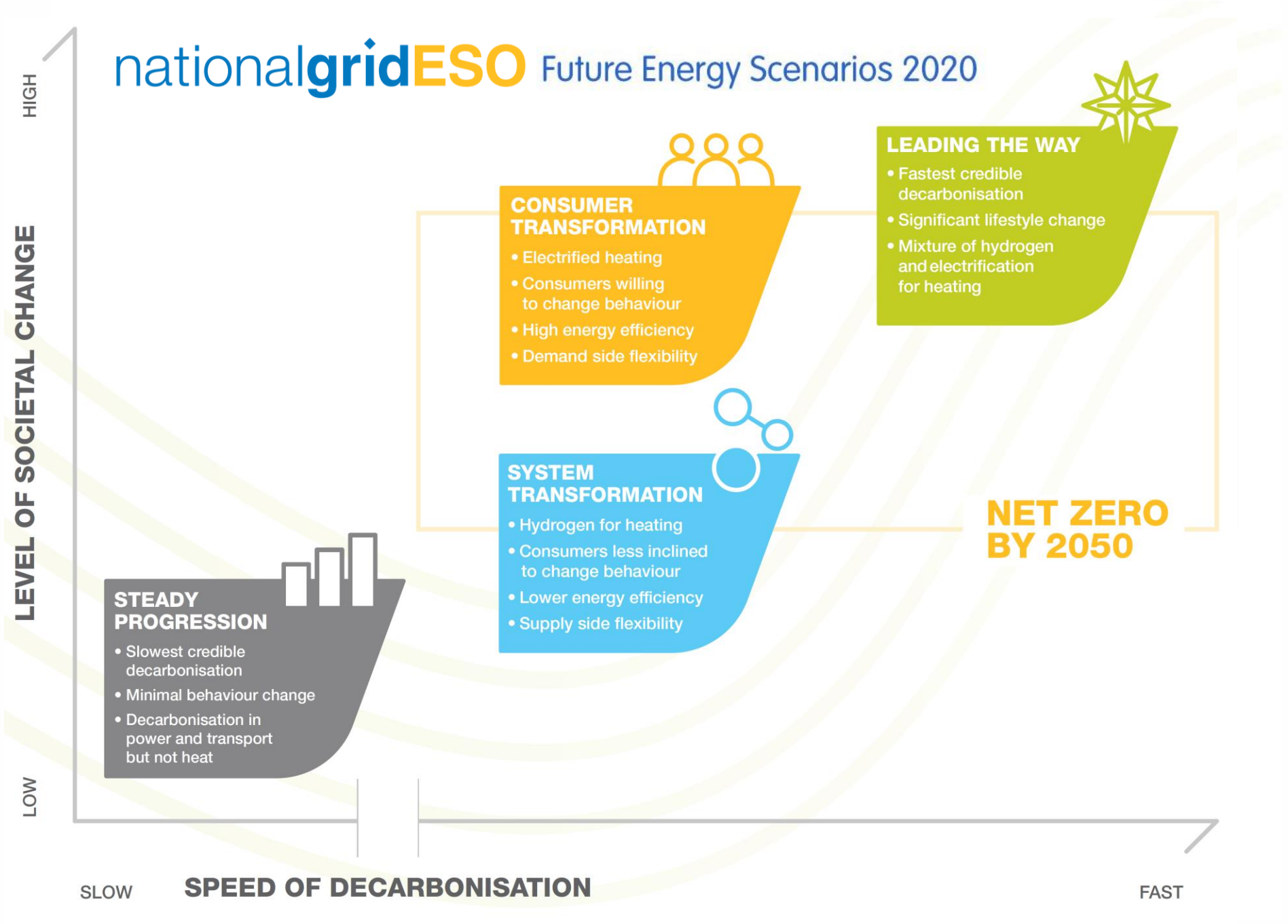
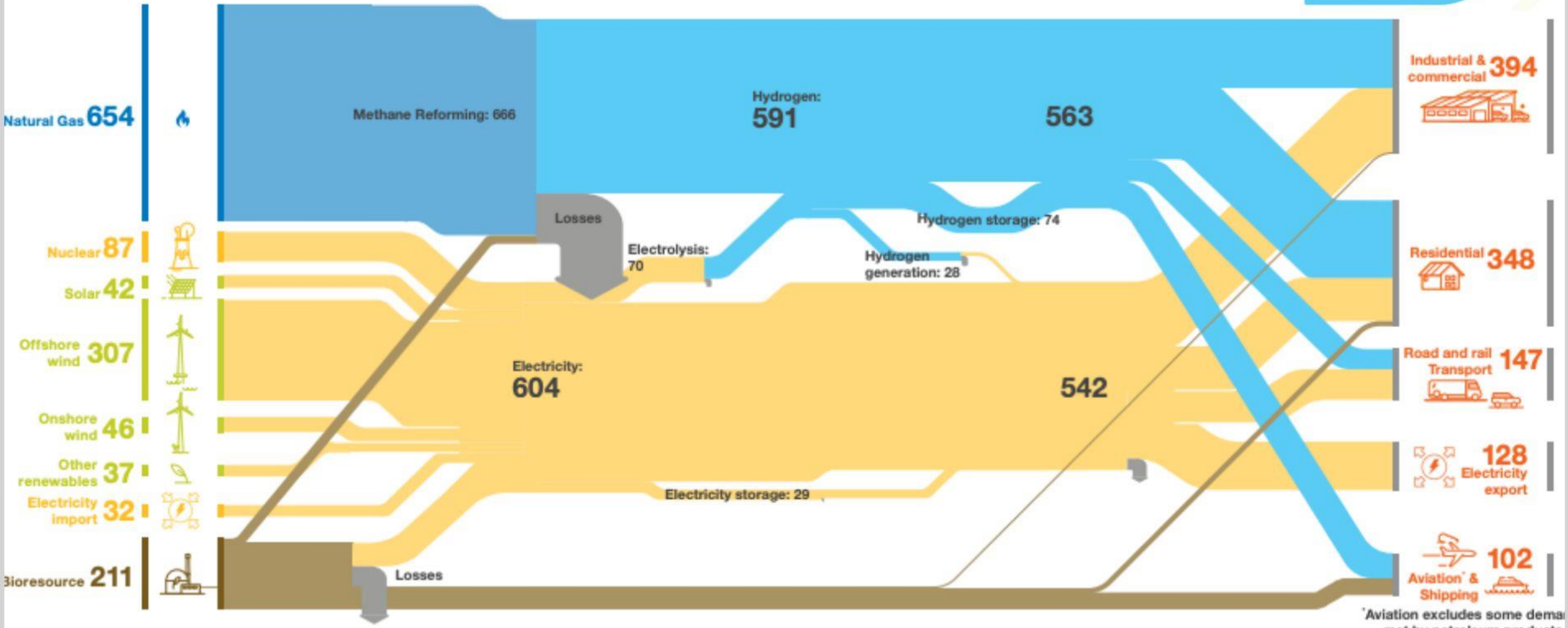

nationalgridESO Future Energy Scenarios 2020
HIGH
LEVEL OF SOCIETAL CHANGE
LOW
CONSUMER TRANSFORMATION
• Electrified heating
• Consumers willing to change behaviour
• High energy efficiency
• Demand side flexibility
LEADING THE WAY
• Fastest credible decarbonisation
• Significant lifestyle change
• Mixture of hydrogen and electrification for heating
SYSTEM TRANSFORMATION
• Hydrogen for heating
• Consumers less inclined to change behaviour
• Lower energy efficiency
• Supply side flexibility
NET ZERO BY 2050
STEADY PROGRESSION
• Slowest credible decarbonisation
• Minimal behaviour change
• Decarbonisation in power and transport but not heat
SLOW
SPEED OF DECARBONISATION
FAST

