Decarbonizing the gas end user
An alternative view

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Few words on transition to sustainability

- Now, reliance on natural gas and its infrastructure
- How do we get from A to B?
- Make a few comments intended to stimulate thought and discussion
Dilemma

- There is an existing infrastructure,
  - Particularly the inventory of installed end-use equipment
- Any argument will end with “the fuel has to match the requirements of the existing equipment”
- So either alter the fuel or alter the equipment
- ‘it’s always easier to adapt the fuel than the equipment’, but is it the better choice?

- Btw, only way to change the domestic end user with acceptable social cost is via the replacement method...takes >20 years, but so what? (see below)...method chosen by Dutch government (new appliance type approved for e.g. 10% H2...
Random thoughts

- If you have enough biomass for replacement, super...upgrade and distribute

- Hydrogen (from P2G)? What can we do with it?
  - Add to the natural gas grid in some fraction (=‘stretch’ the gas)
  - Methanate (alter the gas)
  - Use in specific applications (alter the equipment)

- And, how much H2 do we have and how much do we want?
Add to the grid? Say 10%?

- is that good?
- 10% is 3% reduction in CO$_2$, that’s it
  - Is that enough?

De Vries, et al., Appl. Energy, in press
Add to the grid? Say 10%?

- Even 10% depends on the natural gas to which it’s added!
- Based on interchangeability analysis, but says nothing about installed appliances...
- Guarantees no increase in risk...can ignore, but then accept extra risk

De Vries, et al., Appl. Energy, in press
What else?

- Methanate?
  - Fine for end use, pity about the extra energy and that so much effort must be made to compete with a pipeline commodity

- Dedicated use of H2?
  - Alternative view:
    - First, don’t bother the domestic end user with new equipment, use in the energy-intensive industry...
    - Second, don’t use ‘excess’ wind power for P2G, but make excess wind power 😊...so much wind power that we can drive the industry.
    - And when there’s a shortage of H2 (short term), use natural gas from the grid.
  - Advantages: relatively easy to implement at end user...industry uses more expensive combustion equipment and usually ‘revision’ of equipment every 5 years...
  - (DNV GL working on new system for use from 100% H₂ to 100% NG)
### Dedicated H2

- **Advantages (con’t):**
  - *Complete decarbonization of industrial users; relatively few with relatively large gas consumption (compared to domestic)*
  - Uses NG to prevent interruption of industrial production

- **Challenges:**
  - Need to get H2 to the industries:
    - When clustered, relatively simple...and can isolate parts of the gas grid for this purpose
    - When not clustered, local storage (distribution using trucks? A la distribution for transportation) or even dedicated pipelines, depending on H2 production location.
    - Or, local H2 production...i.e., electrolyzer close to industry...
What about the domestic end users?

- Leave them alone:
  - Most usage for heating/hot water...‘everybody’ uses condensing boilers...already 90% efficiency...and leave for long-term developments when you’re sure which range of fuels/energy they’re going to get...
Decarbonizing the gas end user

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