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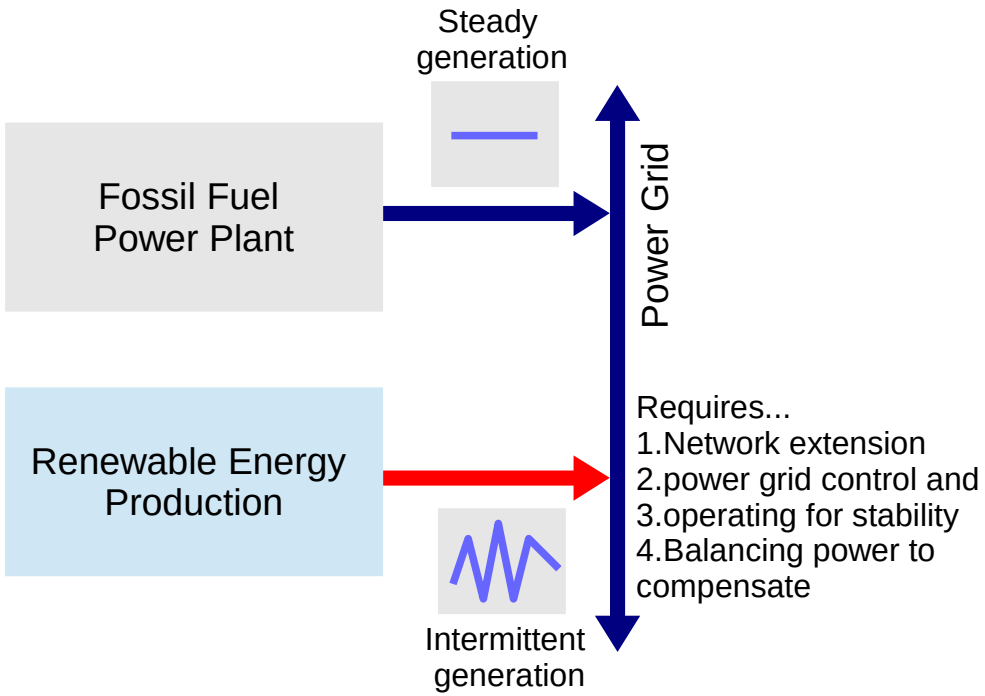
Mobility and Energy storage Systems

THE POWER-TO-GAS GROUP

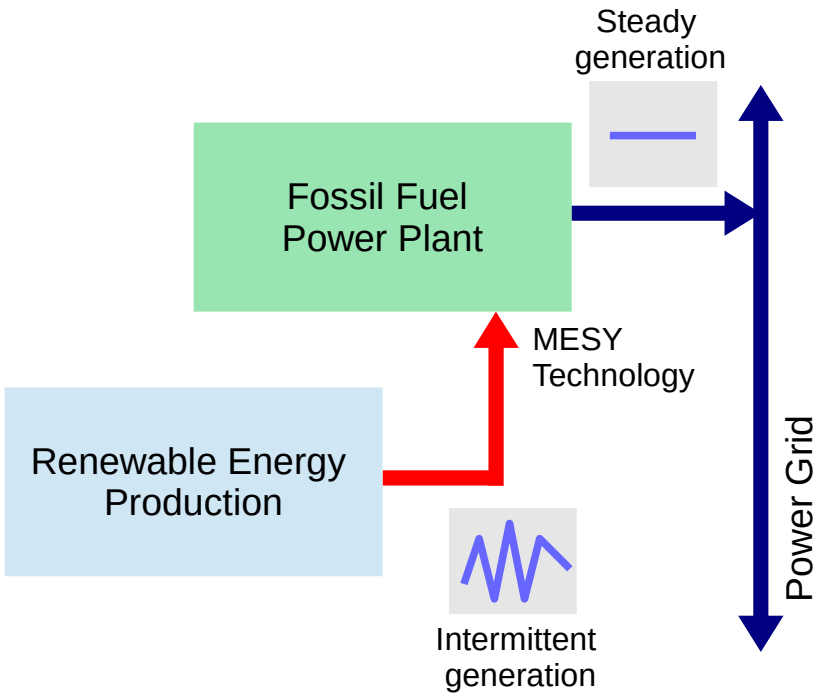
MESY's Carbon Emission Reduction strategy

