



MESY

Mobility and Energy storage Systems

T H E P O W E R - T O - G A S G R O U P

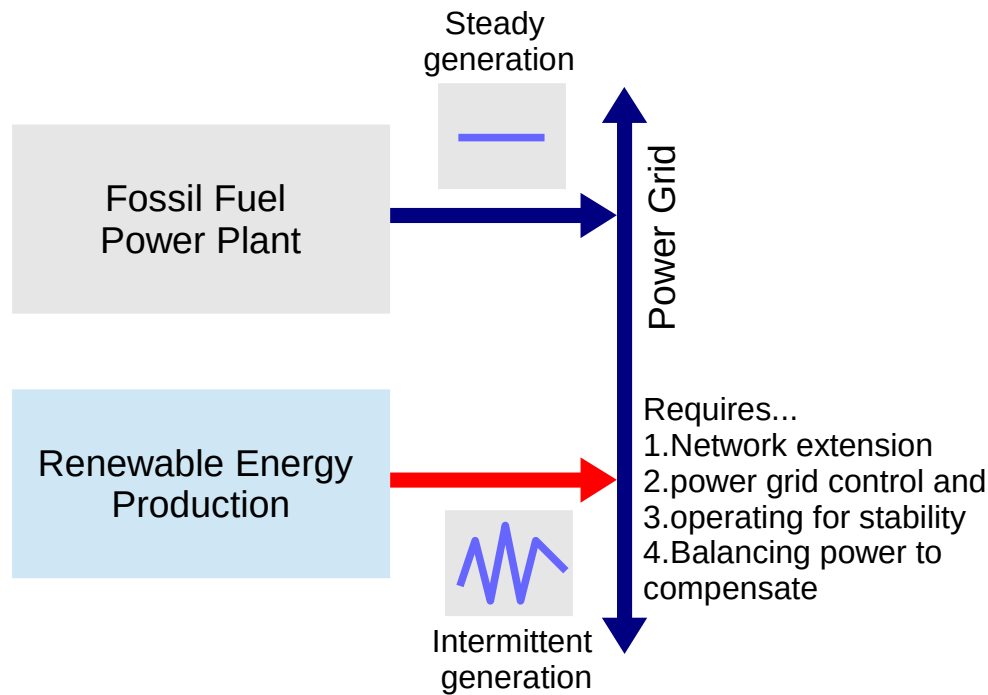
What we do...



New strategy for cost savings of Billions in the Energy Market

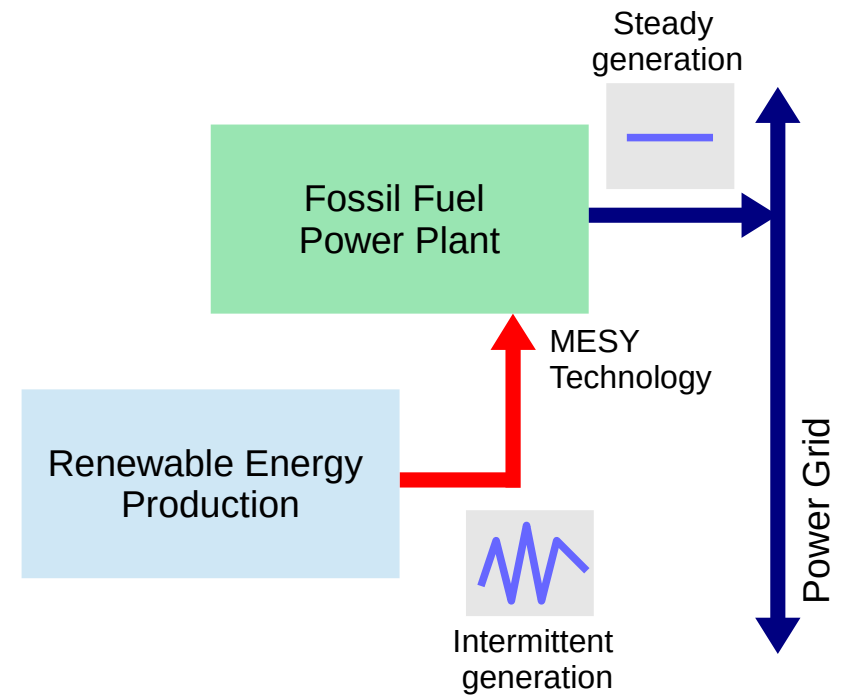
Very expensive and complex.

Requires Billions of Investments to stabilize Power Grids
(e.g. Germany 21 Milliarden €)



Very cheap and simple.

No Investments necessary to stabilize the power grids.



