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Sustainable gases and gas infrastructure in 2030/2050

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Assume it is 2050. We have failed in the reduction of our CO2 footprint. What would have been the reason?

A. Technically it was not feasible

B. Lack of natural resources like Lithium

C. Society did not accept the necessary changes: Nimby etc.

D. Society did not accept the transition costs

E. ….

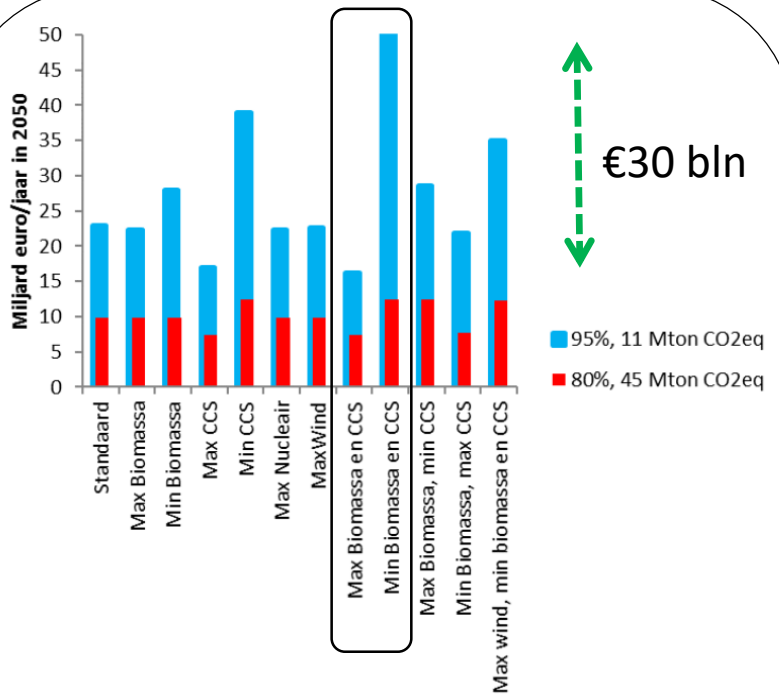
PBL: large variations in transition costs are dependent on options employed; the national costs include learning curves and savings

Note: These pathways are ‘reasonable’, no extremes

Tabel 2.1. Randvoorwaarden voor de met OPERA doorgerekende varianten. 2050

	Maximale CO_2 opslag Mton CO_2/jaar	Maximale inzet bio-massa (PJ)	Biomassa binnen-land (PJ)	Biomassa buiten-land (PJ)	Maximale capaciteit Wind op land (GW)	Maximale capaciteit Wind op zee (GW)	Maximale capaciteit kern-energie (GW)
Standaard	25	400	143	258	7	40	0
Max Biomassa	25	700	143	558	7	40	0
Min Biomassa	25	250	143	108	7	40	0
Max CCS	50	400	143	258	7	40	0
Min CCS	10	400	143	258	7	40	0
Max Nucleair	25	400	143	258	7	40	10
MaxWind	25	400	143	258	14	80	0
Max Biomassa en CCS	50	700	143	558	7	40	0
Min Biomassa en CCS	10	250	143	108	7	40	0
Max wind, min bio-massa en CCS	10	250	143	108	14	80	0
Max Biomassa, min CCS	10	700	143	558	7	40	0
Min Biomassa, max CCS	50	250	143	108	7	40	0

Current biomass: 80 PJ



The calculation ‘which is not allowed’:

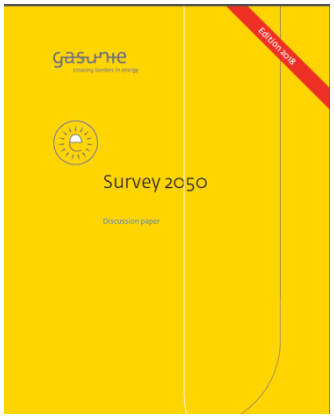
€30 bln/7 mln HH = €4000 per HH annually