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
CO_2-Reduction without follow-up costs, worldwide

CO_2 free
Energy Production

LARET©
Electrolyzer

H_2
O_2

BLUESKY-PIPELINE
H_2 and O_2

HYENTRANS©
High power
Steam Generation

MESY Technology

Coal fired power plant to LEPP

Gas power plant to LEPP

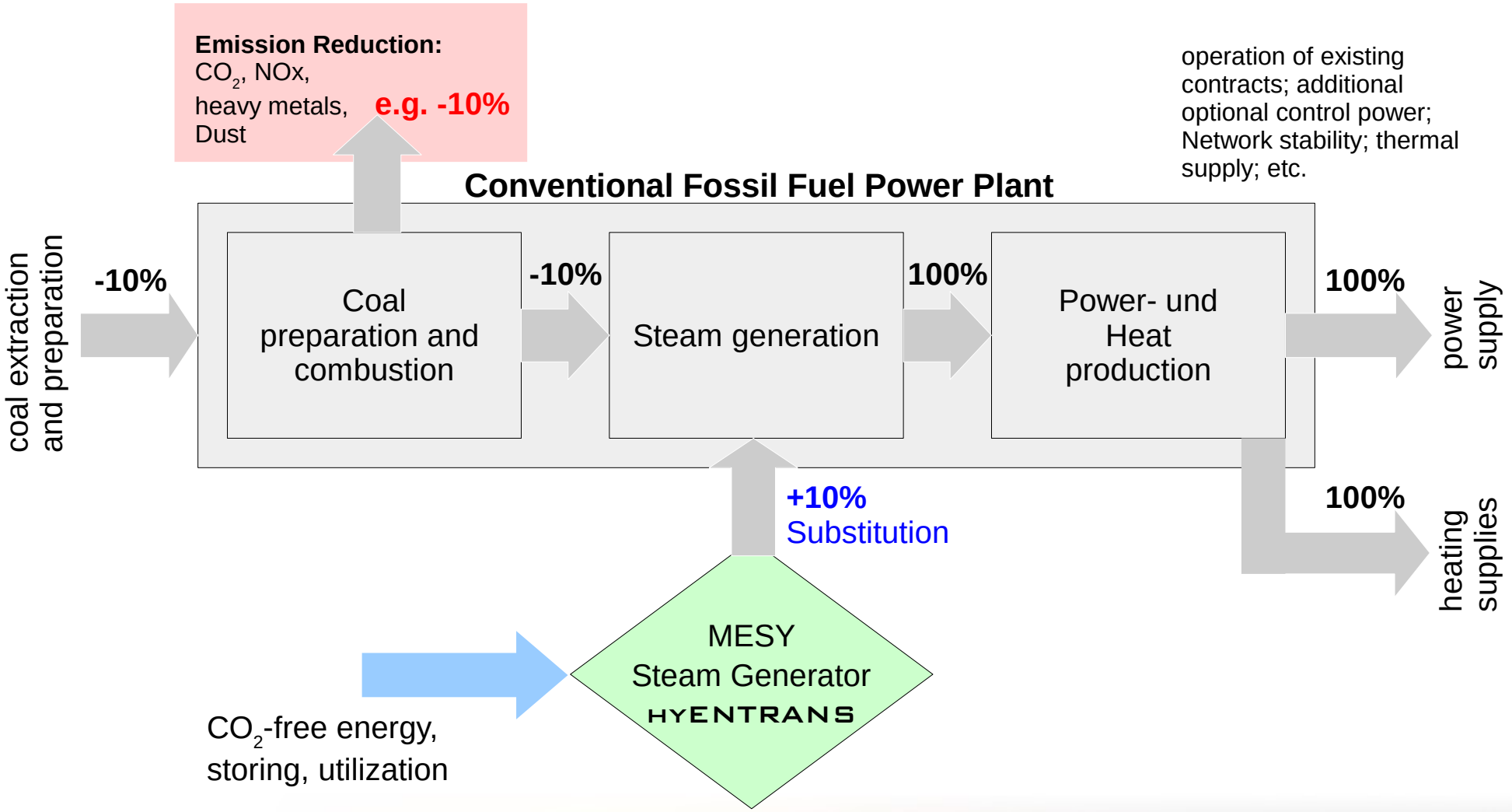
New ZEPP

ZEPP = Zero Emission Power Plant

LEPP = Low Emission Power Plant

The Strategy of CER

Carbon Emission Reduction