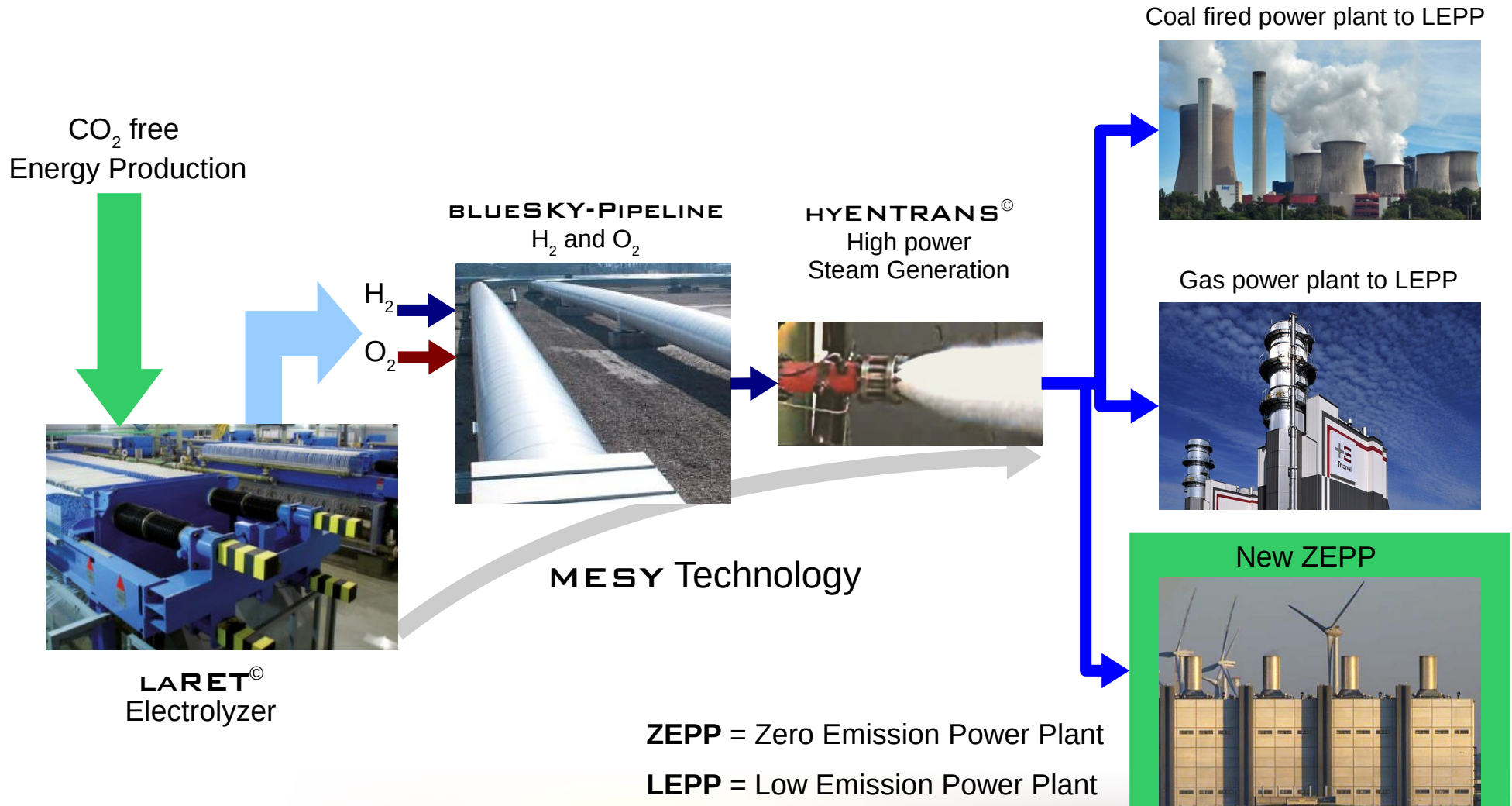
Economy effects for the energy markets

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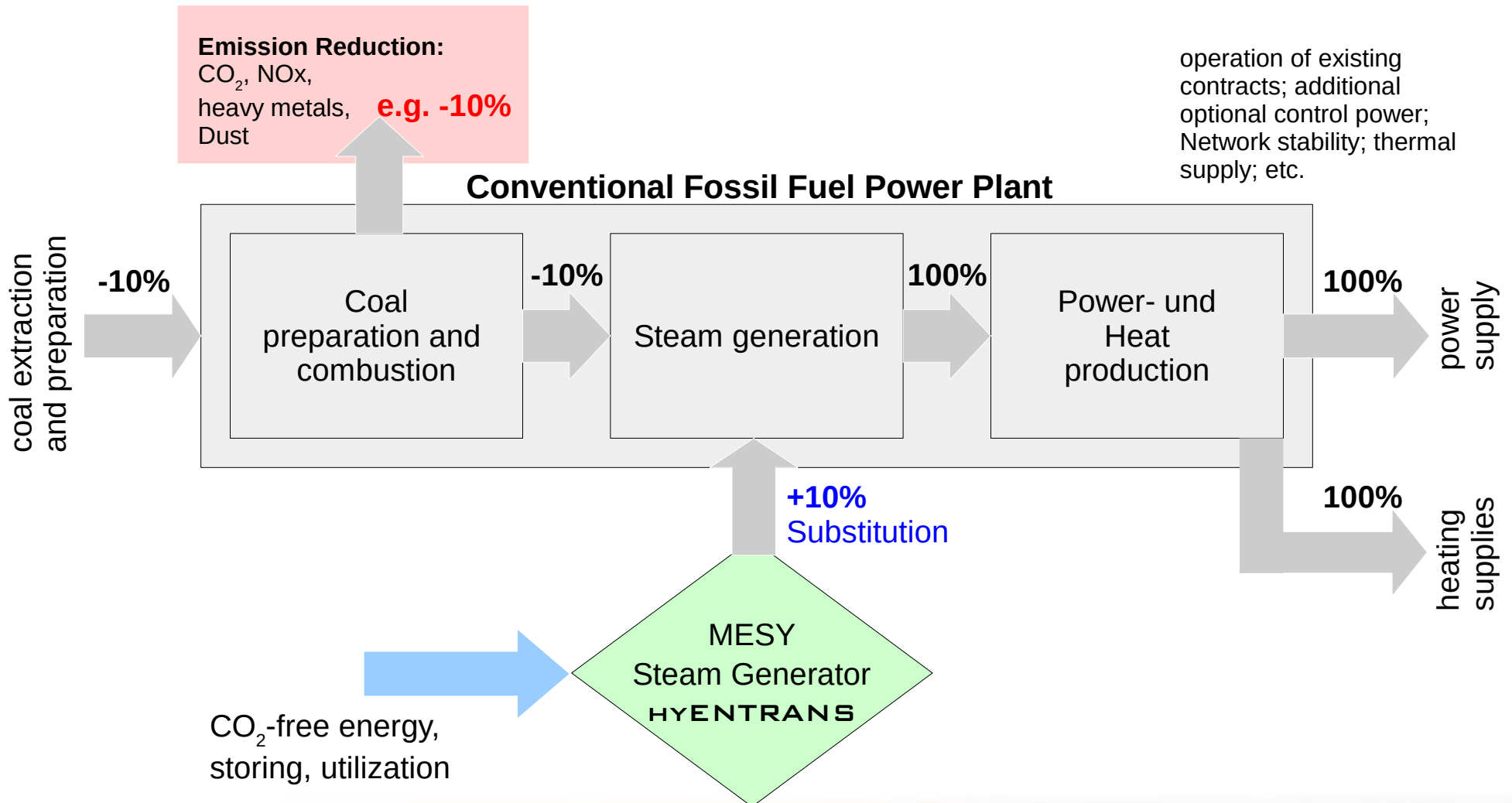


1. Examples

CO₂-Reduction without follow-up costs, worldwide



