

# Safety Aspects of the Energy Transition



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# About NIPV

- ▶ Netherlands Institute for Public Safety
- ▶ Public organisation
- ▶ Knowledge and education centre
- ▶ Supports Dutch emergency service organisations (organised in 25 security regions) with:
  - ▶ Expertise / know how
  - ▶ Scientific and applied research
  - ▶ Education / training
- ▶ One of the main themes: Safety aspects of the energy transition



# Energy transition

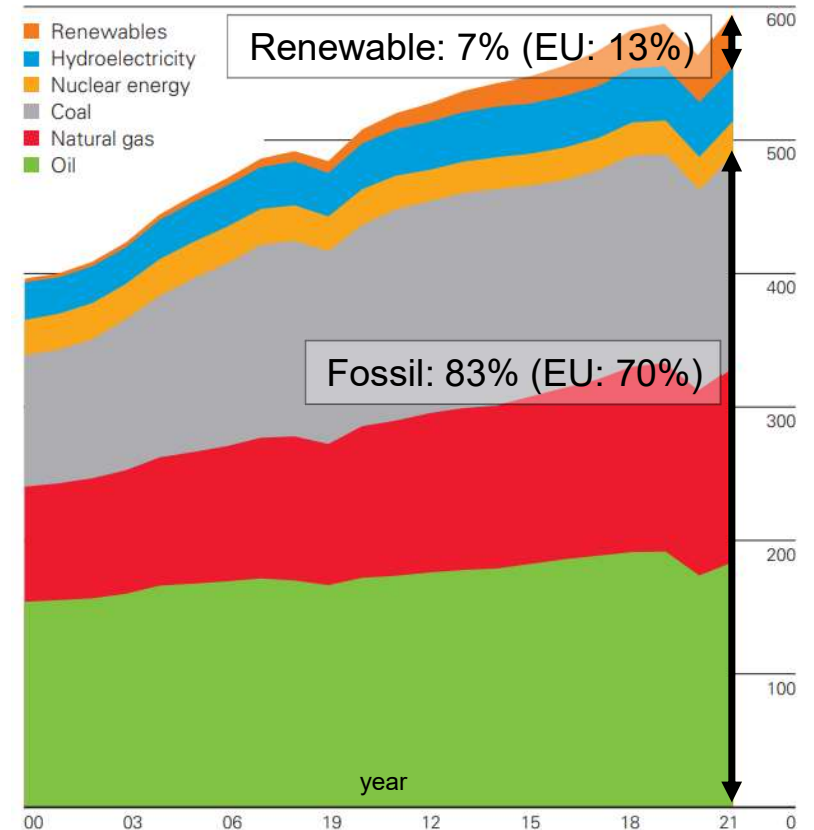
- ▶ Drive: Stop climate change / temperature rise:
  - ▶ CO<sub>2</sub> emission down (EU: no net emissions by 2050)
  - ▶ Replace fossil energy sources with renewable sources



source: [topsectorenergie.](https://topsectorenergie.nl)

## World consumption

Exajoules



source: [Statistical Review of World Energy 2022 \(bp.com\)](https://www.bp.com/statisticalreview)

# Energy transition topics at NIPV

## Research Topics:

- ▶ CO<sub>2</sub>
- ▶ Geothermal energy
- ▶ Biomass
- ▶ Hydrogen (H<sub>2</sub>)
- ▶ Ammonia (NH<sub>3</sub>)
- ▶ Wind energy
- ▶ Solar Panels (PV)
- ▶ Li-ion Home / EV Batteries / Energy storage systems

## Research focus:

- ▶ Risk Management
- ▶ Public Safety
- ▶ Incident Handling



# CO<sub>2</sub>

## ▶ Application

- ▶ Carbon Capture, Storage and Usage (CCS&U)
- ▶ Transport pipelines: to underseas storage areas and to greenhouses