Future Energy Scenarios - System Transformation

SYSTEM TRANSFORMATION

- Hydrogen for heating
- Consumers less inclined to change behaviour
- Lower energy efficiency
- Supply side flexibility

Energy flows in 2050 (TWh) - National Grid Future Energy Scenarios 2020

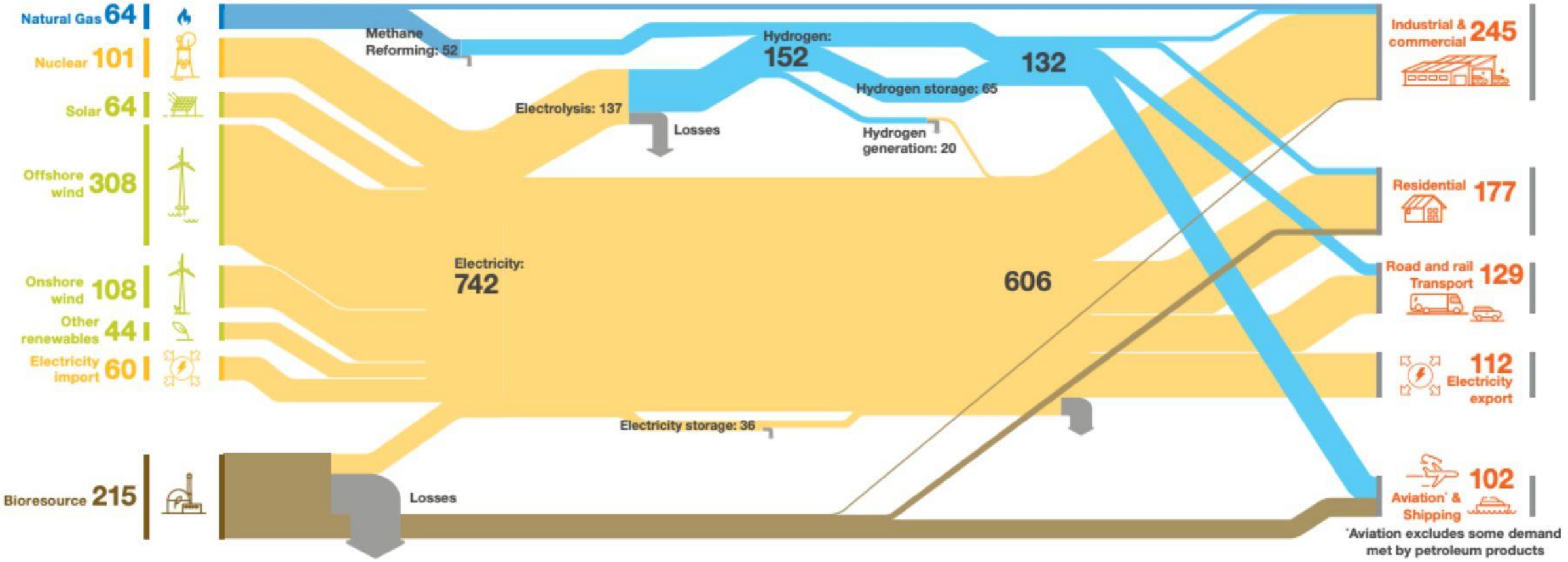


Future Energy Scenarios - Consumer Transformation

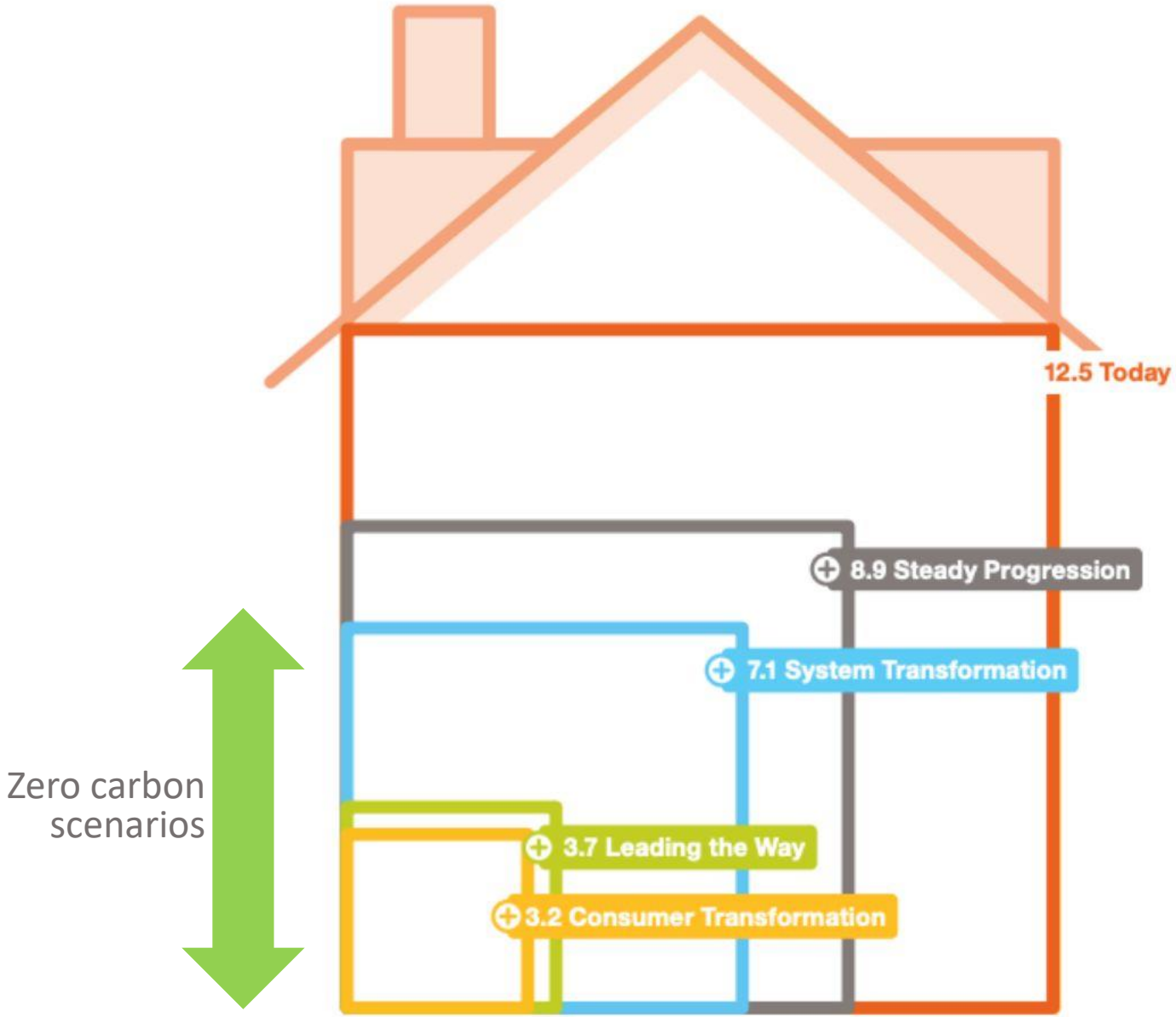
CONSUMER TRANSFORMATION

- Electrified heating
- Consumers willing to change behaviour
- High energy efficiency
- Demand side flexibility