The Strategy of THOR

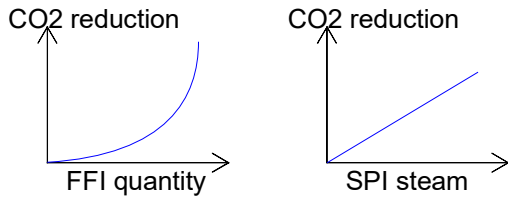


How it works?



The THOR project in the application

Expected effect

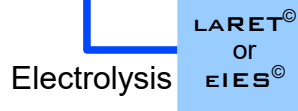


THOR requirements:

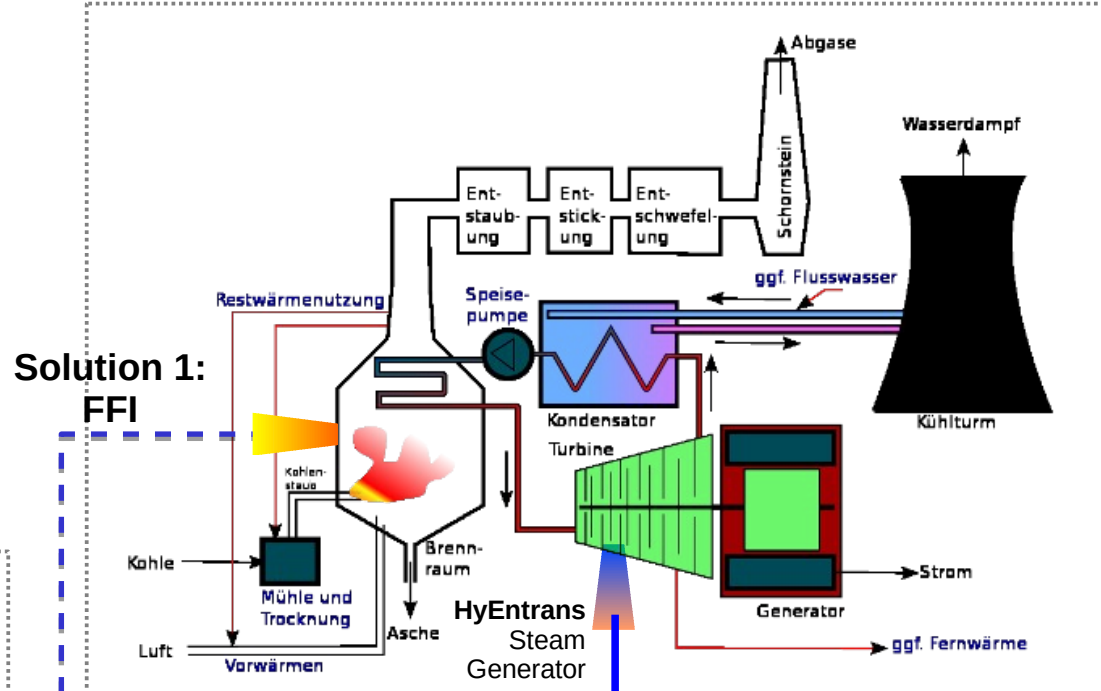
Input:

- Deionized water
- CO₂-free Electric power

Zero CO₂ Energy Production



Example: Coal Fired Power Plant



Solution 1: FFI

Solution 2: SPI

THOR products:

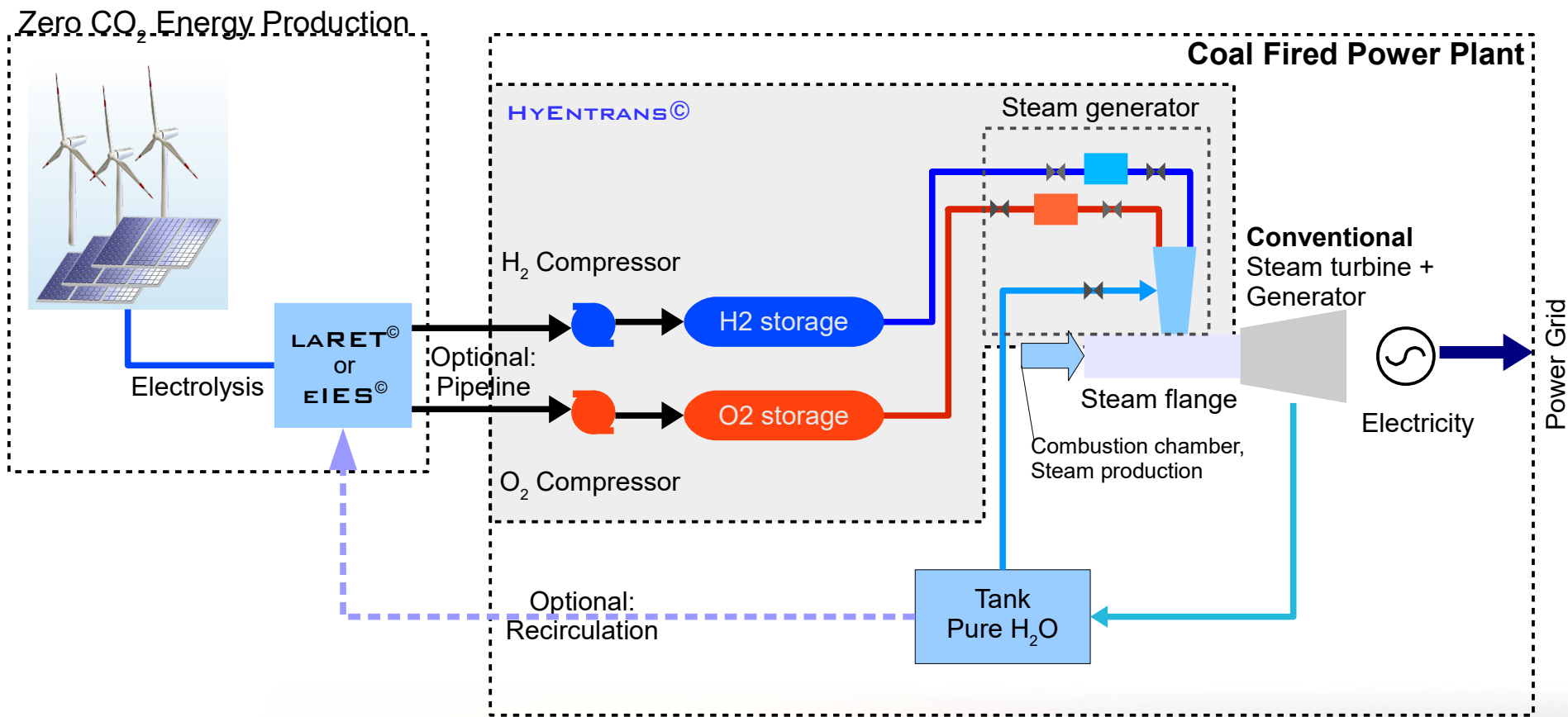
Output:

- Full flexible Electric power
- Steam
- Heat
- Gas (Hydrogen + Oxygen)