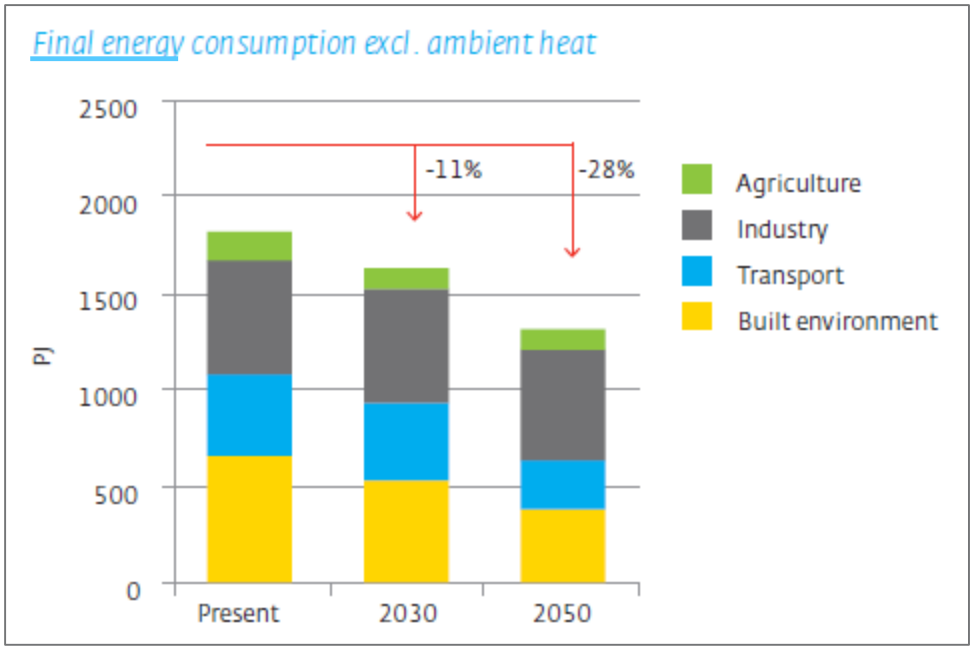
Source: “Verkenning Klimaatdoelen”, October 2017

Our energy demand will remain substantive

Gasunie has studied the potential consequences of this policy in depth and has published the results: Gasunie Survey 2050 (January 2018).

- Feasibility, Flexibility, Security of Supply and Costs
- Others have done the similar studies, with similar results





Some other conclusions

- Natural gas demand in NL remains relative flat until 2030
- Hydrogen becomes important

How to develop a sustainable energy system at the lowest costs?