Energy flows in 2050 (TWh) - National Grid Future Energy Scenarios 2020

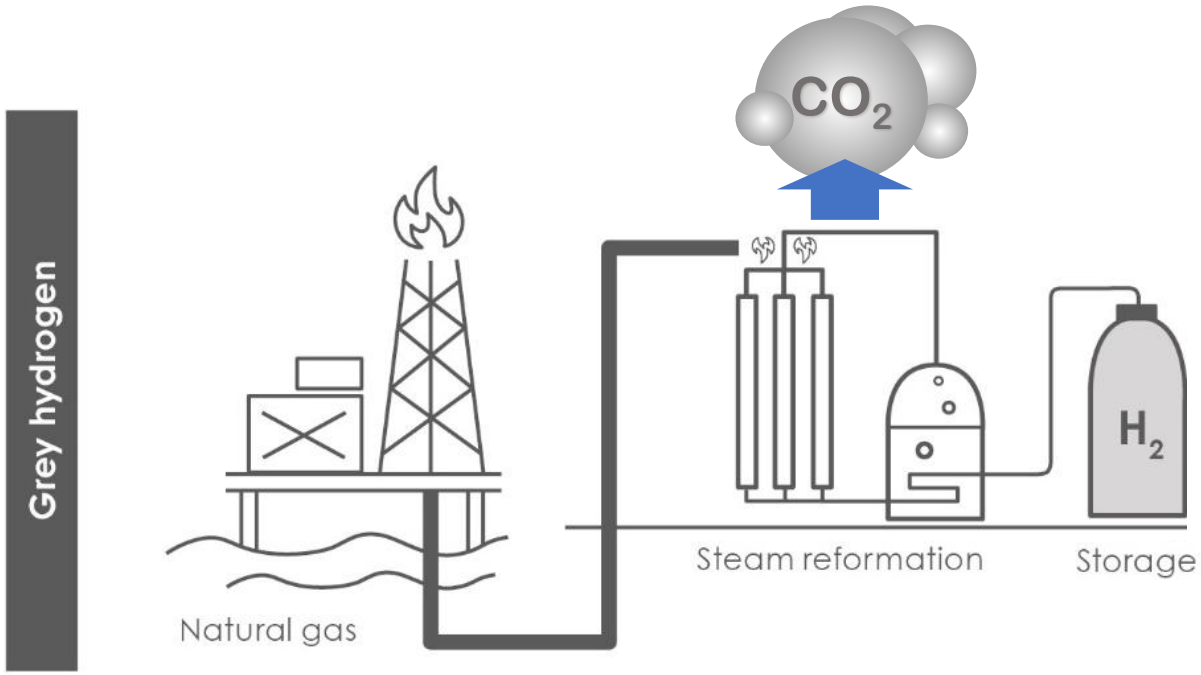


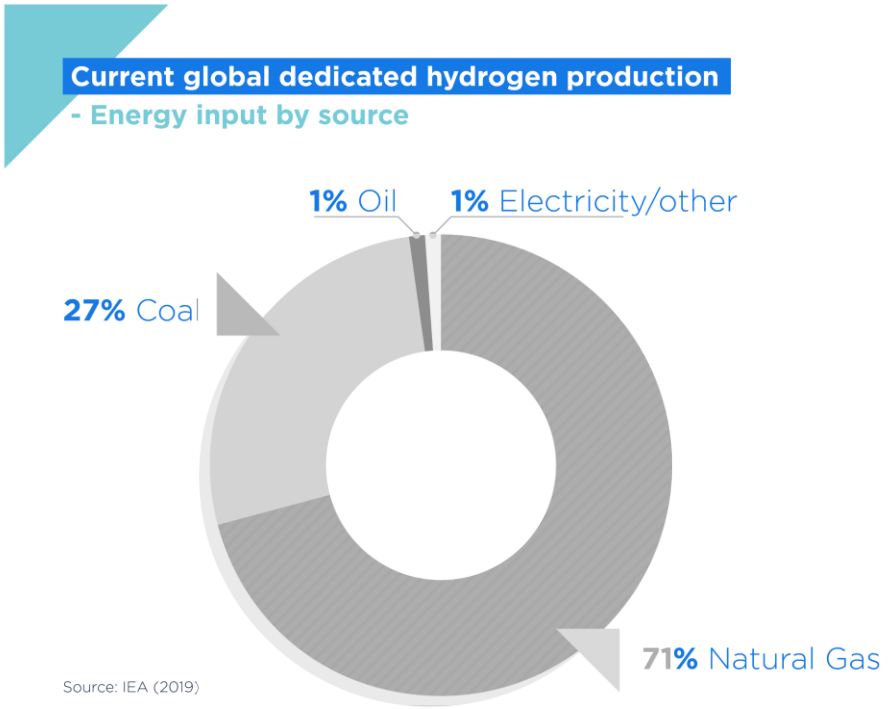
Average Heating and Hot Water Demand per home (MWh/year)



