European Commission

Clean energy for EU islands Forum 2024

The specific challenges of energy communities and cooperatives on islands

BluEnergy Revolution

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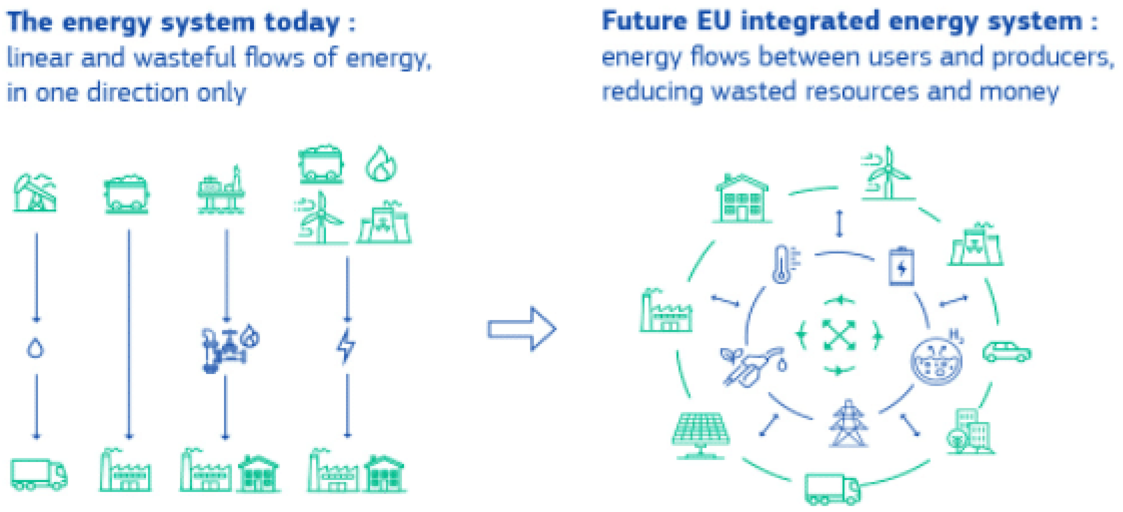
ENERGY COMMUNITIES OPPORTUNITIES/CHALLENGES IN ISLANDS

Sector coupling can contribute to the cost-efficient decarbonisation of the energy system, by valuing synergy potentials and interlinkages between different parts of the energy system. The European Commission understands sector coupling as a strategy to provide greater flexibility to the energy system so that decarbonisation can be achieved in a more cost-effective way



Different vector… different energy communities?

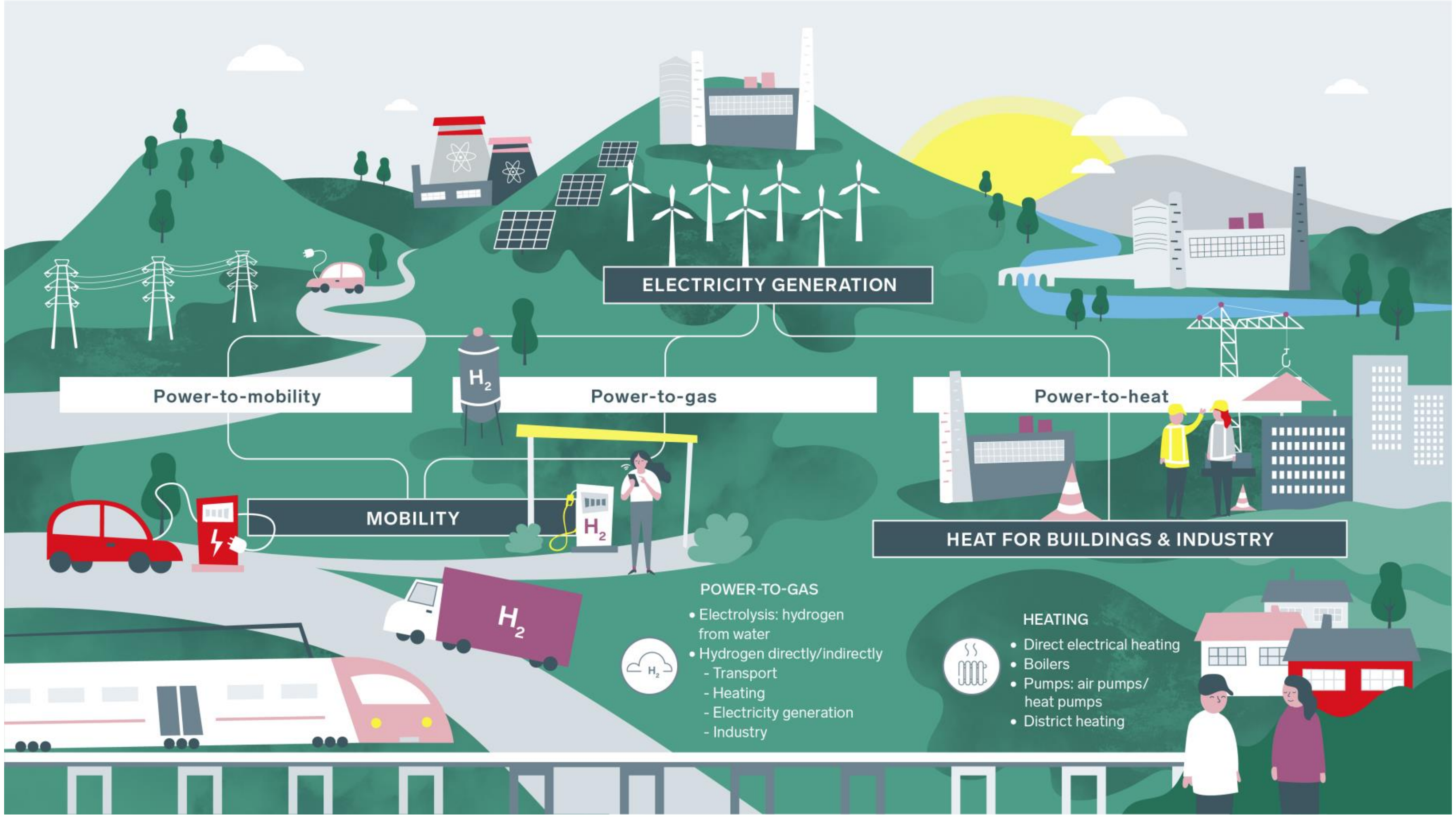
How to remunerate them?