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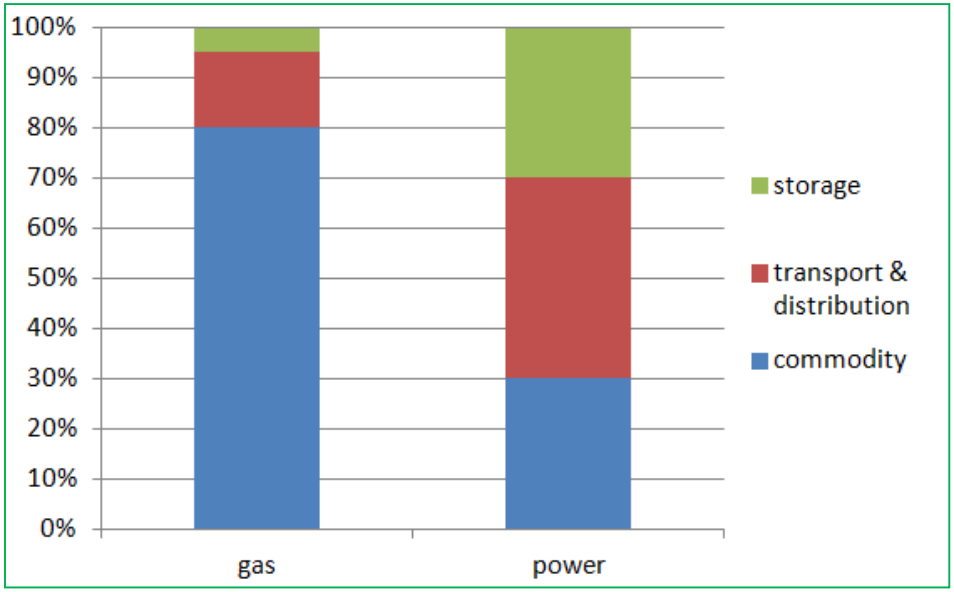
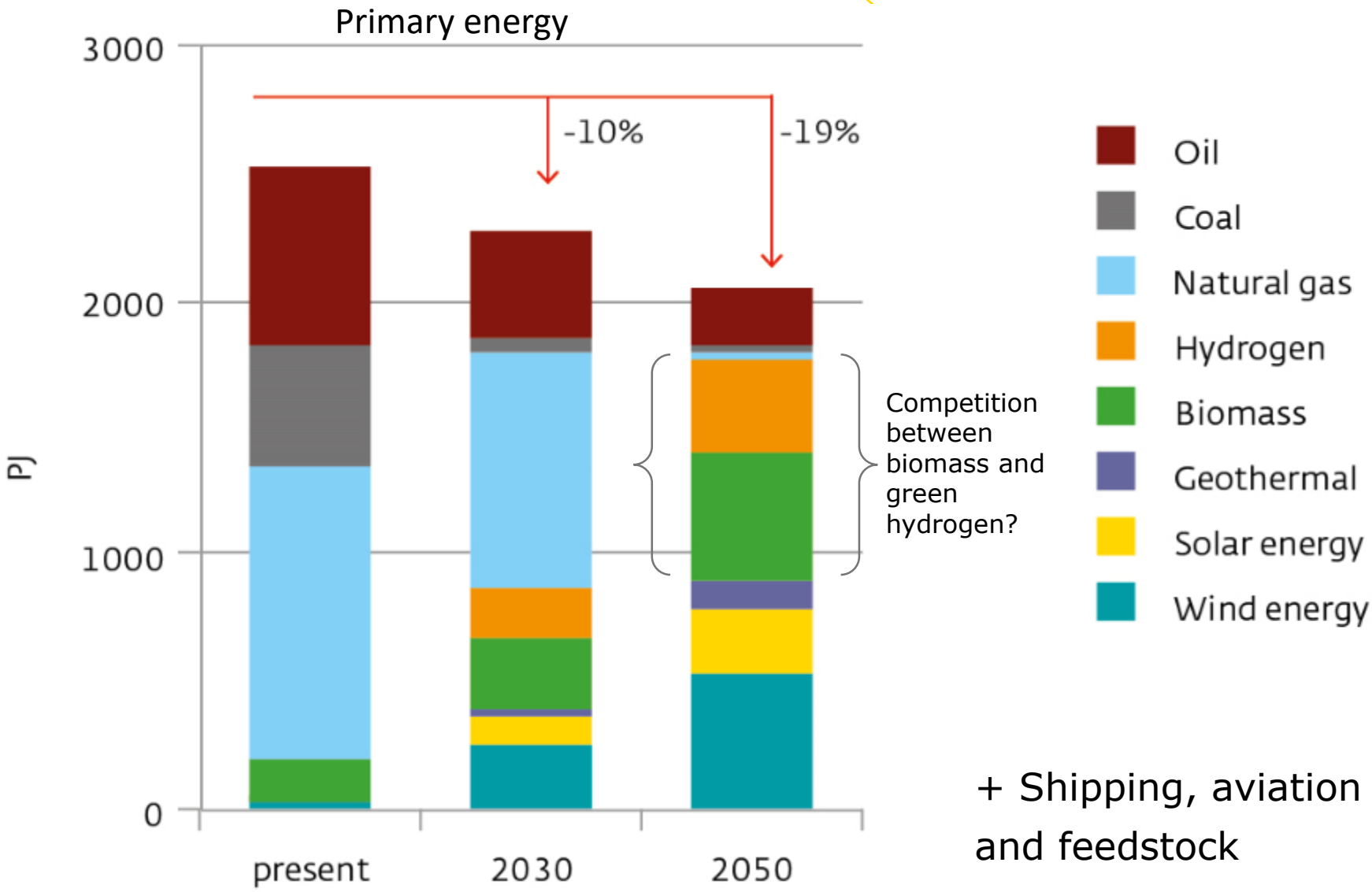
Costs of the energy system are Commodity + Transmission + Storage

- For gas, oil and coal, the main costs are in the commodity
- For electricity, the main costs are in transmission & distribution and 'storage'.
- Gas transport and distribution is 10-20x cheaper than electricity (kW)
- Gas storage is 1000x cheaper than electricity storage (kWh)
- **Any comparison based on commodity only is incorrect**



Schematic of system costs gas & electricity

Note: households pay more for the electricity distribution networks, than for electricity itself; (also without solar panels).