Source: National Grid, Future Energy Scenarios 2020

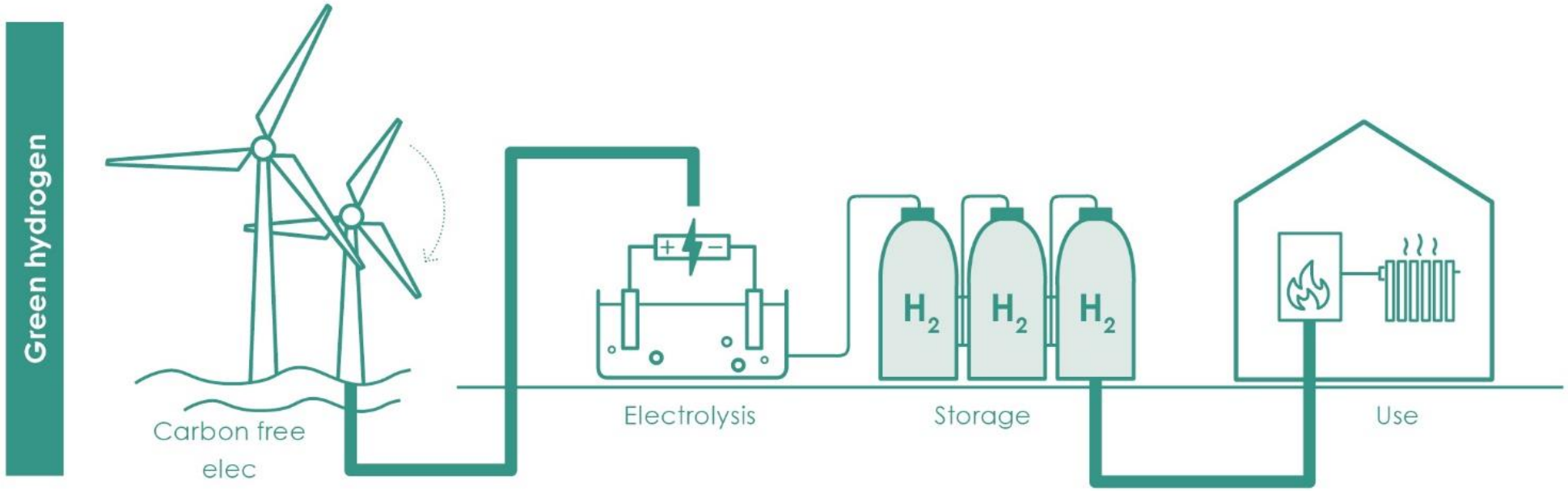
What is Grey hydrogen





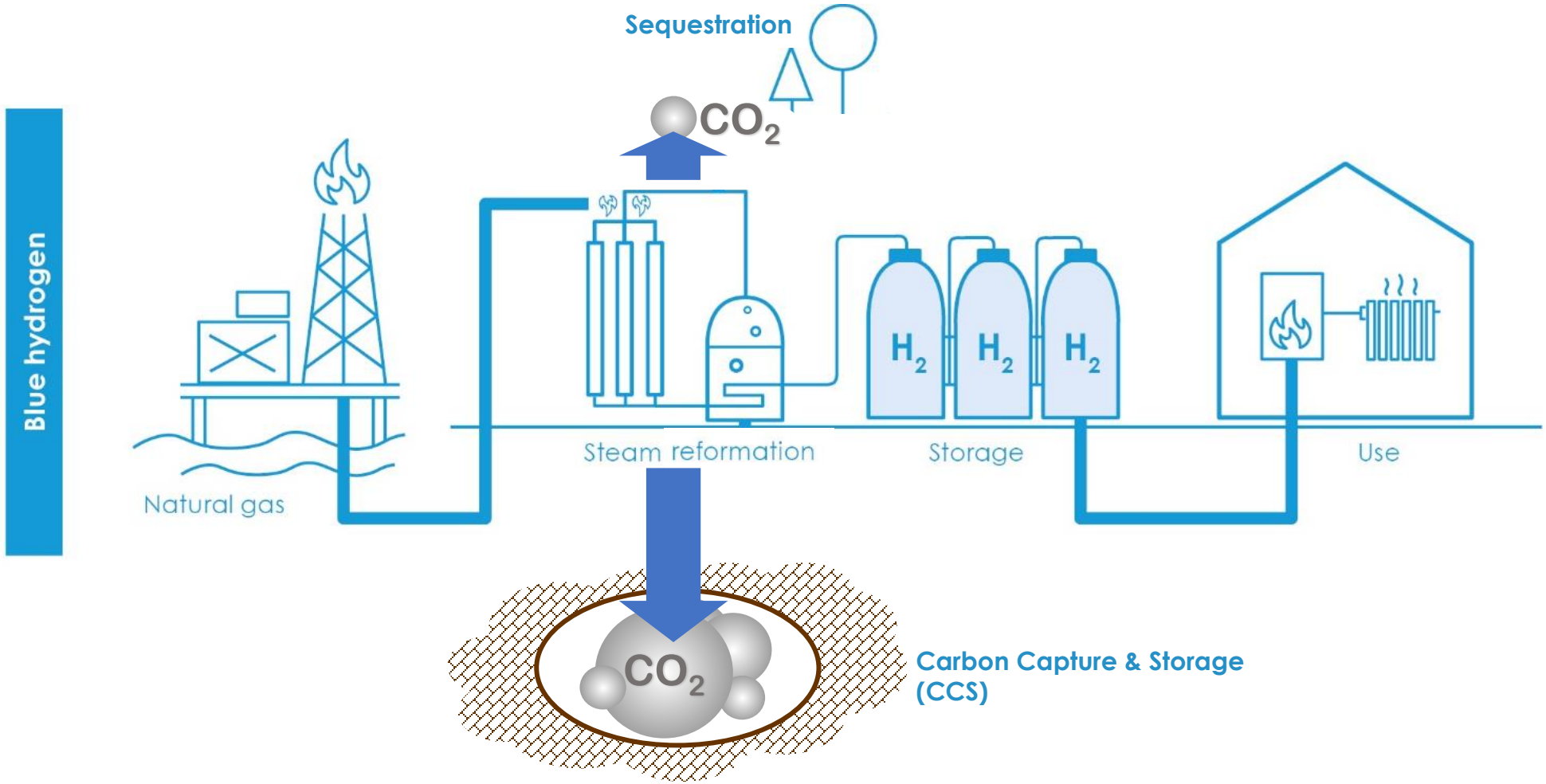
44% of current global total H_2 production equal to UK current gas demand