Products- and Interfaces: HYENTRANS Hydrogen Energy Transformation Facility

HYENTRANS[®] System Overview



Key technology for the energy market

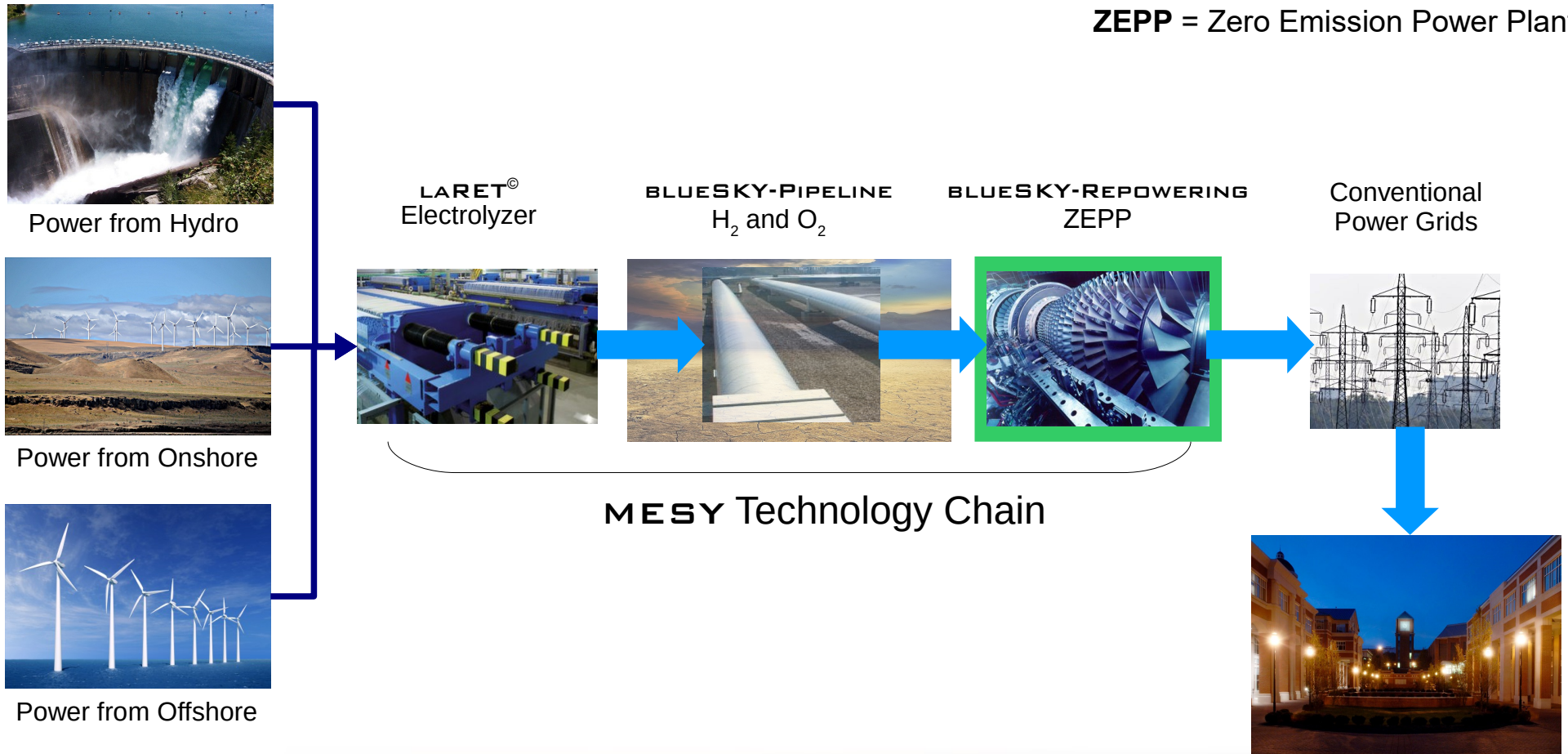
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2. Example

Energy transport over very long distances

ZEPP = Zero Emission Power Plant



The combination of fossil energy production and renewable energy production reduces pollutant emissions drastically and save money.