TRACK THE PRIMARY ENERGY OR THE LOCAL RES PRODUCTION!

Maximisation of energy local self-consumption via sector coupling

https://www.europarl.europa.eu/RegData/etudes/STUD/2018/626091/IPOL_STU(2018)626091_EN.pdf

ENERGY COMMUNITIES OPPORTUNITIES/CHALLENGES IN ISLANDS



…but which vector on the islands? Which Markets are already in place?

ENERGY COMMUNITIES OPPORTUNITIES/CHALLENGES IN ISLANDS

CAPEX 25-35%

OPEX *(different than electricity)* 5-10%

OPEX *(electricity)* 40-50%

TRANSPORT/DISTRIBUTION OF THE H2* 15-20%

An opportunity for power-to-hydrogen for sure....

*transportation at local level via trailers – not considering transportation from island to mainland

ENERGY COMMUNITIES OPPORTUNITIES/CHALLENGES IN ISLANDS

Case Study: 1 MW of PEM Electrolysis for Green H2 on Island

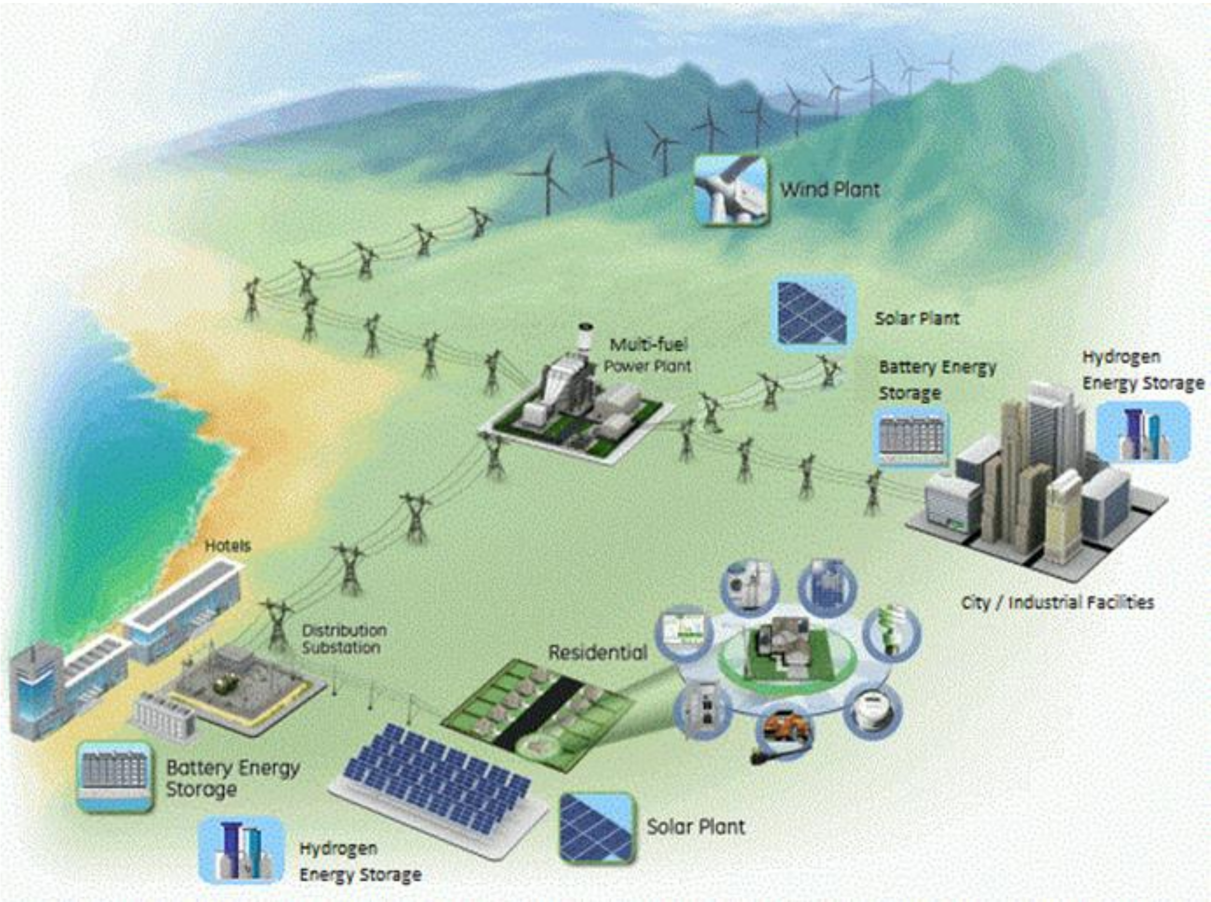
CAPEX: 2,415 M€ (Turnkey – H2 Storage and small buffer Battery integrated)