## ▶ Safety risks:

- ▶ Replaces oxygen (suffocation)
- ▶ Toxic
- ▶ no smell or taste (not noticed)

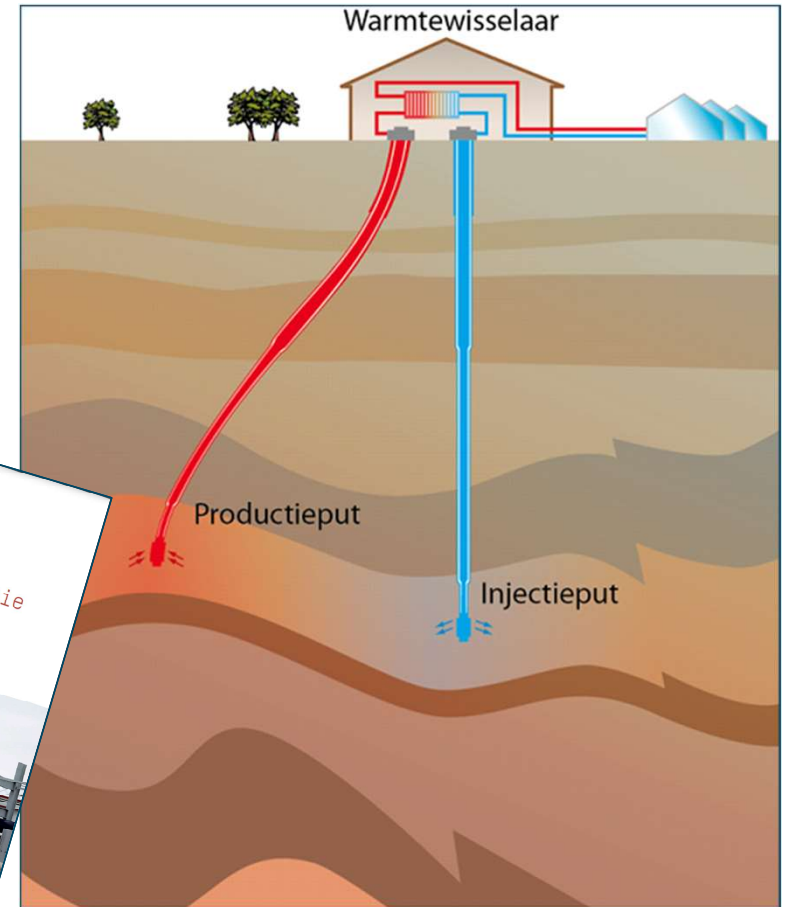


de concurrentiepositie van de huidige industrie versterken (foto: North Sea Port)



# Geothermal Energy

- ▶ Application
  - ▶ heating of house blocks
- ▶ Safety risks:
  - ▶ Vibrations (during construction)
  - ▶ contamination of aquifer
  - ▶ Radioactivity
  - ▶ surface water pollution
  - ▶ release of dissolved gas