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Economy Effects of THOR

Benefit for fossil fuel power plant operators

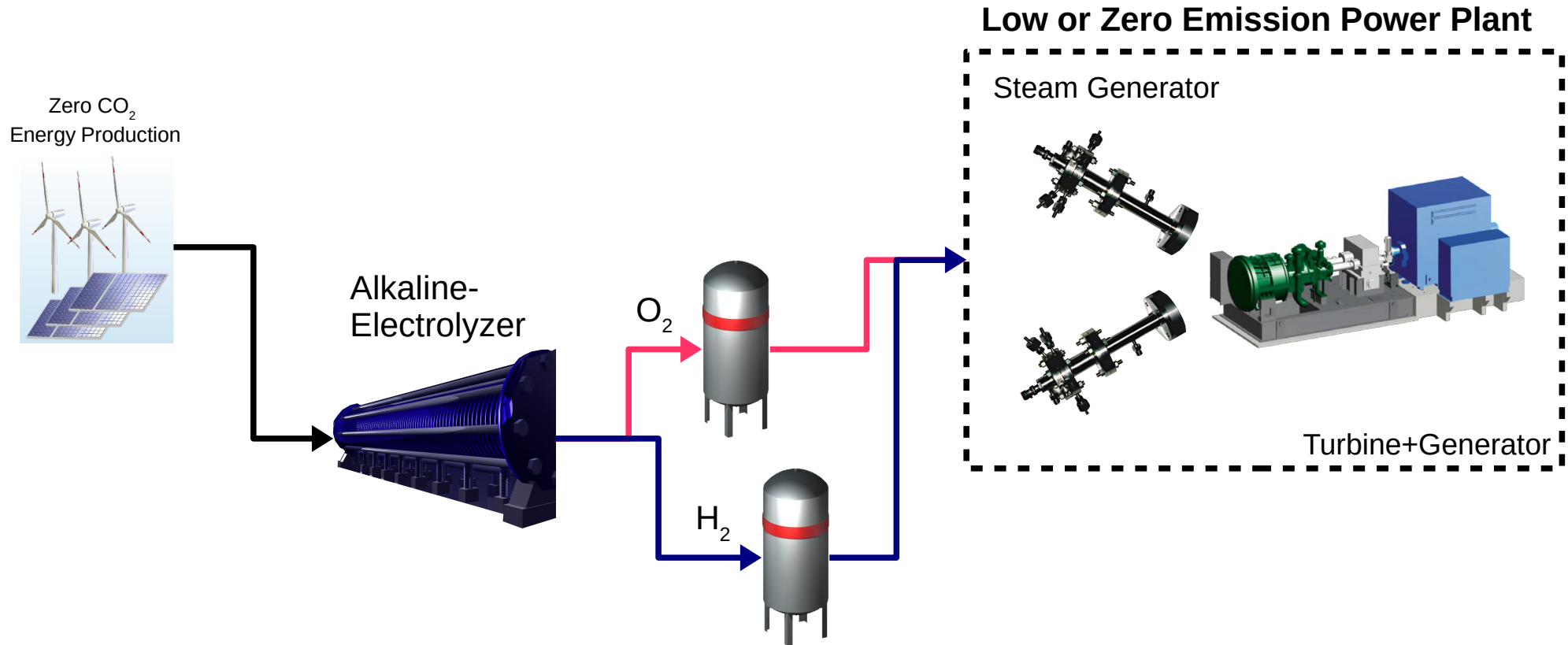
- Reduction in CO₂ emissions with NO follow-up costs
- Fast control performance for supporting grid stability
- Simple and save installation
- Simple integration and control
- Simple and low costs of dismantling
- High performance compression per volume
- No changes to the existing facilities
- **In other countries:** Reduction of investments in the expansion of electricity networks, because fluctuating electricity production from wind farms are smoothed before being fed. (In Germany, the potential would **11 Bil.€** investment savings = 25% Renewable Energy Production (=total green energy production of 2014), appraisal ~50% of 21 Bil.€ planed investment of Germany “Network Development Plan”, Status 2013)

Expenditure

- Requires Green Energy and Transformation into gas for one or more power stations



Option for new power plants or installation in existing power plants

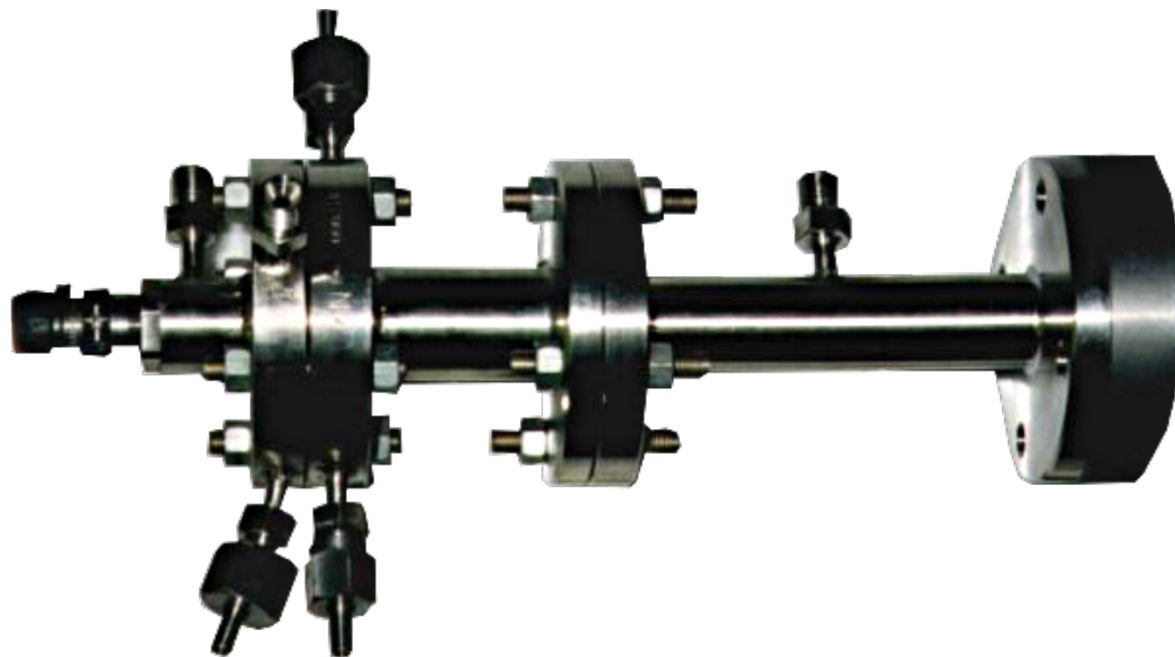


The 150 MW_{term} High Power Solution (LARET Option)