+ Shipping, aviation and feedstock

Source: Gasunie Survey 2050

Sustainable gases and gas infrastructure are needed to minimize the transition costs

- The claim of 'electrifying everything' is doubtful
  - Most studies end up with 35-40% electrification; up from 18% now
  - The costs of electricity transport, distribution and storage drive up energy transition costs and will ultimately pose the energy transition at risk.
  - Note: average CO2 emissions from electricity are still 250% of natural gas.

- A CO2-free system with gas infra requires CO2 free gases:
  - Biomass has to play an important role
  - Scaling up green gas production from (imported) biomass
    - Including CCS to achieve at negative emissions
  - Around 2025/2030, hydrogen from offshore wind (or desert-solar) may start to compete

Gasunie has proposed to develop, with partners, a national H2-system, including the development of a national H2-infrastructure by 2030

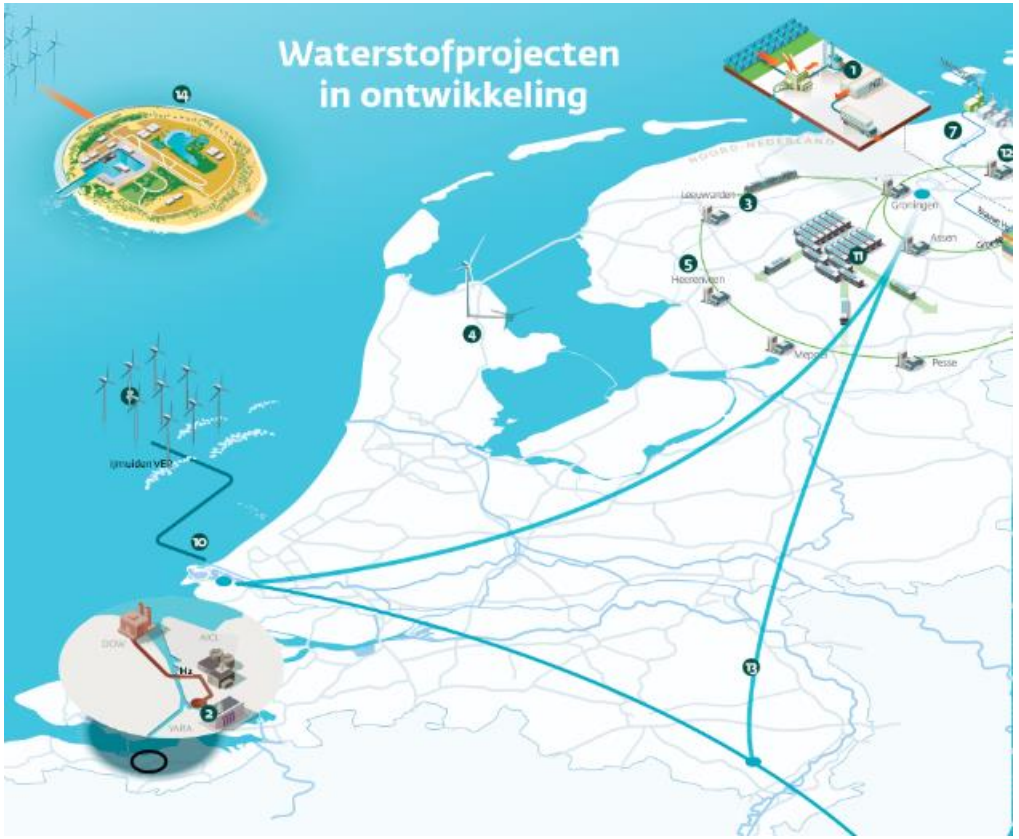
Since creating an economy with hydrogen as energy carrier will not occur automatically, since there is a need for:

1. System approach

2. Learning curves

3. Economies of scale

4. Market development



Analogy to the development of the natural gas market