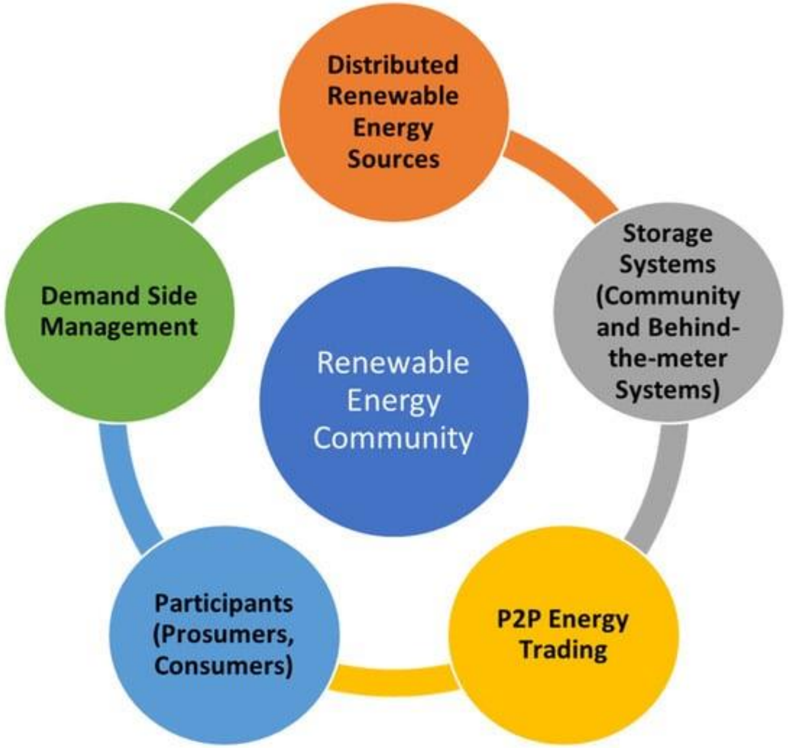
TAKING ADVANTAGE OF ITALIAN INCENTIVATION SCHEME: 100 €/MWh if locally self-consumed

COUPLING WITH PV	1800 EOH *(typical PV production of Southern Italy Island)*	**With REC incentive:** 3,72 €/kg
		Without REC Incentive: 12,09 €/kg
COUPLING WITH WIND	3000 EOH	**With REC incentive:** 2,17 €/kg
		Without REC Incentive: 7,99 €/kg

An opportunity for power-to-hydrogen for sure from local incentives (if any)....

ENERGY COMMUNITIES OPPORTUNITIES/CHALLENGES IN ISLANDS





https://www.youtube.com/watch?v=Ofi1aTwQXKQ

Leveraging islanders' sense of ownership: our own energy community, our own energy!

WHATEVER VECTOR IT WILL BE!

Thank you!