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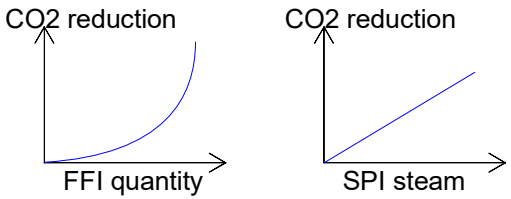
The CER project in the application

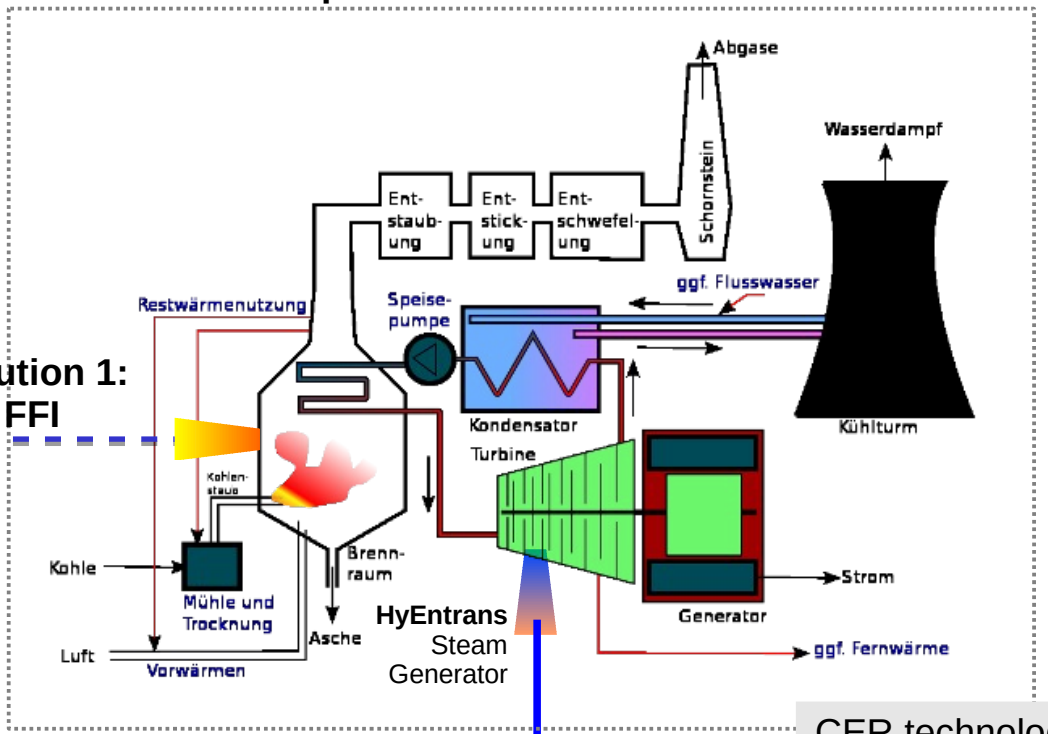
Expected effect



CER technology requirements:

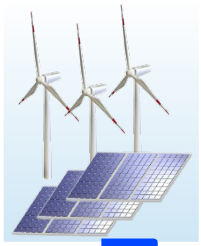
Input:
- Deionized water
- CO_2-free Electric power

Example: Coal Fired Power Plant



Solution 1: FFI

Zero CO2 Energy Production



Electrolysis

LARET© or EIES©

Hydrogen

Oxygen

Gas storage

Solution 2: SPI

CER technology products:

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

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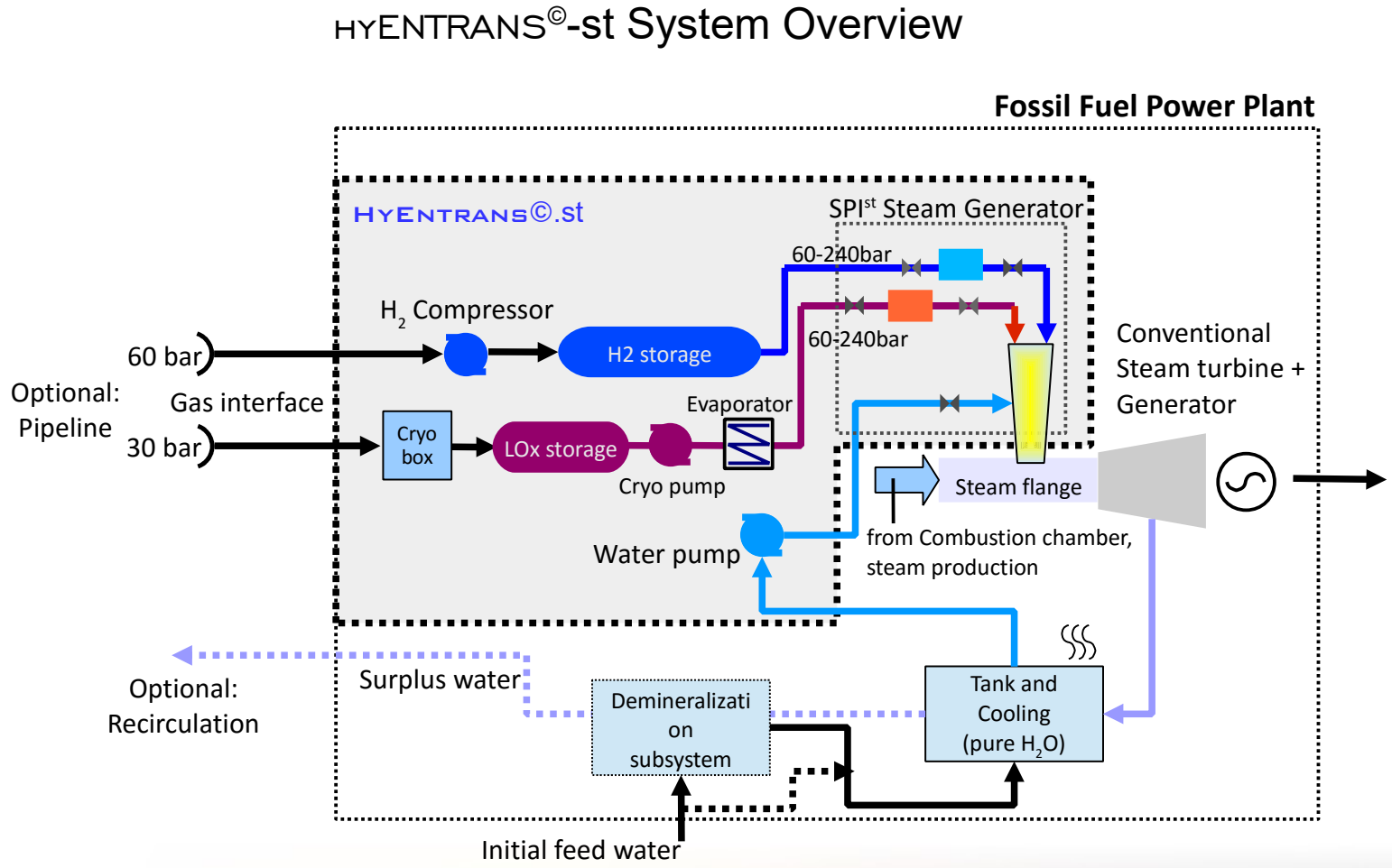
Products- and Interfaces:
HYENTRANS *Hydrogen Energy Transformation Facility*