What is Green hydrogen



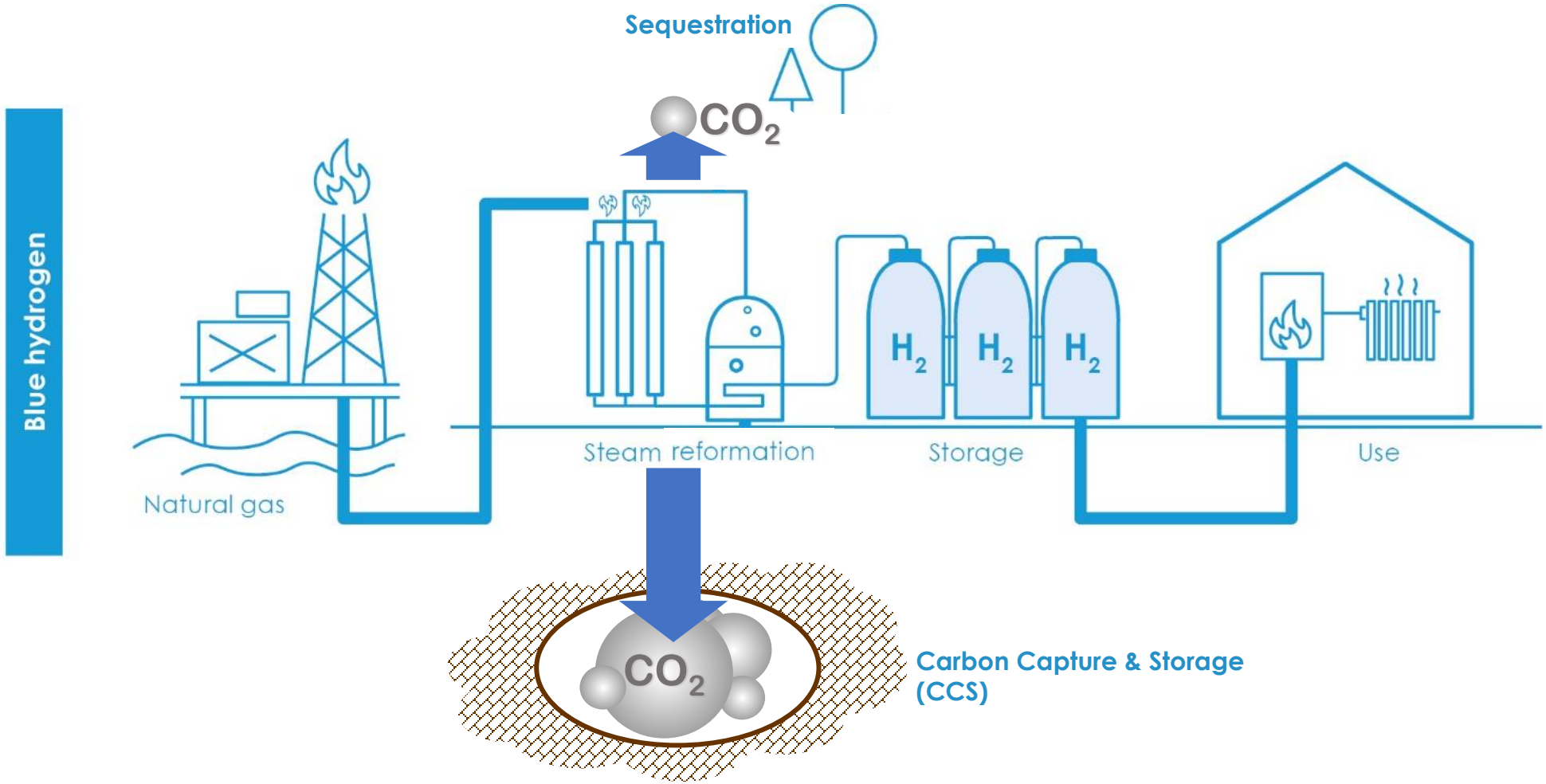
What is Blue hydrogen

As proposed by UK gas-supply industry



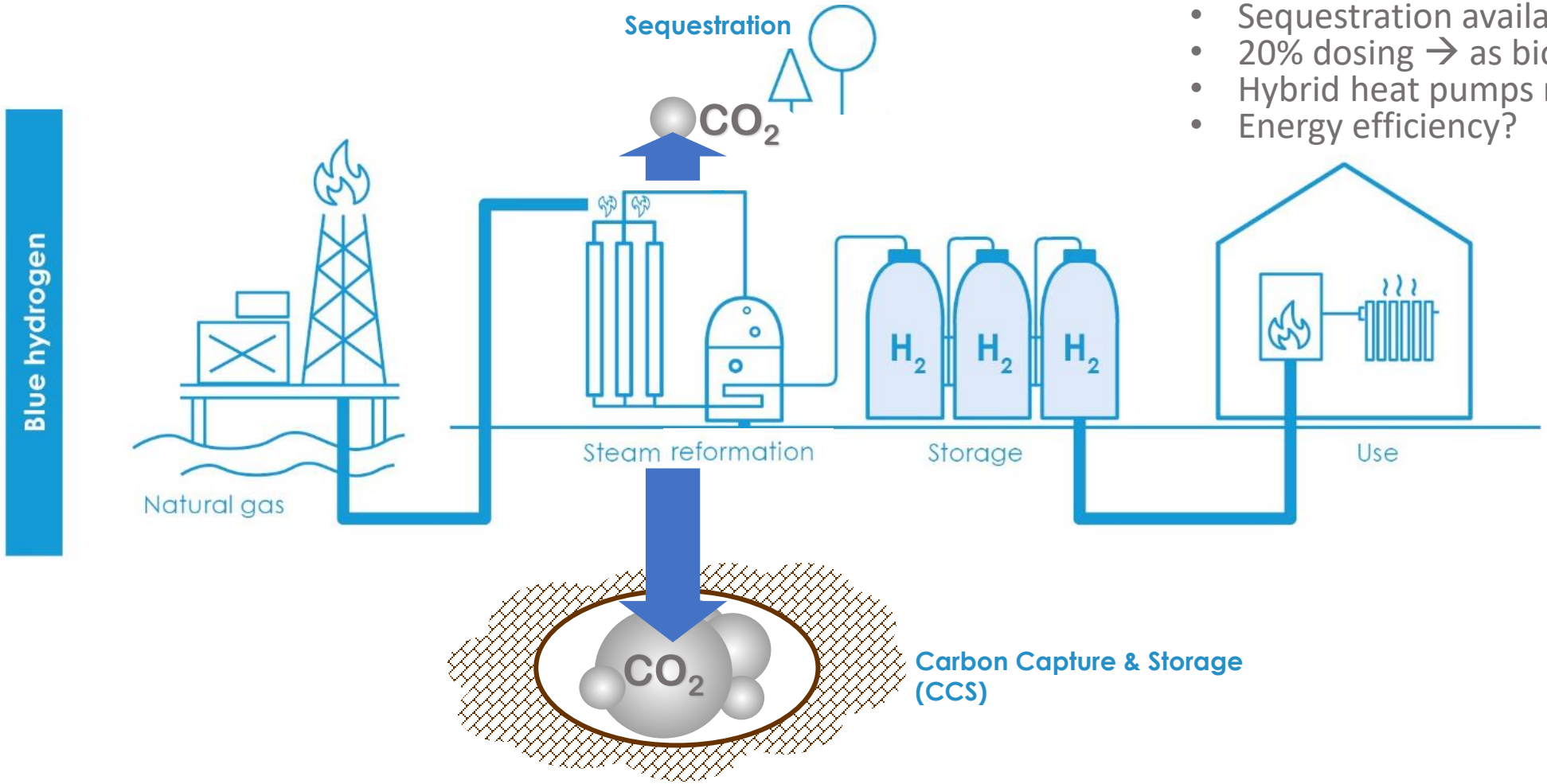
What is Blue hydrogen

- CCS unproven at scale (& cost)?
- Large scale storage (x3 elect grid)?
- Supply system leakage?
- Implementation timescale?

