ENERGY

NEFUSTA

New Energy Vehicles Fuelling Station

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15 October 2018

 DNV GL ©2018

Context

NEFUSTA project (New Energy Vehicles Fuelling Station :

- Partners: HAN Univ. of Appl.Sc., CGI, Dekra, SWECO and DNV GL
- Objective:
  - develop a new fuelling station **concept** that links energy supply for vehicles to **power balancing** of the electricity grid
  - develop a **business case** for this fuelling station
- Supported by the TKI Urban Energy research program (NL)
- Supported by the Clean Mobility Centre in Arnhem, NL

Goal

This project helps to meet the following needs:

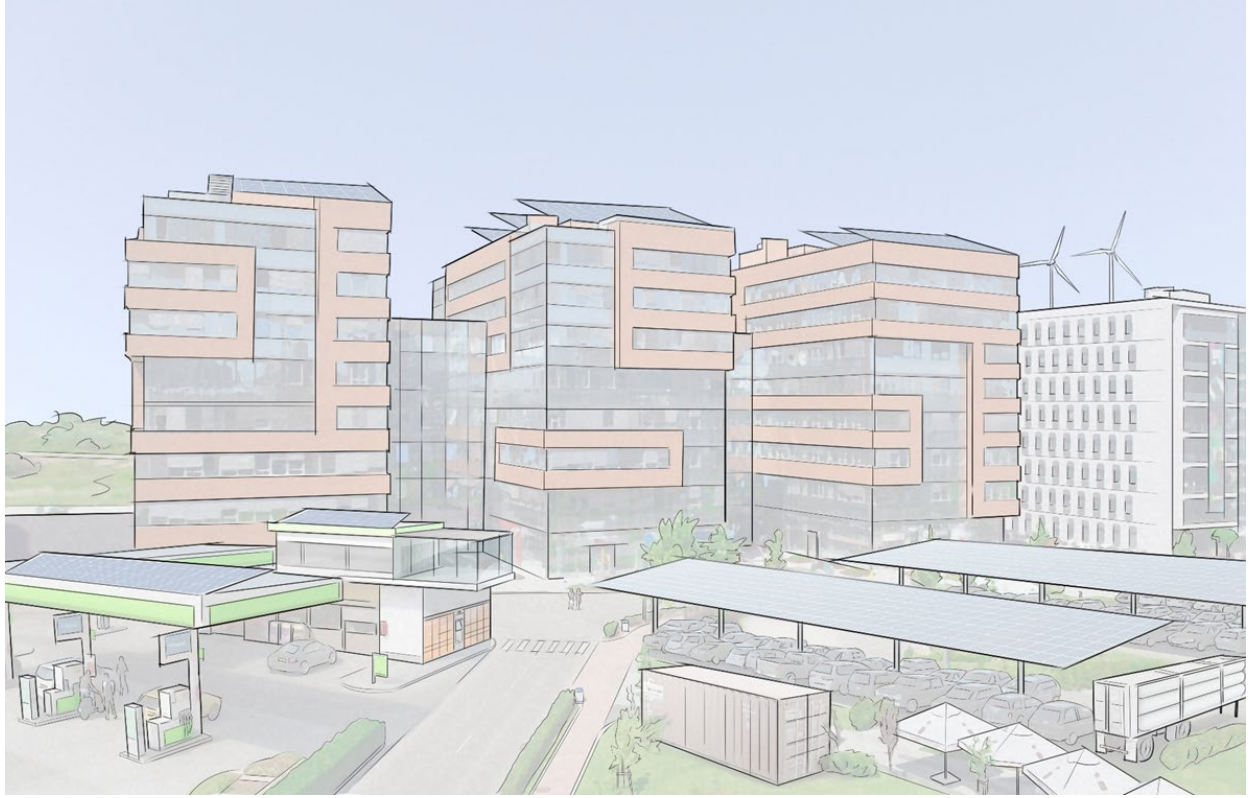
- Large-scale integration of sustainable energy sources
- Large-scale road transport based on sustainable energy carriers requires a new infrastructure for the energy supply of vehicles.