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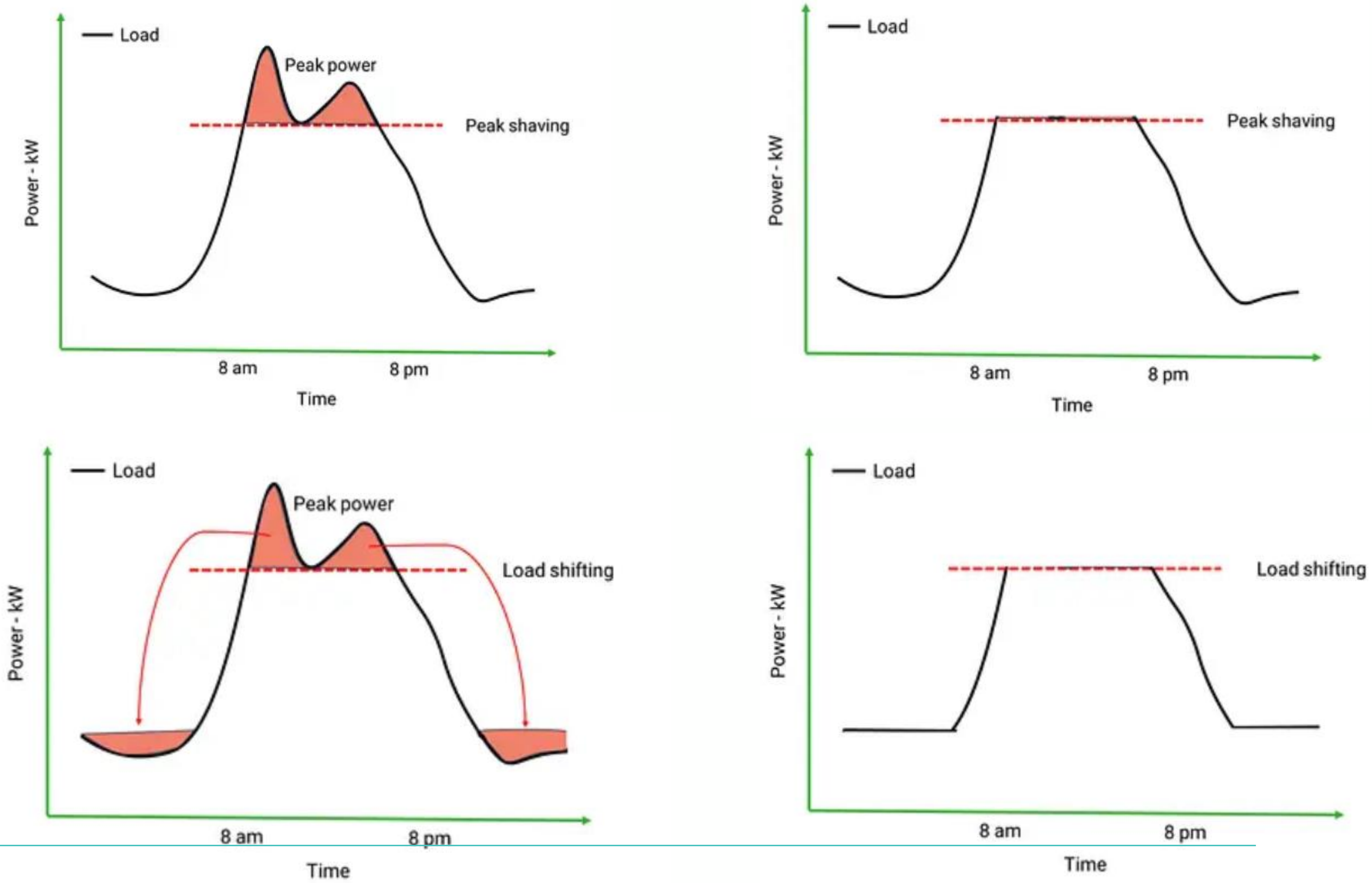
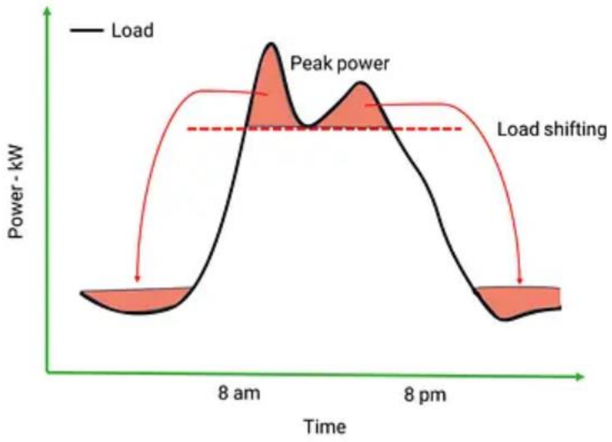
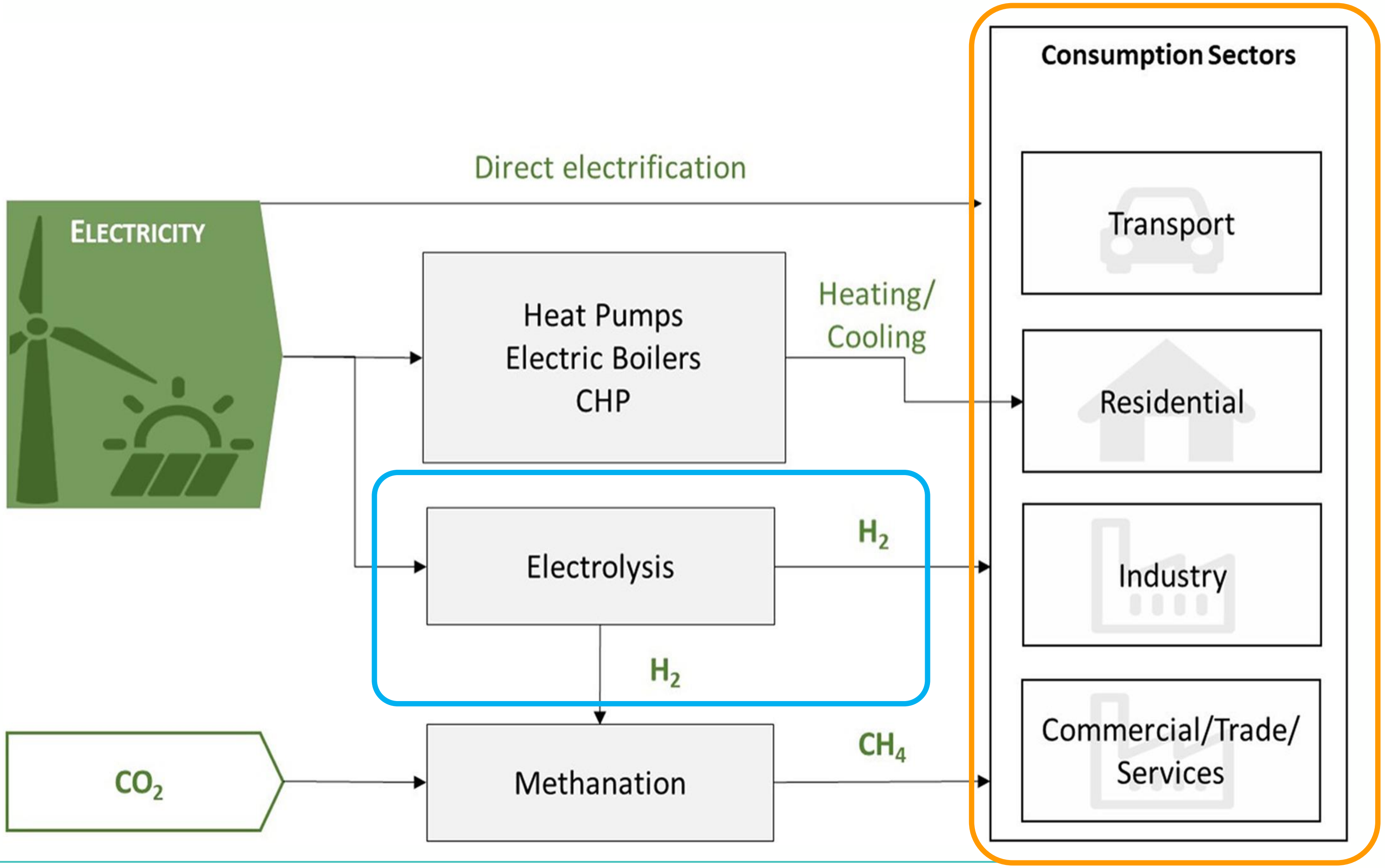
ISLANDS GRID CONNECTION CHALLENGES