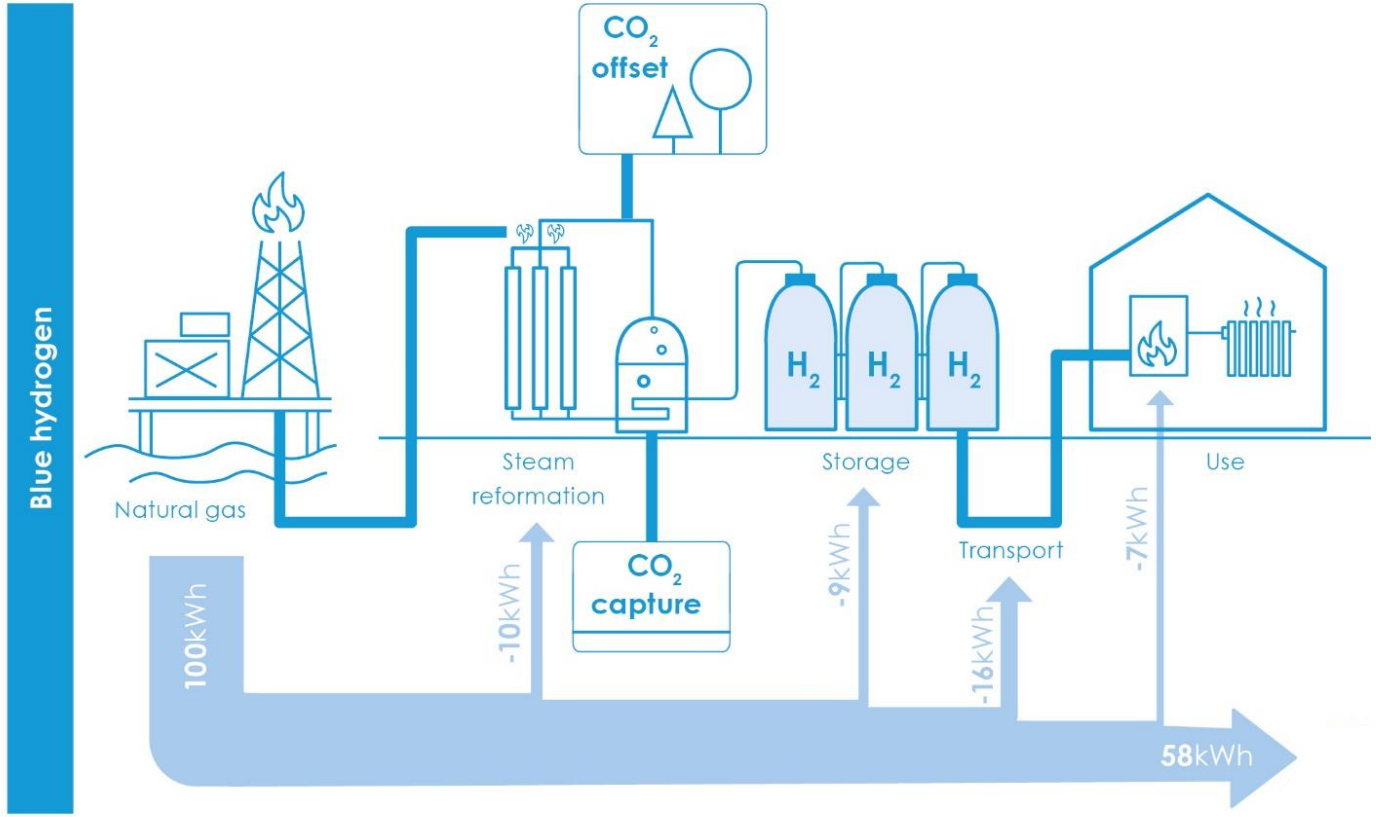


What is Blue hydrogen

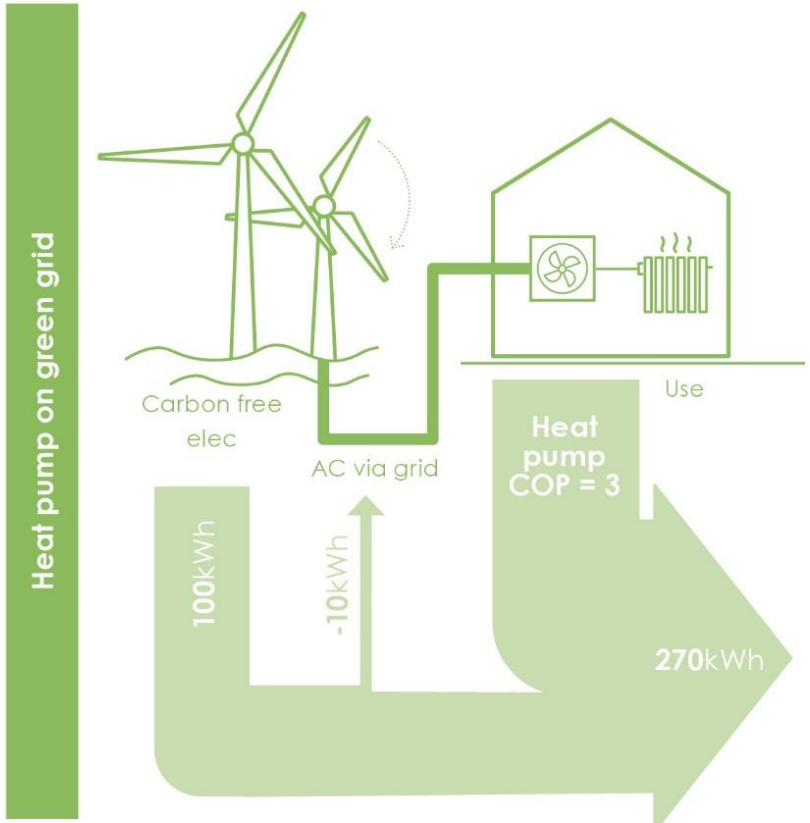
- CCS unproven at scale (& cost)?
- Large scale storage (x3 elect grid)?
- Supply system leakage?
- Implementation timescale?
- Sequestration availability?
- 20% dosing → as biodiesel in petrol?
- Hybrid heat pumps no route to market?
- Energy efficiency?



Efficiency comparison



58% efficient



270% efficient

HYDROGEN IN THE ENERGY SYSTEM OF THE FUTURE: FOCUS ON HEAT IN BUILDINGS

Norman Gerhardt, Jochen Bard, Richard Schmitz, Michael Beil, Maximilian Pfenn
Fraunhofer Institute for Energy Economics and Energy System Technology (IEE)

German National Strategy.

- **Based on Green Hydrogen**
- **To serve sectors unable to be served by electricity**