This is done by:

- developing a new concept for a charging station based on existing technology
- illustrate and maximize profitability of the station
- developing tools to roll out the concept

Activities

- Nefusta is primarily aimed at examining the business prospects, not at creating a detailed design of a service station
- Basic engineering is required to determine the business case
- Activities performed are:
  - Stakeholders analysis
  - Regulations and Safety
  - Concept Engineering
    - Concept definition
    - Determine system architecture
    - Risk validation
    - Artist impression
  - Techno-economical analyses
  - Knowledge dissemination



Fuelling station as energy buffer

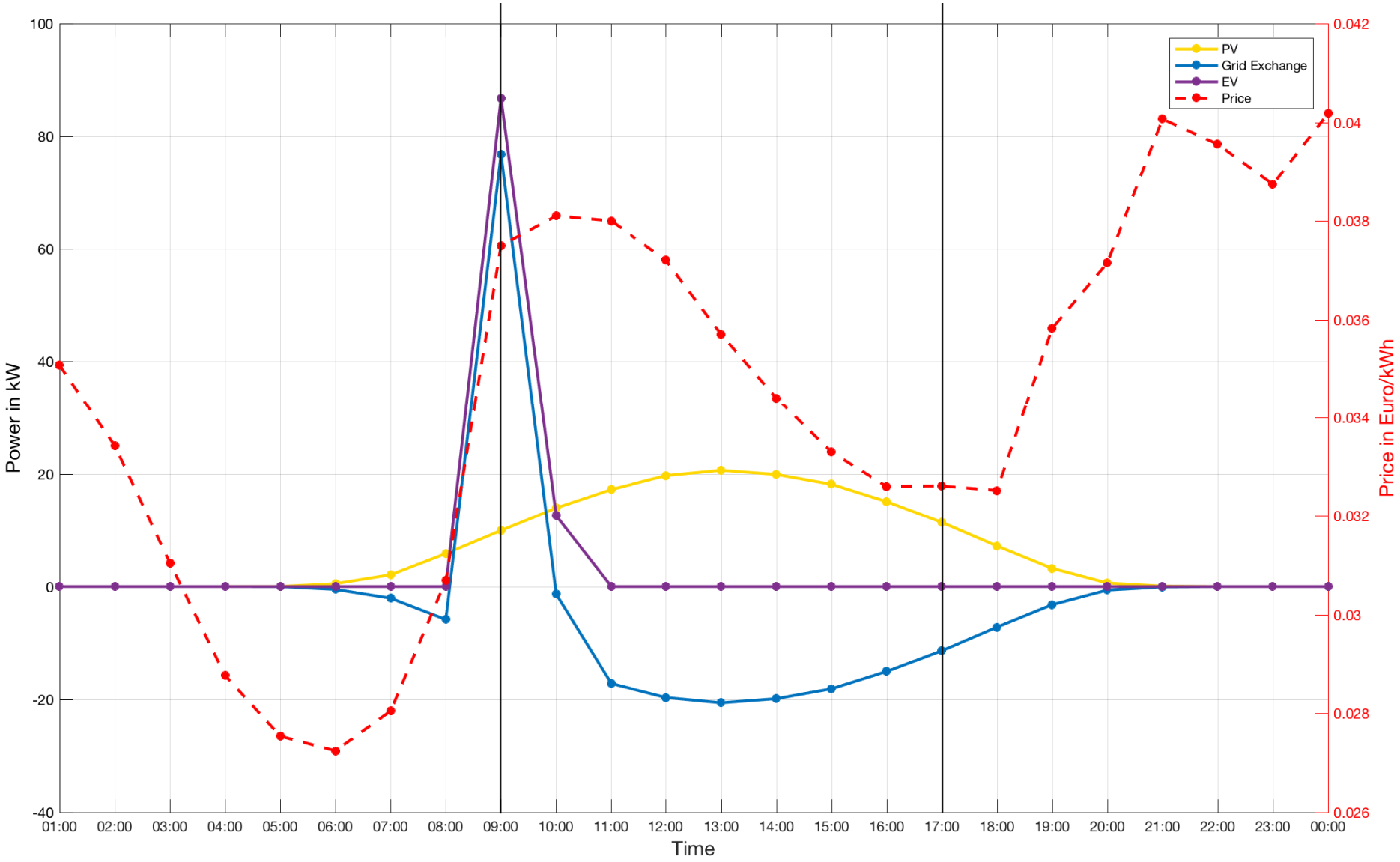
Illustration of amount of energy turned over in a fuelling station:

- Current situation:
  - Dutch car fleet clocks up 13,200,000,000 km annually
  - Number of service station in The Netherlands 4200
  - One average station supplies energy for 27,000,000 km
- Transfer to electricity:
  - Assume
    - Amount of km's remains constant
    - Electricity requirement is 14kWh/100km
  - One average station supplies 3.77 GWh annually
    - Equivalence of electricity consumption of about 1250 Dutch households
    - Electric power appr. 1 MW per station

Need and realisation of buffer function

- Buffer function is needed for large-scale integration of sustainable energy sources with uncontrollable, fluctuating output:
  - Wind energy
  - PV
- Current buffers (pump plants) provide for hours. Days of storage are required
- Nefusta station is one of many required options to extend the buffer function of the electricity infra-structure
- Storage in Nefusta:
  1. Smart charging
  2. Batteries
  3. Hydrogen storage

- Summer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Grid Exchange
EV
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Power in kW
Price in Euro/kWh
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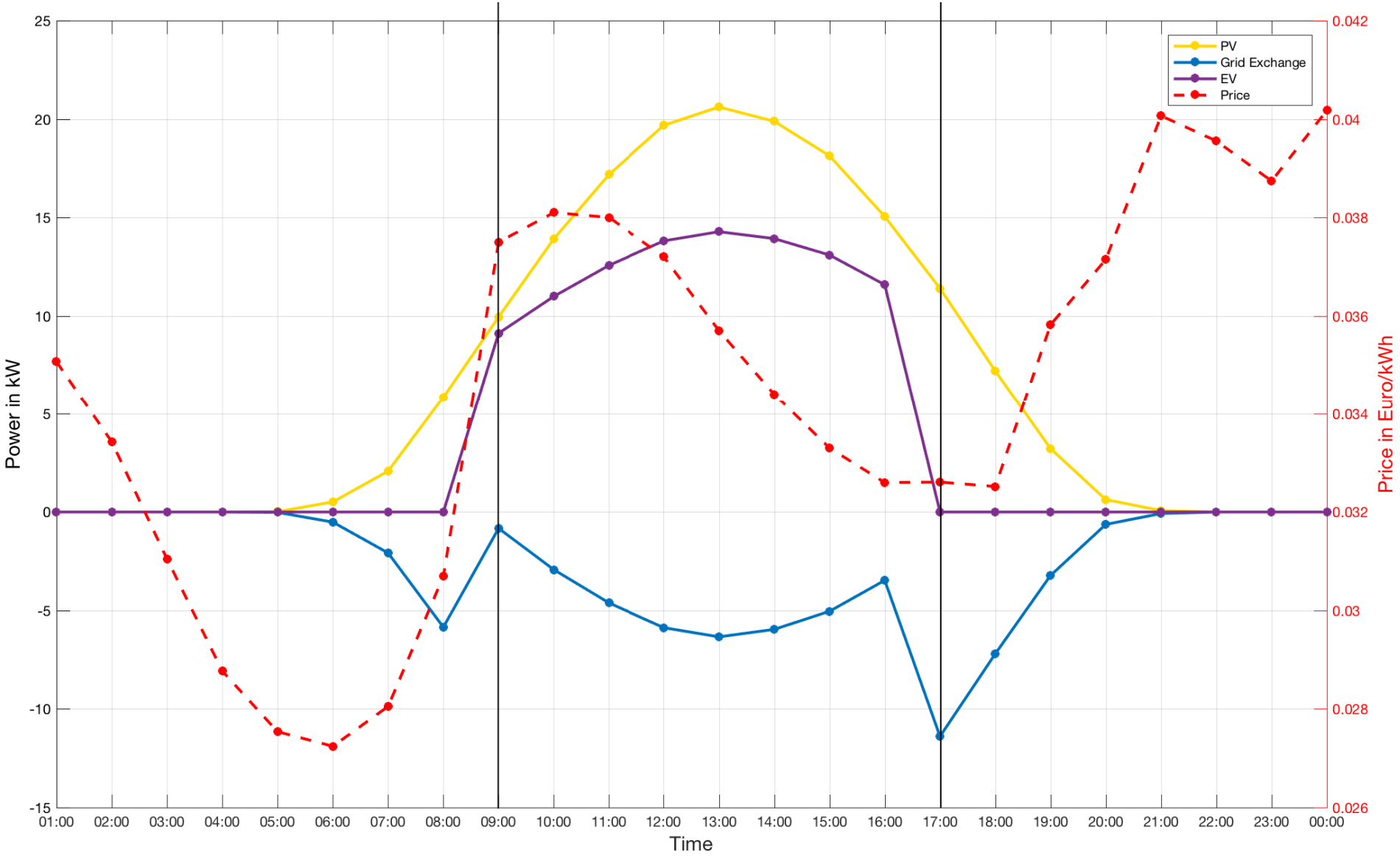
- Summer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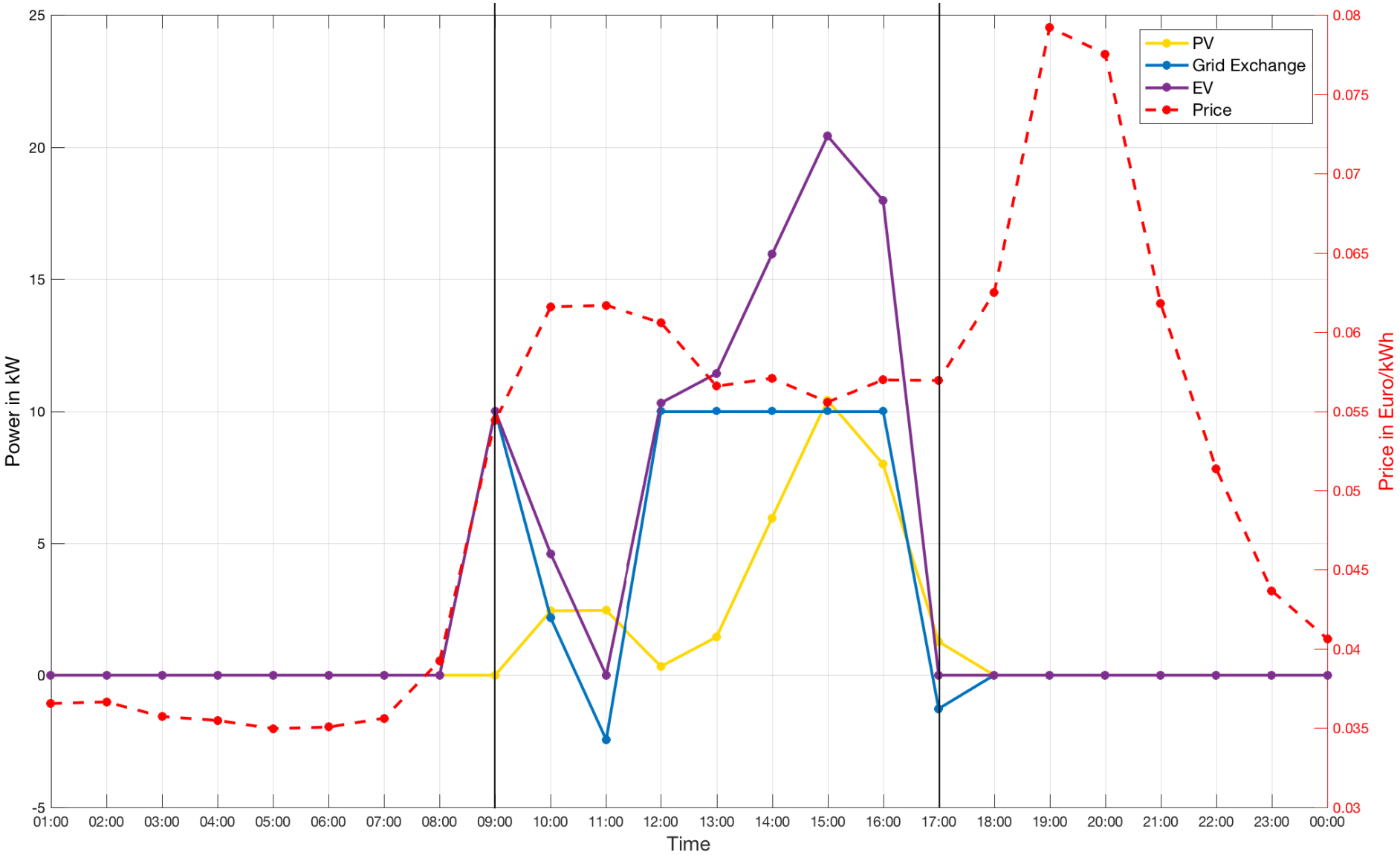
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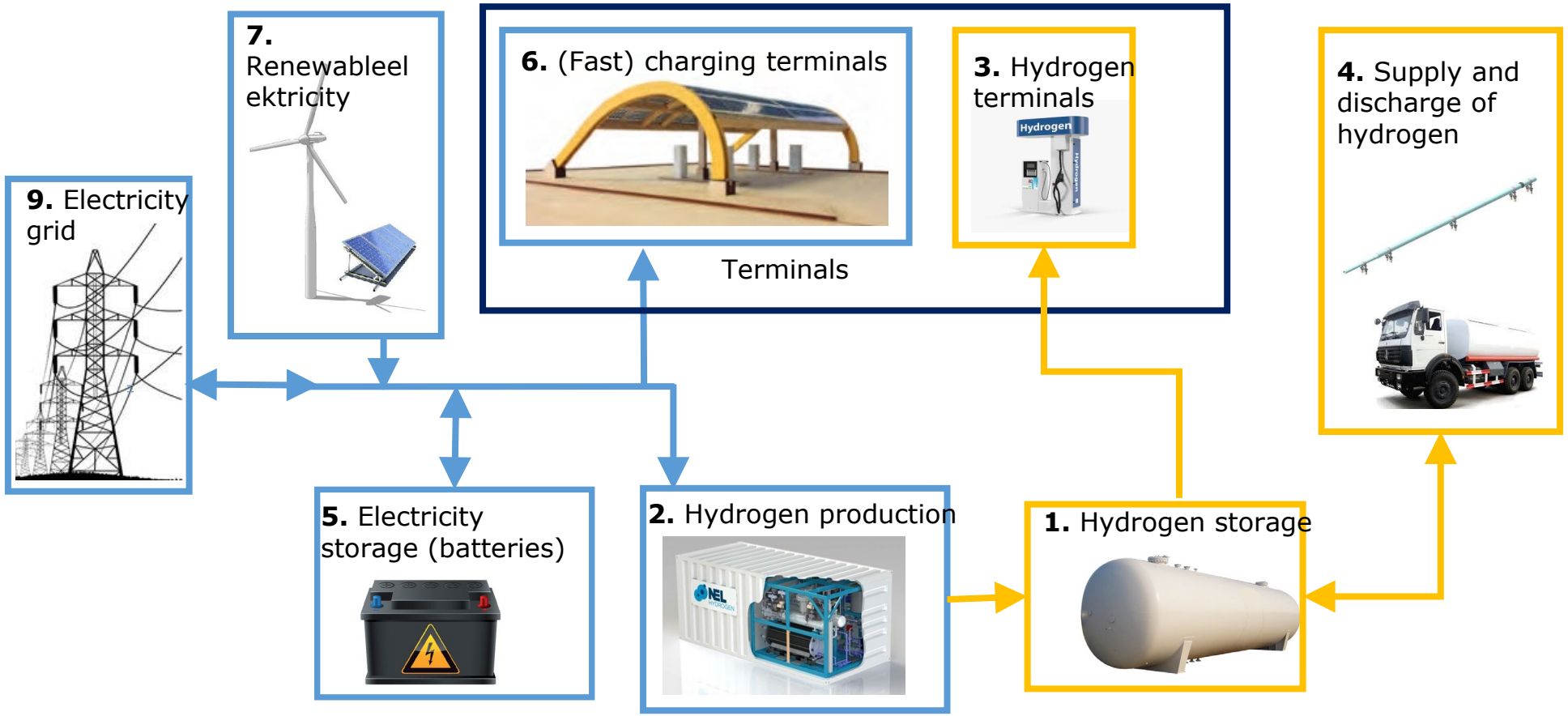
General setup of Nefusta station