150 MW sample
to show how it works

Steam generator up to 150 MW per unit



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HYENTRANS Steam Generator

50 MW_{therm}

For 1 kg steam (Efficiency considered)

- 0,0182 kg H₂
- 0,1438 kg O₂
- 0,8380 kg H₂O
- 2757,1 kJ/kg steam (500°C / 80 bar)

For 50 MW steam (Efficiency considered)

Output:

- 18,13 kg/s steam with 500°C / 80 bar / ~ 50 MW

Input:

- 15,20 kg/s H₂O Water with ambient temperature / 100 bar
- 0,33 kg/s H₂ Hydrogen mit ambient temperature / 100 bar
- 2,61 kg/s O₂ Oxygen mit ambient temperature / 100 bar



Sample of a set of steam turbine and generator for the power industry from Siemens in combination with HYENTRANS Power up to 50 MWe (SST-300)

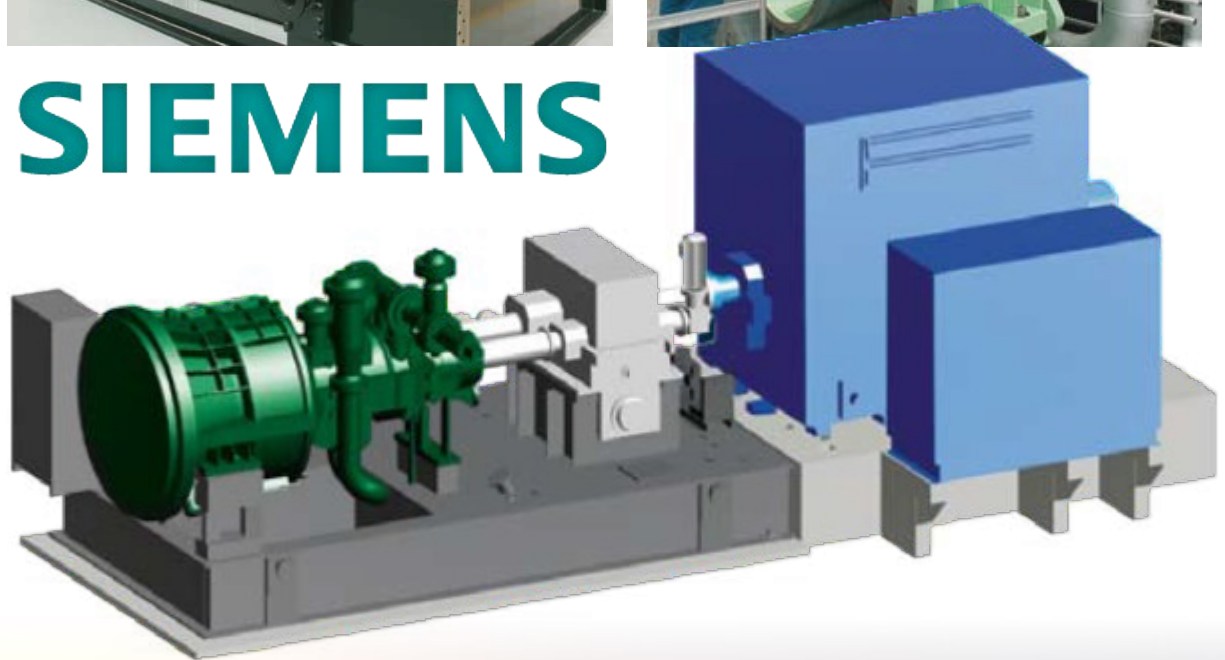
Technical data

- Power output up to 50 MW
- Speed up to 12,000 rpm
- Live steam conditions
 - Pressure up to 120 bar / 1,740 psi
 - Temperature up to 520 °C / 968 °F
- Bleed: Pressure up to 60 bar / 870 psi
- Controlled extraction (single or double)
 - Pressure up to 45 bar / 655 psi
 - Temperature up to 400 °C / 750 °F
- Exhaust steam pressure
 - Back pressure up to 16 bar / 232 psi
 - District heating up to 3 bar / 43 psi
 - Condensing up to 0.3 bar / 4.4 psi