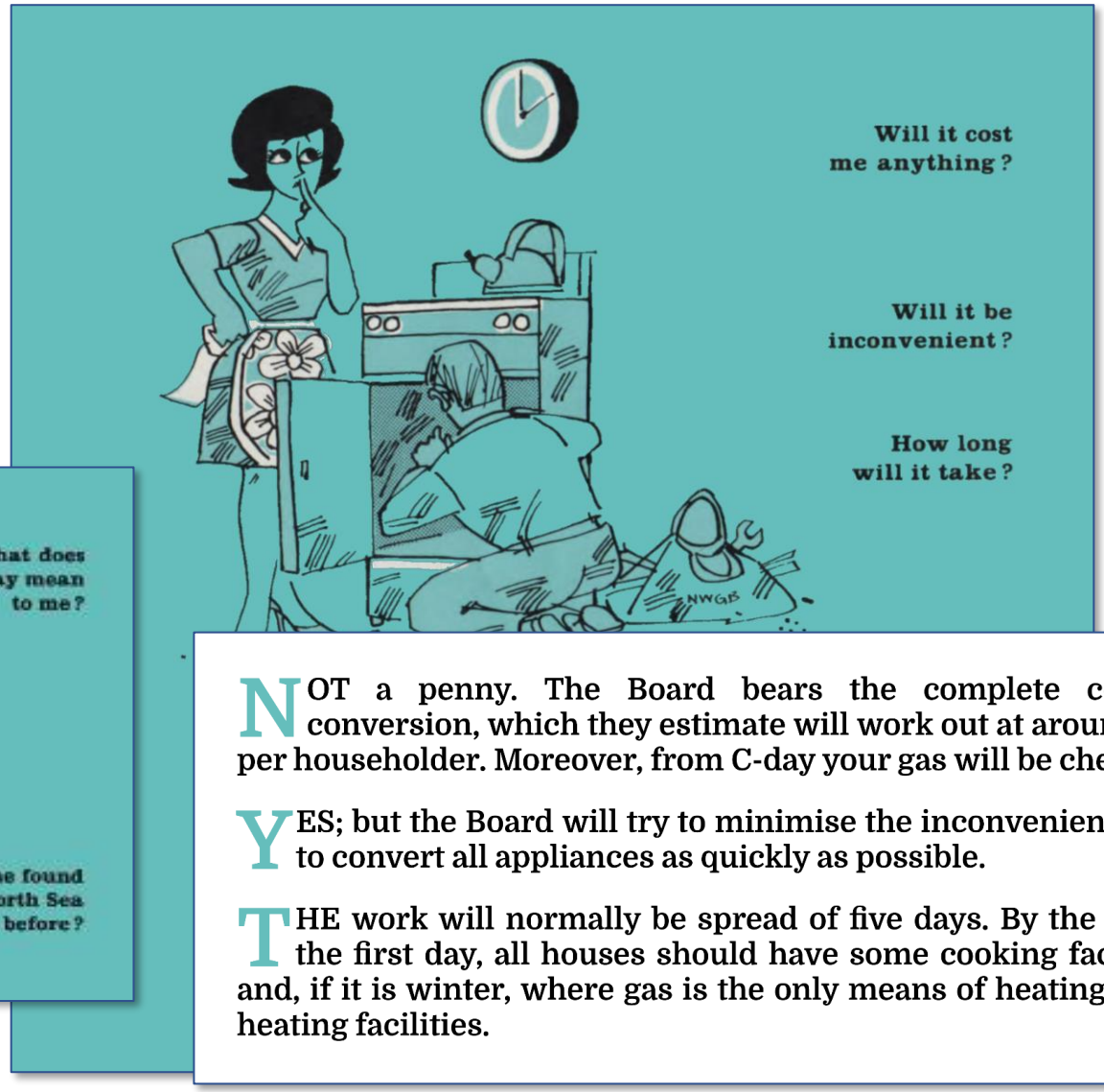
Germany's National Hydrogen Strategy

#Gas (/topics/Gas) #Hydrogen (/topics/Hydrogen)

In the fight against climate change, hydrogen made with renewable electricity is increasingly seen as a silver bullet for sectors with particularly stubborn emissions, such as heavy industry and aviation. Germany has set out to become a global leader in the associated hydrogen technologies, and the governmnet has penned a National Hydrogen Strategy to fulfil these ambitions. This factsheet summarises the strategy, which was approved by government on Wednesday 10 June. (UPDATE - strategy approved)

‘We’ve did it before’

but without social media …..!



NOT a penny. The Board bears the complete cost of conversion, which they estimate will work out at around £30 per householder. Moreover, from C-day your gas will be cheaper.

YES; but the Board will try to minimise the inconvenience and to convert all appliances as quickly as possible.

THE work will normally be spread of five days. By the end of the first day, all houses should have some cooking facilities, and, if it is winter, where gas is the only means of heating, some heating facilities.

Costs

- Hydrogen switchover costs claimed to be similar to electrical (but appear to exclude any building retrofit).
- CCS and future technology upscaling costs are fragile
- H_2 costs assume largescale consumption - not peak lopping (ref CCC) - increases £/kWh
- Electrical grid upscaling far more robust
- Lock in to Grey H_2 if technology development falters
- Manufactured H_2 cost/kWh higher than NG
- Elec (vs H_2) private investment is far larger - Wind turbines no longer need subsidy, etc.
- Are consumers or Government to pick up H_2 rollout costs and delivery risk?

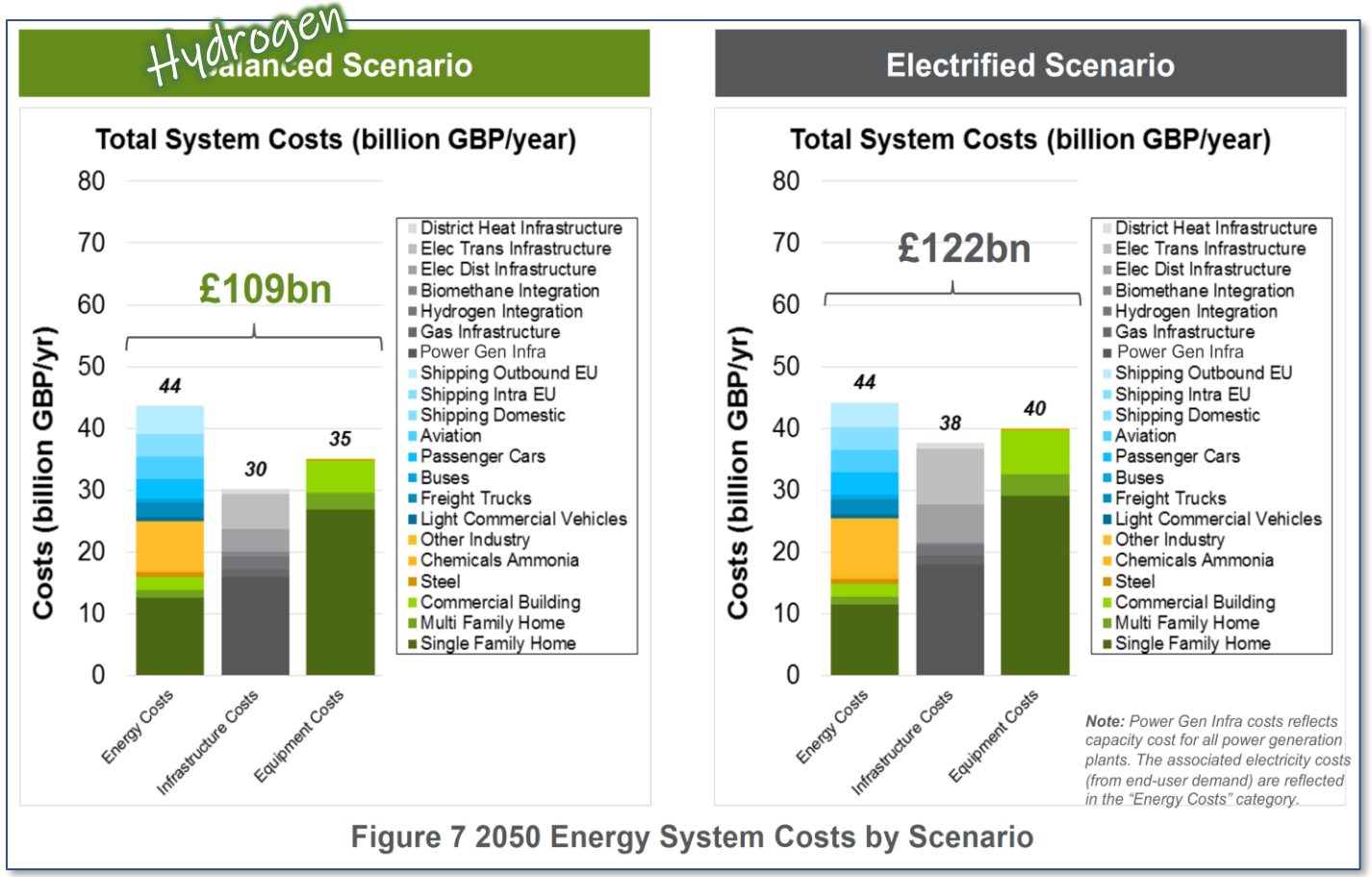
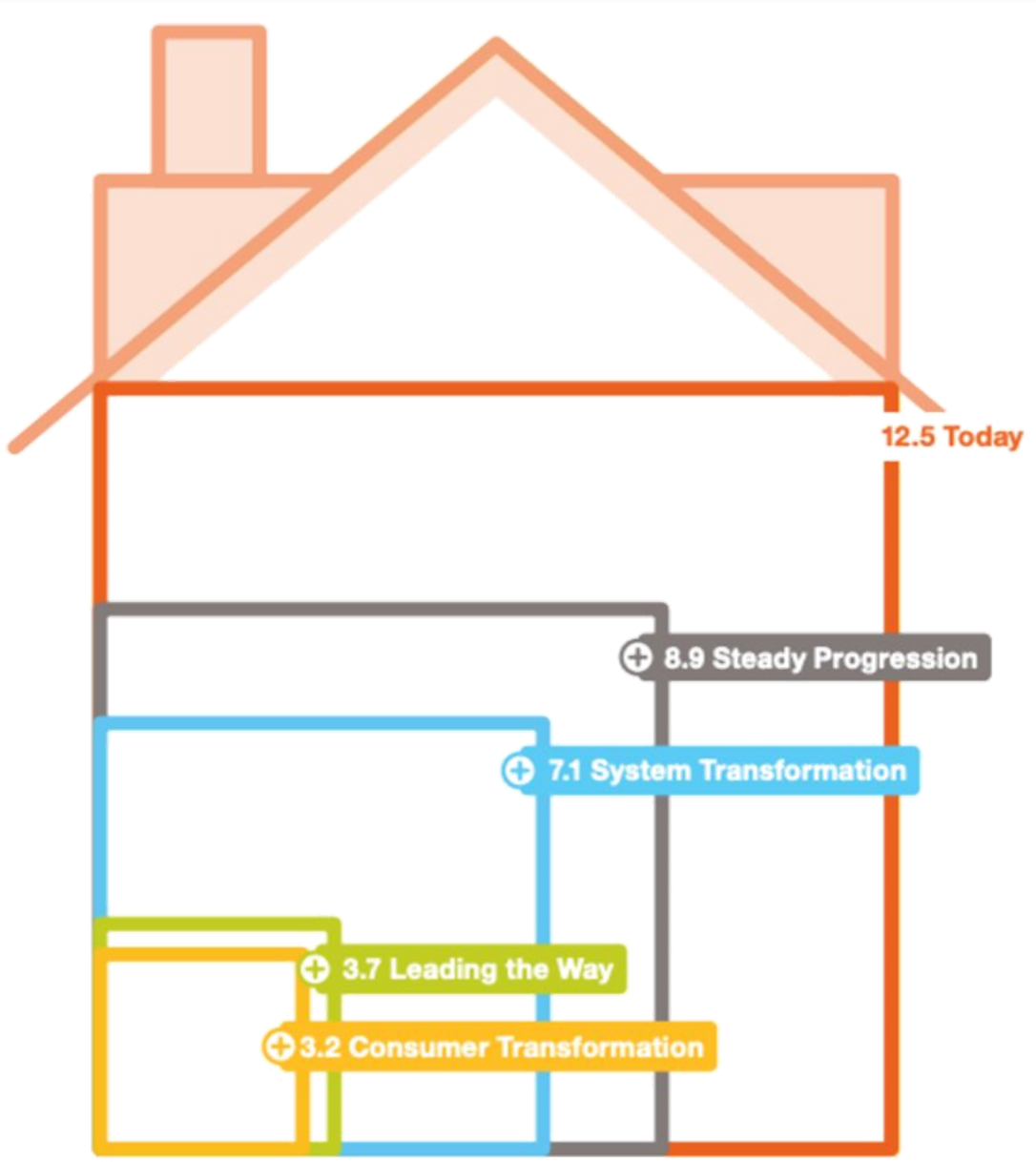