H2 SECTOR COUPLING opportunities



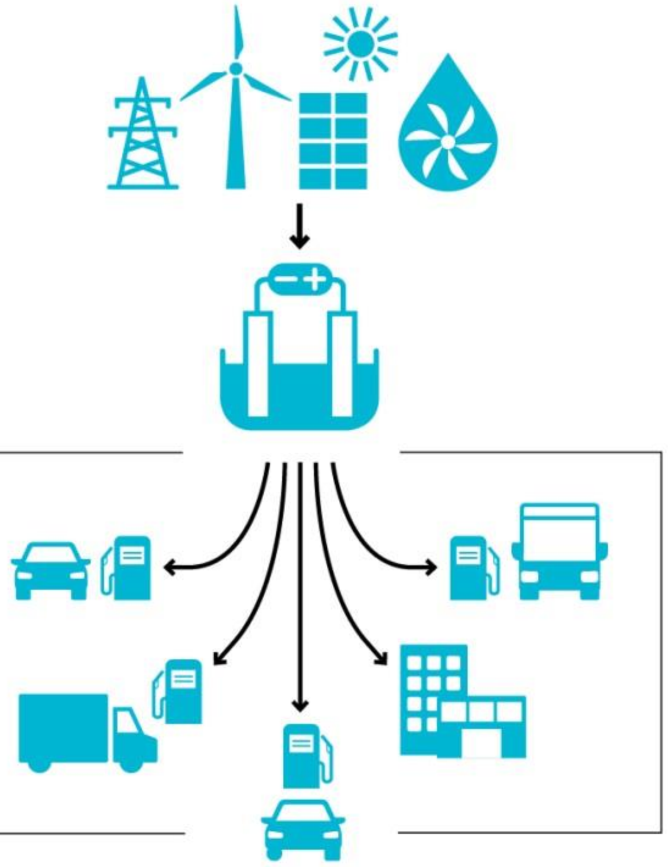


ISLANDS GRID CONNECTION CHALLENGES

Hydrogen Valley archetypes promise near-term commercial business cases

Archetype 1

Local, small-scale & mobility-focused



- Local (green) hydrogen production projects serving mobility applications (esp. semi-captive fleets of buses, cars, trucks, etc.)
- Key focus is on aggregating consumption volumes and sharing refuelling infrastructure (e.g. HRS)
- Legacy of mobility/ electrolyzer demo projects
- Mostly led by public-private initiatives

Source FCH 2 JU, Inycom, Roland Berger

Roland Berger

H2-FUELED VESSELS

Hydrogen application in maritime segment is spreading in several projects, covering a wide range of applications.

Hydrogen demand is foreseen to increase significantly in incoming future due to launching and operation of H2 deploying units.

As example, table below shows some H2-fueled applications already operational. Several more are under construction or in design phase.

Most suitable applications due to technical/economical aspects are:

- Internal water (**ADVANTAGES:** low power need)
- Small working boats (**ADVANTAGES:** predictable demand)
- Pleasure boats (**OPPORTUNITY:** on board genset)

H2 Reference Storage size

Small Yacht / Tender / Prototype [kg]	**10**
Mega Yacht / Commercial Vessel [kg]	**250**

US EXAMPLE – Regulation is a topic particularly for passengers' ferries

Examples of Operational H2 Vessels

NAME	VESSEL TYPE	H2 CAPACITY [kg]	H2 STORAGE	STATUS
BIIM	Port unit	10	MH	Launched
HYNOVA 40	Tender	22	Compressed	In operation
ZEUS	Research vessel	50	MH	In operation
ELECTRA	River Tug Boat	750	Compressed	In operation

Sector Coupling: Power to water

Desalination requires a considerable amount of energy.

Seawater desalination via MSF consumes typically 80.6 kWh of heat energy (290 MJ thermal energy per kg) plus 2.5 to 3.5 kWh of electricity per m3 of water, while large scale RO requires only about 3.5 to 5.0 kWh of electricity per m3

Desalination itself can be seen as a viable option to store renewable electricity, which exceeds the demand.

economic feasibility of desalination depends strongly on local availability and cost of energy (Zejli et al., 2002).

Site-specifi caspects have a significant impact on final costs, including feed-water transportation, fresh water delivery to end-users, brine disposal and size of the plant.

Typical figures for the investment cost of new installed desalination capacity range between **USD 800** and **USD 1500** per unit of capacity (m3/d).

A key issue is the disposal of brine. High salt-content brine is the desalination waste to be disposed of or recycled.

At present, it is mostly discharged into the sea or diluted and sprayed into an open space.

However, the negative impact of brine on the ecosystems and the growing desalination capacity mean that a sustainable solution is needed for disposal and/or brine recycling to avoid environmental impacts

https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2012/IRENA-ETSAP-Tech-Brief-I12-Water-Desalination.pdf

Sector Coupling: Power to Heat

Heat pumps or boilers serve to convert electric power into efficient heating or cooling.

Thermal storage systems enable flexible coupling of power and heat sectors.

Renewable power-to-heat refers to technologies that use renewable electricity to generate useful heat for buildings or industrial processes (i.e. via heat pumps or electric boilers).

Electric boilers use electricity to heat water, which is then circulated through pipes or disseminated with fan coils to provide space heating, or stored in hot water tanks for later use.

Heat pumps use electricity to transfer heat from the surrounding heat sources (air, water, ground) to buildings

Heat pumps can fulfil both heating and cooling requirements by using heat in the ambient air, water or ground as the primary source of energy and a small quantum of auxiliary energy to drive the process.

