

# Unlocking Energy Hubs: A strategic roadmap for Hydrogen-Enabled Flexibility

## Context and problem

The rapid growth of renewable energy in the Netherlands is severely limited by grid congestion. Electricity networks cannot expand quickly enough, leading to delays and curtailment of renewable energy. Reinforcing grid capacity is expensive and time-consuming, creating a growing bottleneck for the energy transition.

## Energy Hub as a Solution

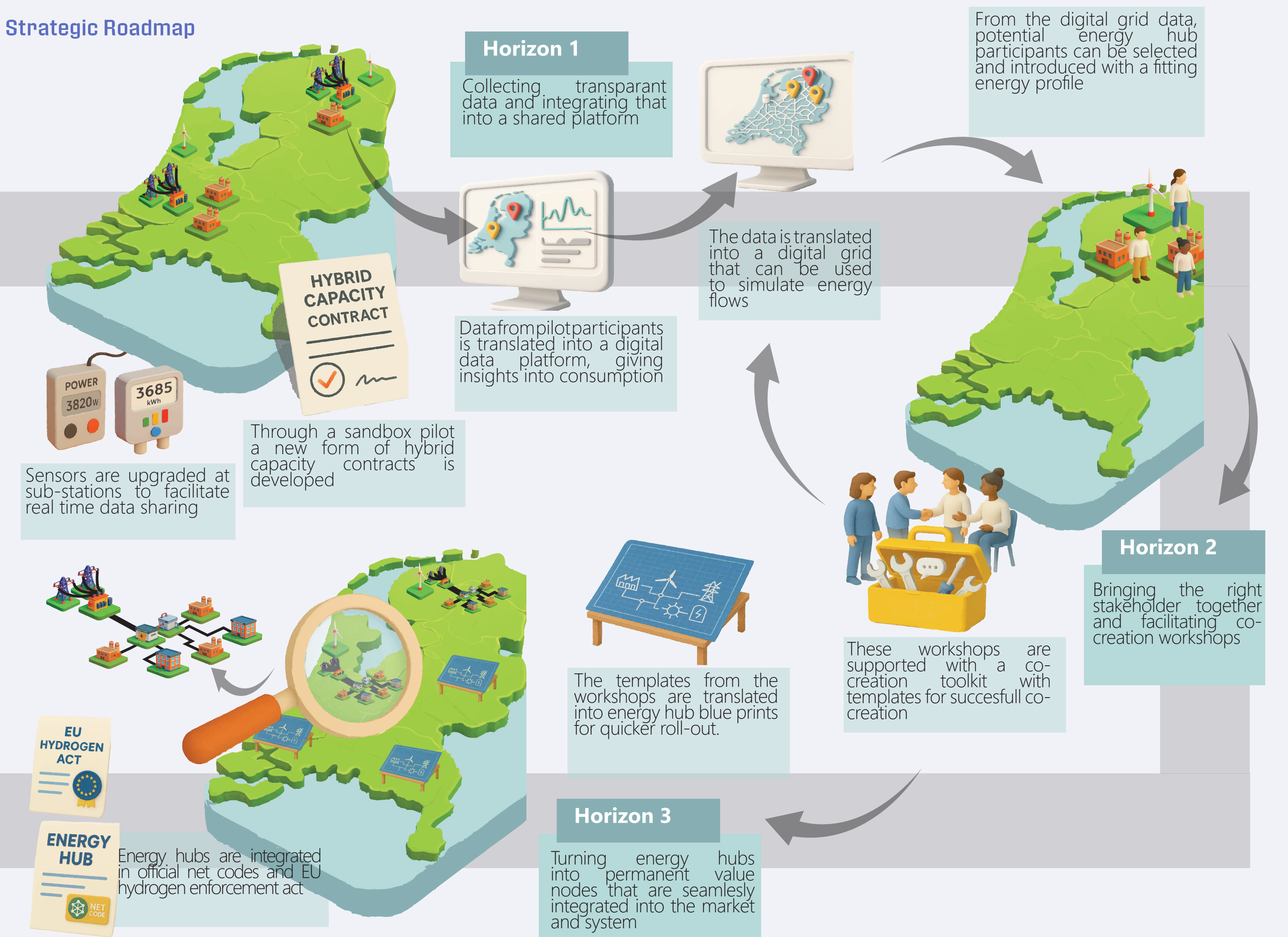
Energy Hubs offer a local, integrated solution by combining renewable generation, flexible storage, and conversion technologies, including hydrogen. These hubs can balance local energy flows, relieve grid congestion, and connect energy sectors. However, their large-scale deployment faces significant uncertainties in technology, regulation, operation and stakeholder cooperation.

## Key take aways

Through a strategic design process and stakeholder co-creation, several key success elements for energy hub implementation emerged.

- Real-time data sharing between stakeholders
- Hybrid Contracts combining flexibility services with stable revenue
- Transparent risk-sharing frameworks
- Participatory governance for decision making
- Staged development to learn and adapt.

## Strategic Roadmap



## Conclusions

- Energy hubs can relieve Dutch grid congestion by integrating renewables, storage, and hydrogen.
- Hydrogen enables seasonal and cross-sector flexibility but needs policy consistency and social acceptance.
- Large-scale hubs face uncertainties in regulation, market design, and stakeholder cooperation.
- A staged, participatory roadmap supports joint decisions, using real-time data, hybrid contracts, and transparent risk-sharing.
- Energy hubs will only succeed if treated as socio-technical systems combining technology with stakeholder alignment.

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