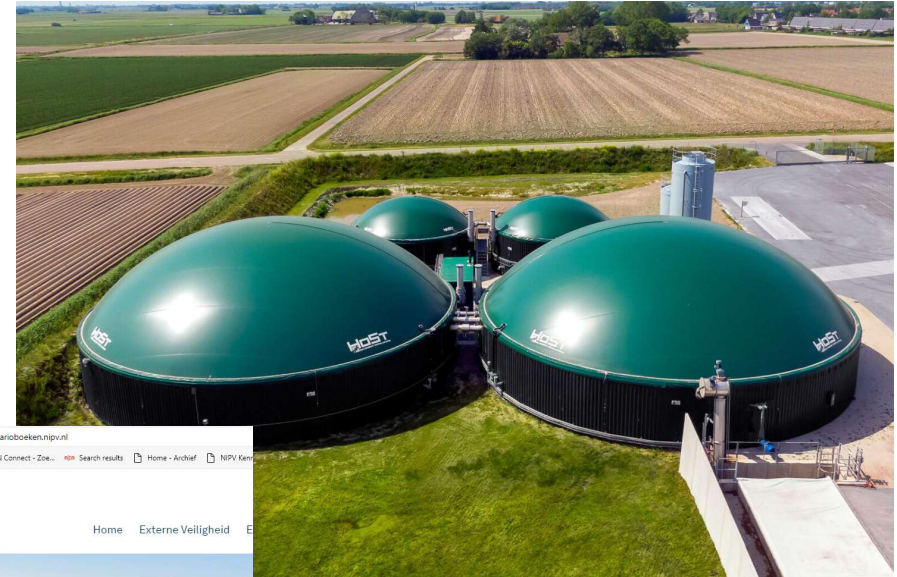
# Wind Energy

- ▶ Application
  - ▶ Electric energy generation
- ▶ Safety risks:
  - ▶ full blade brakes off
  - ▶ tower falls over
  - ▶ Ice shedding
  - ▶ fire (in generator)



# Biomass

- ▶ Application
  - ▶ Gas (methane) generation from waste / manure
- ▶ Safety risks:
  - ▶ flammable
  - ▶ explosion
  - ▶ intoxication / suffocation



[Home - Scenarioboeken \(nipv.nl\)](https://scenarioboeken.nipv.nl)



# Hydrogen (H<sub>2</sub>)

- ▶ Application
  - ▶ H<sub>2</sub>-gas generation, storage and use
- ▶ Safety risks:
  - ▶ torch (jet) fire
  - ▶ explosion of accumulated gas – overpressure / heat



# Ammonia (NH<sub>3</sub>)

- ▶ Application
  - ▶ (long distance) transport of H<sub>2</sub> (easier to transport than H<sub>2</sub>)
- ▶ Safety risks:
  - ▶ Toxic
  - ▶ (flammable)



# Solar Panels (PV)

- ▶ Application
  - ▶ Electric energy generation
- ▶ Safety risks:
  - ▶ fire
  - ▶ electrocution
  - ▶ roof collapse
  - ▶ detachment of PV panels in wind
  - ▶ dispersion and deposition of (silicium) shards