Preliminary results

- Stakeholders are being identified:
  - their objectives and rationale were determined
  - key players are incorporated in the project in an advisory role
- Regulations and safety issues are manageable
  - Hydrogen seems favourable compared to LPG from a safety perspective
- Possible configurations for the station were determined

Configurations

- Possible configuration for a NEV station were developed based on: **Fuelling/charging behaviour and presence of vehicles**
  - Charging (80% commuting / 20% alternative)
  - Refuelling hydrogen (more conventional?)
- **Boundary conditions energy supply and risk mitigation of refuelling facilities**
  - Electricity supply of charging stations (slow vs. fast charging)
  - Supply hydrogen (Elektrolysis, trailer or pipeline, risk profiles)
- **Profile of electricity demand** (largest demand during office times, peak around 18:00hr)
- **Supply profile of sustainable energy** (elektricity generation from sustainable sources varies both during a year and during a day)
- **Need for storage**
  - Matching demand and availability
  - Congestion of the electricity network

Configurations Nefusta station

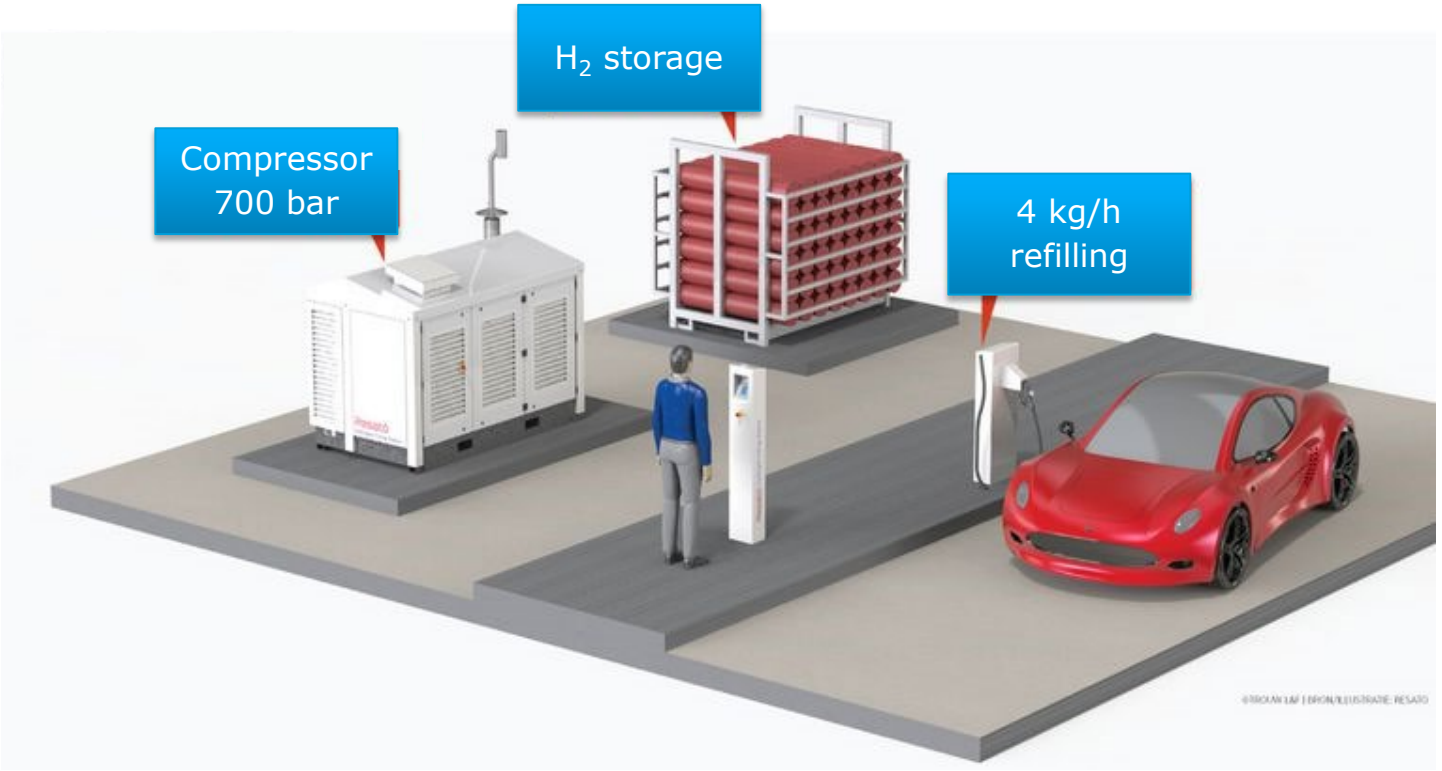
		1. Commercial area (industry or office): charging area and hydrogen	2.Transit Location Fast charging and hydrogen	3. Residential area
Charging	for commuting (80%)	+	-	+
	Remaining (20%)	-	+	+/-
Match between car charging and buffer requirement from grid		+	+/-	-
Utilization rate		+	+/-	+
Applicability of hydrogen		+	+/-	-
Possibility to manipulate charging behaviour		+	-	+
Extra profit station owner - intraday- or imbalance market - Hydrogen production and sale		+	+/-	-
Secondary functions: Drop-off/Pick-up, Shops, Restaurant, Meetings, …		+	+	-

Cost strongly depends on required speed of charging/refuelling

- Electric charging:
  - Standard charging station € 500
  - Fast charger station € 25,000

    Connection to grid not included

- Hydrogen:
  - Station 3 minute refilling € 1,500,000
  - Station 1 hour refilling € 150,000



Remaining activities

- Concept design for a station
- Model station including:
  - Energy flows
  - Added value of processes and/or actions
- Economic analysis:
  - Station setup and size will be optimized for profitability
  - Risk validation of setup
  - Sensitivity analysis will be performed

- Develop Roadmap to full new energy vehicle infrastructure

Conclusion

- Stakeholders are identified
- Regulations and safety issues can be solved
- Possible configurations for the station were determined
- Station at a commercial area seems most promising

NEFUSTA

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