According to IRENA analysis, heat pumps will play a critical role in the building sector and will increase to over 250 million units by 2050, supplying 27% of the heat demand.

https://www.irena.org/

chiusura dell’intervento

- Power to water
- Power to h2
- Power to mobility

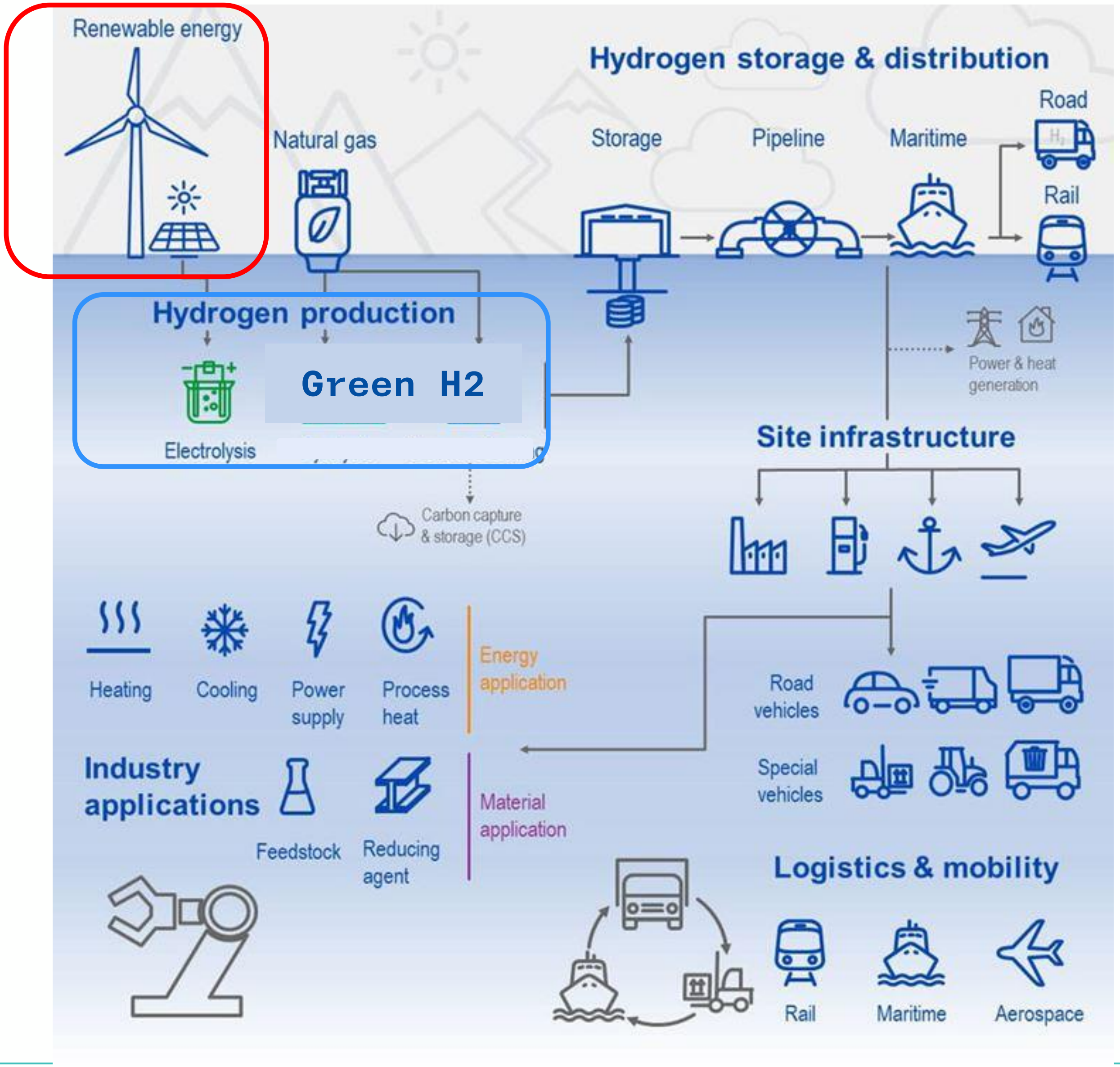
Il sector coupling dell h2 è piu poytente perche non è un sector coupling locale ma va sul mercato gloobale dell H2;

Fare esempio numerico basato su saarema lato wind e PV; stimare produzione annuale;