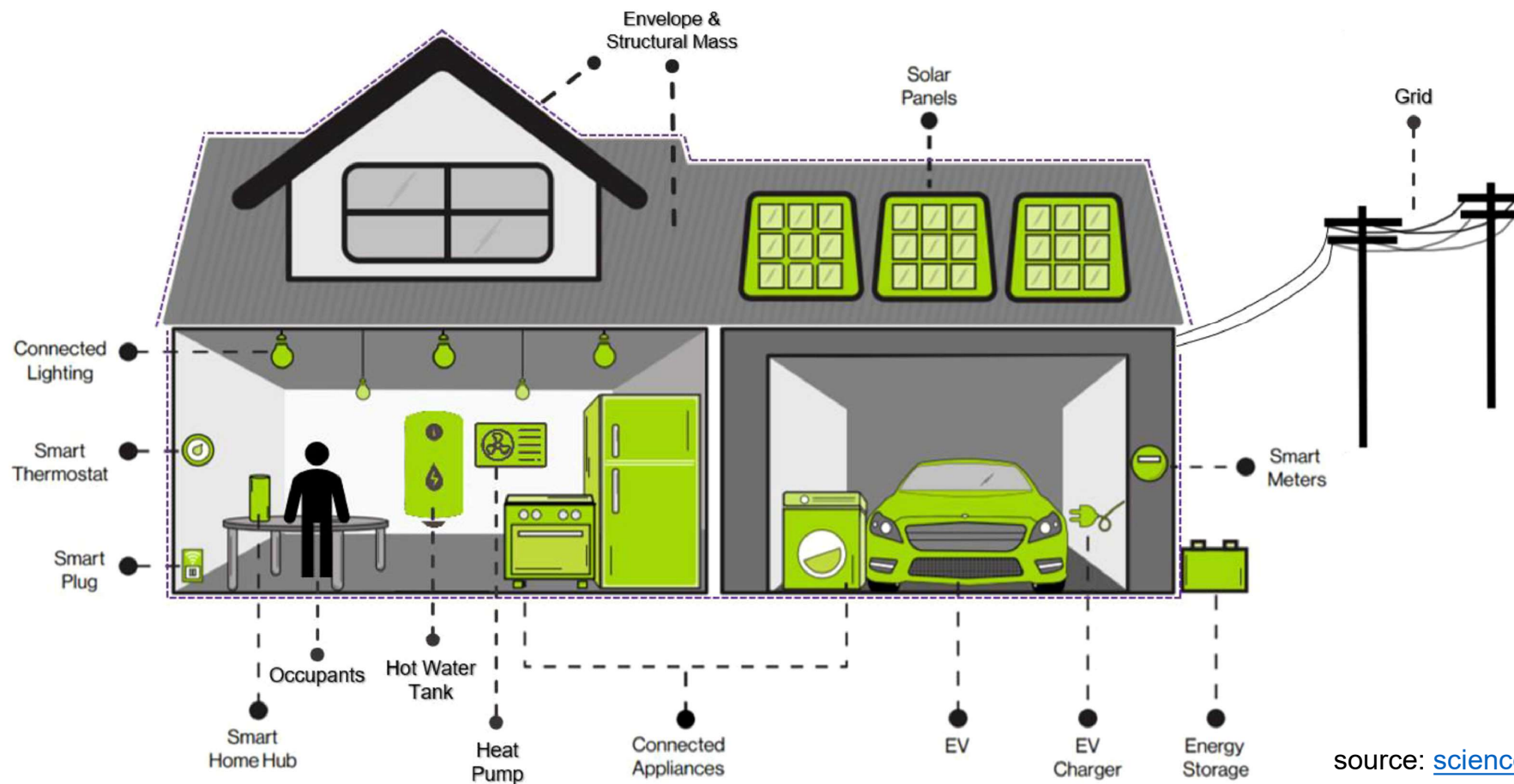


# Li-ion Batteries

- ▶ Application
  - ▶ Electric energy storage
- ▶ Safety risks:
  - ▶ thermal run-away (fire)
  - ▶ flammable gas (explosion)
  - ▶ toxic gas
  - ▶ electrocution



# Home as an energy hub (PVs EVs, LI-ion batteries)



source: [sciencedirect](https://www.sciencedirect.com)

# Home as an energy hub (PVs EVs, LI-ion batteries)

- ▶ Higher currents than anticipated during design
- ▶ under-dimensioned fuse box
- ▶ multi-directional currents
- ▶ home-owner is both energy provider and consumer (incapacitated operator, guided by commercial smart apps)
- ▶ power company loses control – sub optimisation – unbalance - unreliability



source: [sciencedirect](https://www.sciencedirect.com)

# Energy transition and safety (worries)

- ▶ Much enthusiasm for the energy transition exists. However:
- ▶ New technologies lead to unknown risks (unknown incident scenarios, causes and effects)
- ▶ New (commercial) players appear on the market with no safety awareness or experience
- ▶ Risks associated with industrial processes are introduced in domestic domain (private houses) – citizens become process operators
- ▶ to prevent losing momentum, we might turn a blind eye to possible risks for domestic environment, for emergency services and public in general
- ▶ There are no regulations yet

# Energy transition and safety (to make it work)

- ▶ Despite the “rush to save the planet” the energy transition should be done safely
- ▶ Attention should be paid (research) to product requirements, risk management, spatial planning, environmental safety, building and installation permits and incident response
- ▶ This requires action from all stakeholders:
  - ▶ from production through logistics to retail/consumer,
  - ▶ and from regulatory (international and national) and regional (preparatory) authorities to local (emergency) responders.



**Thank you for your attention**