Figure 7 2050 Energy System Costs by Scenario

Pathways to Net-Zero: Decarbonising the Gas Networks in Great Britain
Prepared by Navigant Europe Ltd for Energy Networks Association

For our buildings

- Thermal performance upgrade not considered
- Full range of adaption costs overlooked
- In-building pipework switchover liabilities
- Little engagement with building occupiers / owners for whom energy / hydrogen switchover not a core business
- Hence decisions to permit a switchover, or not, are likely based on non-energy/carbon rationale (e.g. cost, amenity, expectations and disruption)
- As Green Deal showed, lack of appropriate alignment with building stakeholders can bring a national programme to a grinding halt!



In conclusion

- UK gas-supply industry is not proposing Green hydrogen
- Proposes unproven CCS and sequestration technology at scale
- Implementation programme extends CO_2 emitting duration, with potential lock-in
- Disruption to buildings and systems severely underplayed
- Investment costs fragile and likely to end up with building consumers
- Operating costs expected to be significantly higher for consumers
- No inherent benefit for building occupiers /owners to take the risk

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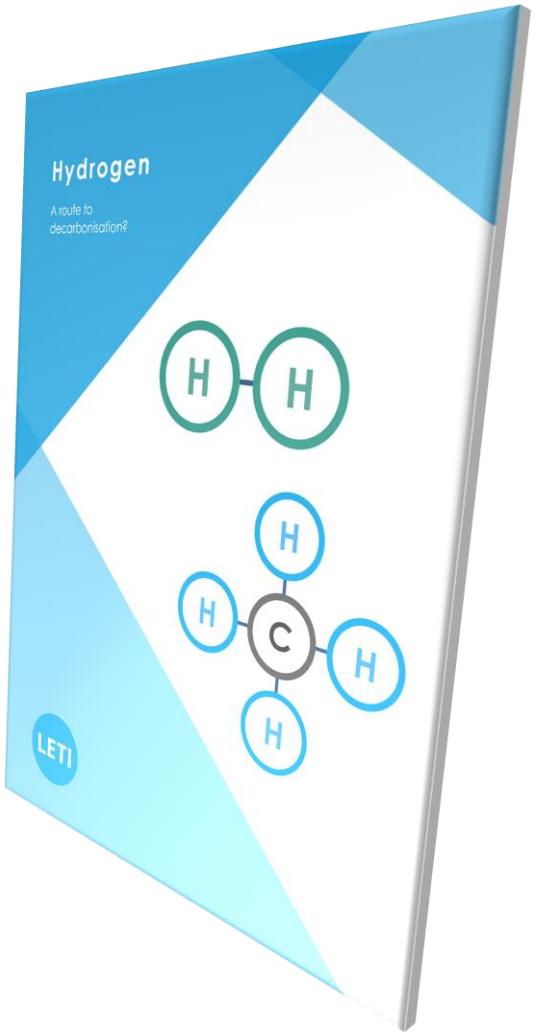
It seems unlikely zero carbon hydrogen via re-purposed gas mains will be available, for most buildings, for the foreseeable future.



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Hydrogen may have other roles:

- Peak CCGT power stations (harnessing its storage abilities)
- High temperature industry
- Long-haul aviation and heavy lift haulage
- Perhaps to local consumer networks in the immediate vicinity of other larger users

Gas suppliers "*over-selling* *'green-gas' to policy makers in order to protect their interests and detract from the importance and value of electrification*"

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THANK YOU

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