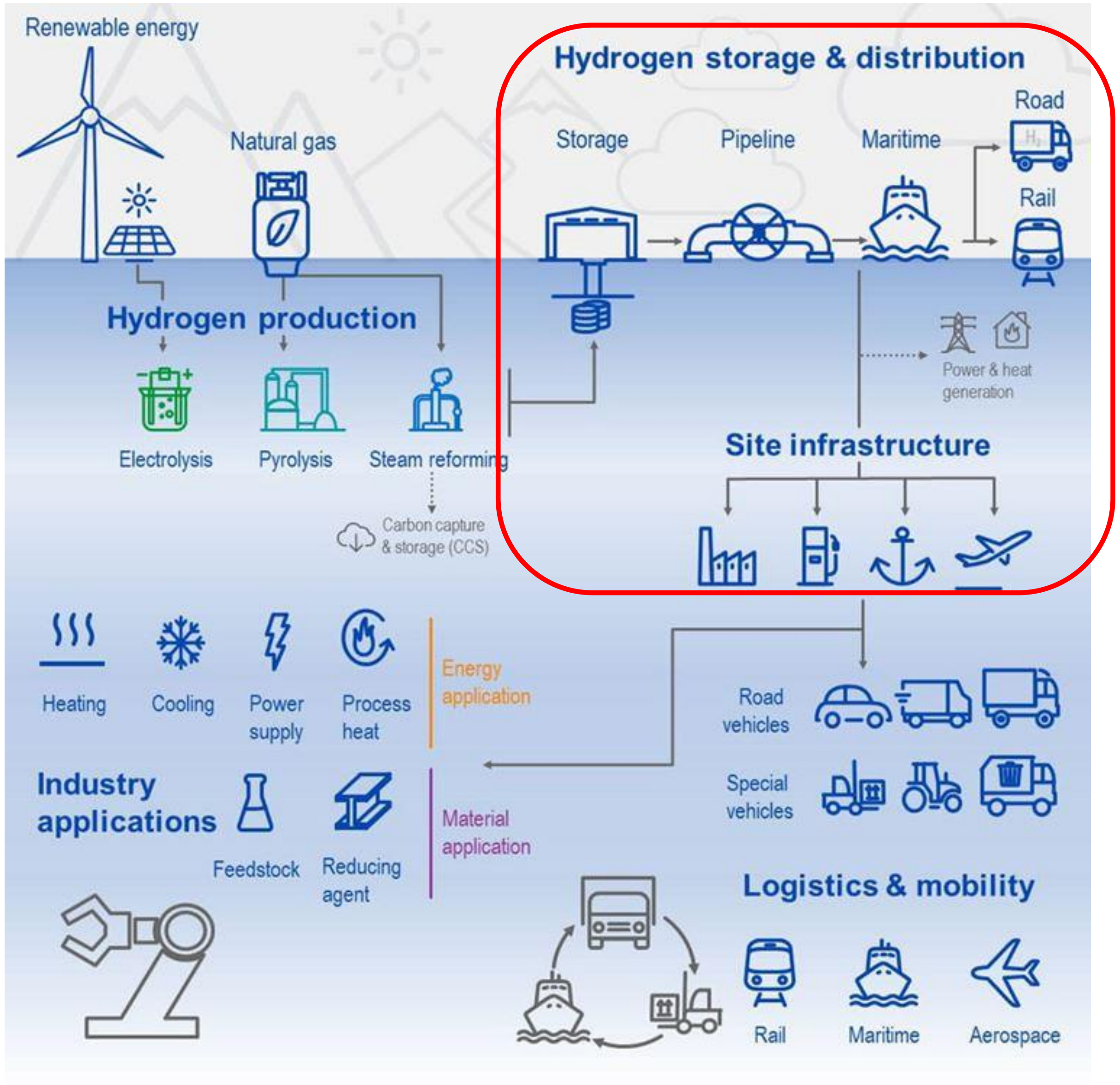
ISLANDS GRID CONNECTION CHALLENGES

- RE surplus amount: MWh
- RE surplus event in time: pattern, predictive, etc
- Storage capacity availability: Mwh,
- Storage availability: SoC
- Energy flow profile: electricity, heat,
- Users community