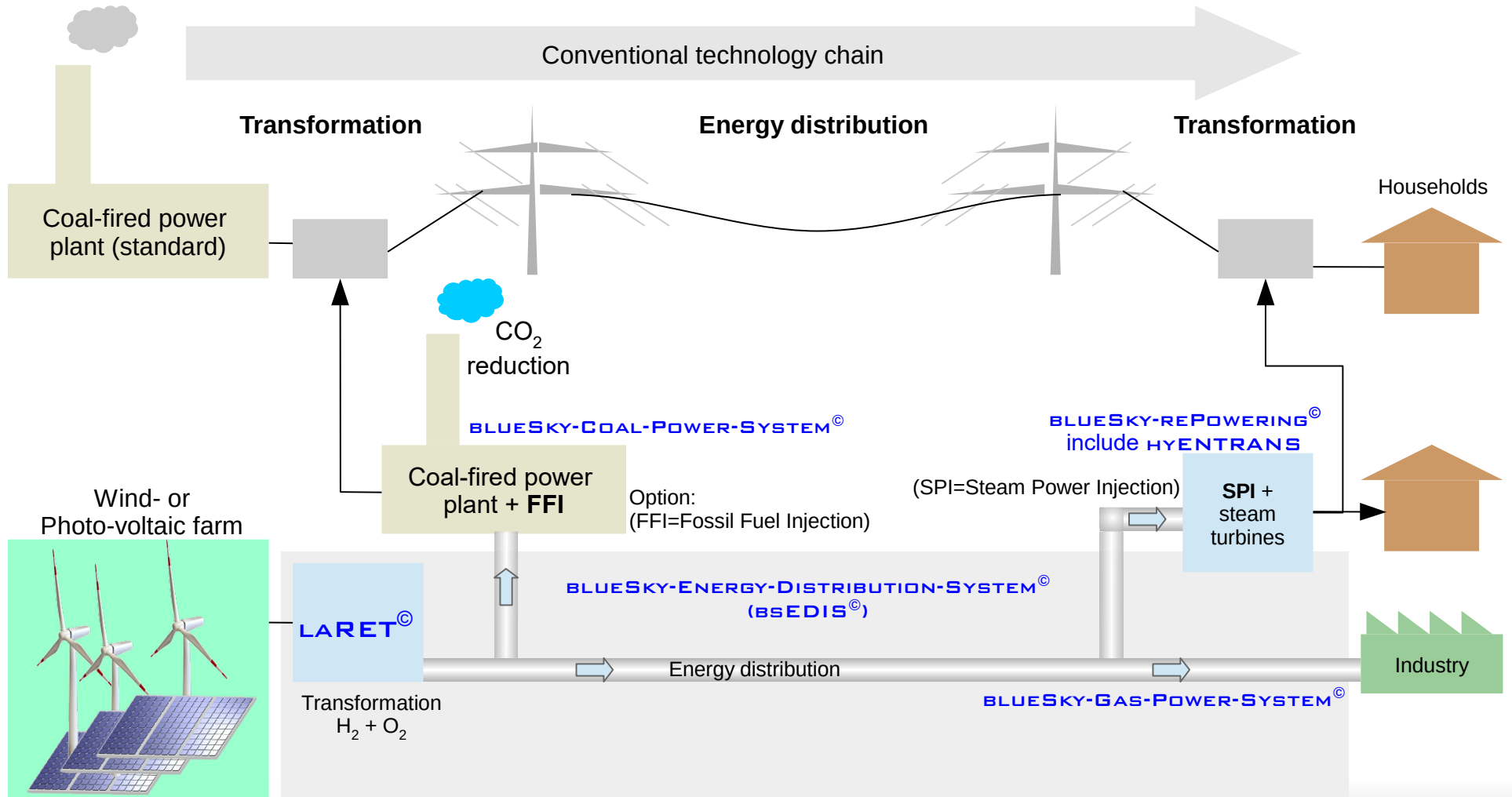
(All data are approximate and project-related.)



SIEMENS



Infrastructure and full Overview



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MESY's solutions

LARET[®] LARGE RENEWABLE ENERGY TRANSFORMER

- **Function:** Transformation of green energy into storable gases (hydrogen and oxygen).

BLUESKY-ENERGY-DISTRIBUTION-SYSTEM[®] (bsEDIS[®]) includes

- **Function:** Transportation, storing and distribution of hydrogen and oxygen gases over 1000ends of km with pipelines. This system covers standard gas interfaces for industry applications.
- Interface: bsEDIS-dPIPE

• BLUESKY-COAL-POWER-SYSTEM[®]

- **Function:** Steam substitution system.
- Interface: bsEDIS-DPIPE
- Includes BLUESKY-HYENTRANS[®]

• BLUESKY-GAS-POWER-SYSTEM[®]

- **Function:** *Gas injection system with operational interfaces.*
- Interface: bsEDIS-DPIPE

• BLUESKY-REPOWERING[®]

- **Function:** Transform hydrogen and oxygen gas into electricity and heat.
- Interface: bsEDIS-DPIPE
- Includes BLUESKY-HYENTRANS[®]



Basic Data

Transformer Infrastructure **LARET**[©]

- Investment Transformer: 600-900 €/kW
- Connecting power: 50 MW
- Energy purchase cost limit ~ 3 cent €/kWh
- H₂ gas production only 6.300 tons per year
- H₂ sales price ~ ≤ 3 €/kg
- Netto turnover incl. tax (hydrogen sales only): ~ 2,7 Mio. €

HYENTRANS Steam Substitution and repowering

- Investment **BLUESKY-HYENTRANS**[©]: ca. 120-160€/kW



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