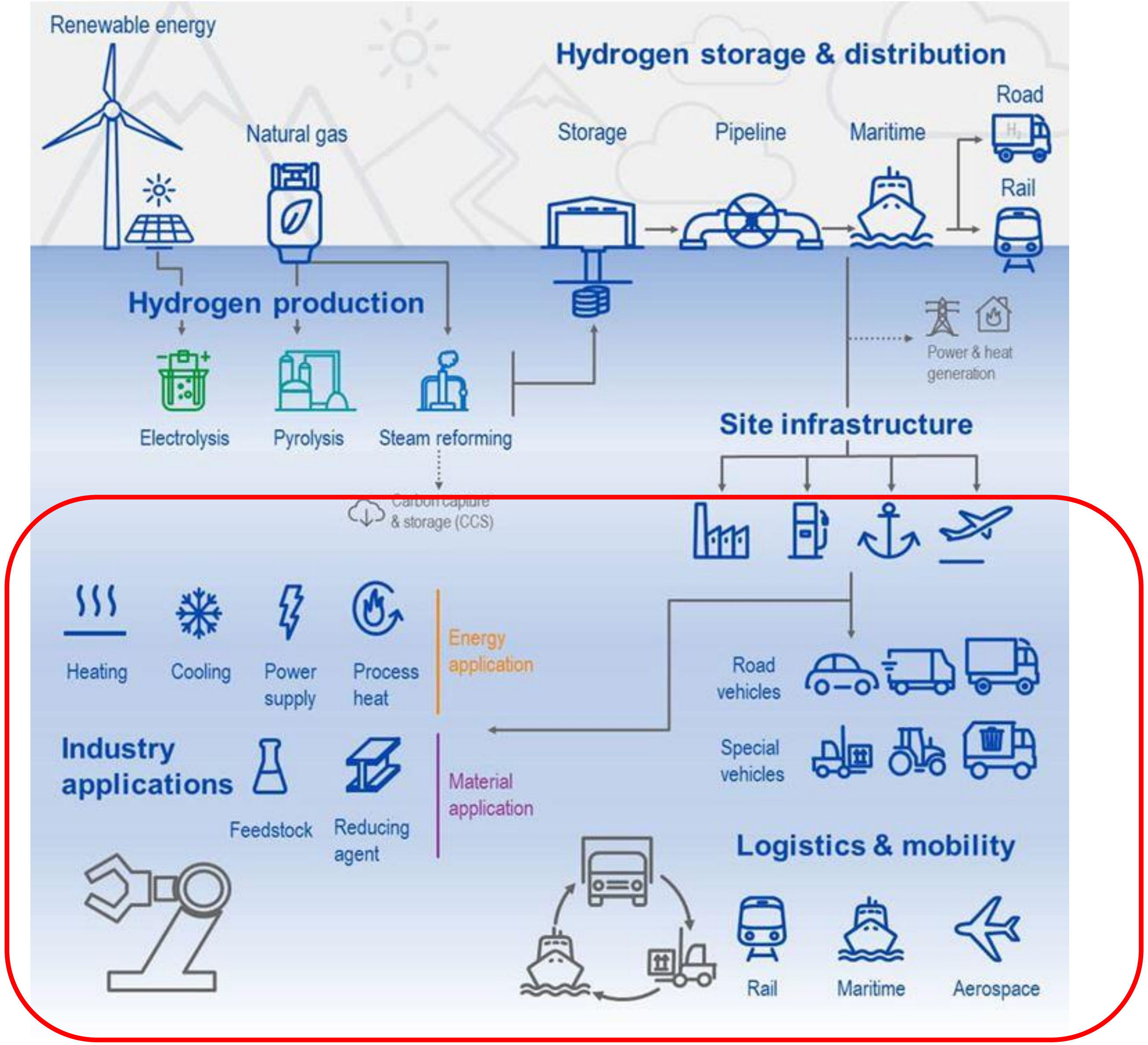
CHALLENGES: renewables generation

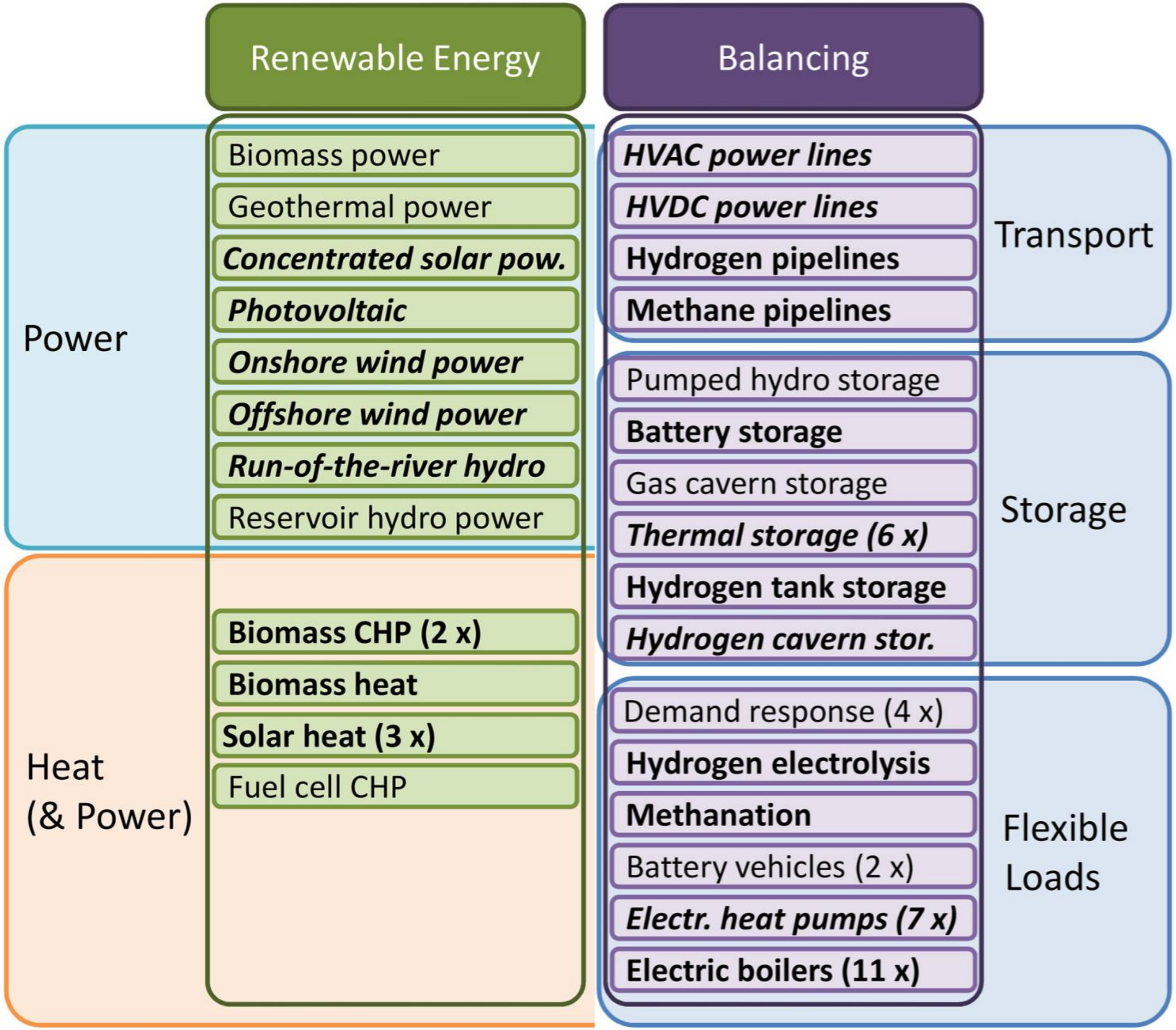


ISLANDS GRID CONNECTION CHALLENGES



CHALLENGES: offtakers/demand side SECTOR COUPLING




Renewable Energy
Balancing
Power
Biomass power
Geothermal power
Concentrated solar pow.
Photovoltaic
Onshore wind power
Offshore wind power
Run-of-the-river hydro
Reservoir hydro power
Heat
(& Power)
Biomass CHP (2 x)
Biomass heat
Solar heat (3 x)
Fuel cell CHP
HVAC power lines
HVDC power lines
Hydrogen pipelines
Methane pipelines
Transport
Pumped hydro storage
Battery storage
Gas cavern storage
Thermal storage (6 x)
Hydrogen tank storage
Hydrogen cavern stor.
Storage
Demand response (4 x)
Hydrogen electrolysis
Methanation
Battery vehicles (2 x)
Electr. heat pumps (7 x)
Electric boilers (11 x)
Flexible
Loads