Key technology for the energy market

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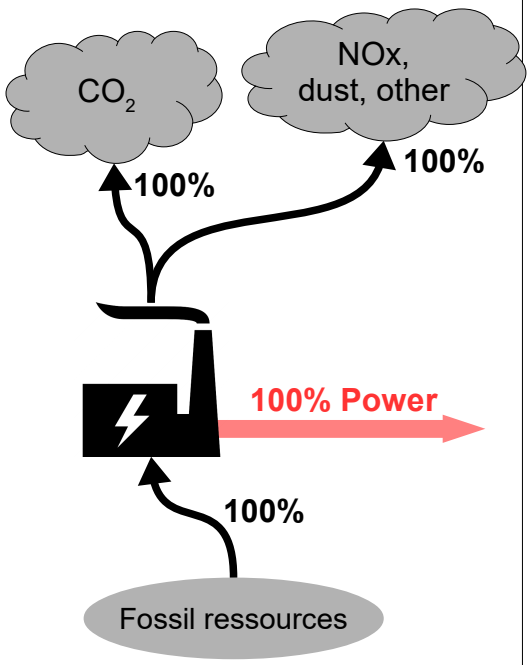
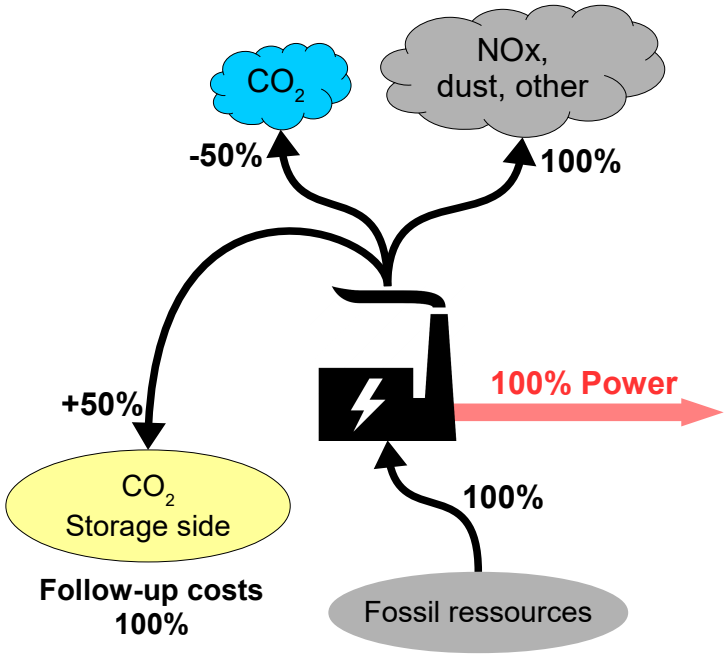
Differences between CCS and CER

Key technology for the energy market

Coal power plant „State of the art“ principle

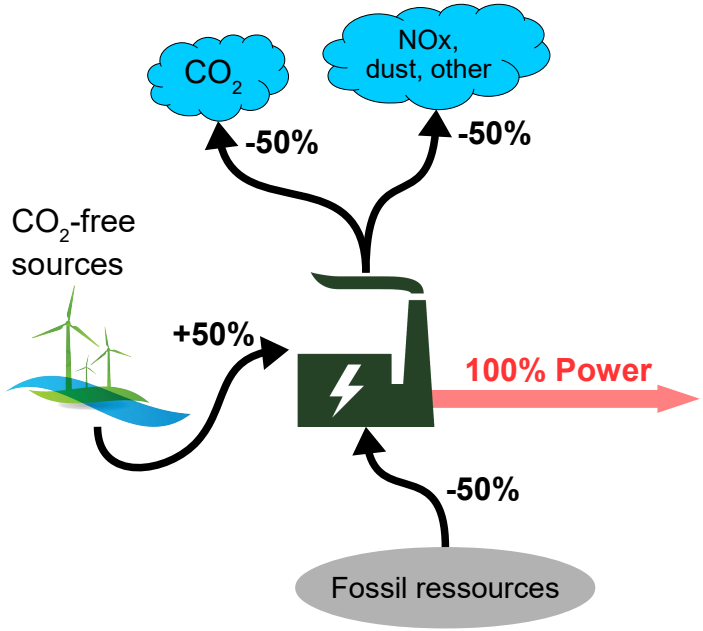


CCS principle



CCS = Carbon Capture and Storage

MESY's CER principle



CER = Carbon Emission Reduction

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2. Example
Energy transport over very long distances

ZEPP = Zero Emission Power Plant

Power from Hydro

Power from Onshore

Power from Offshore

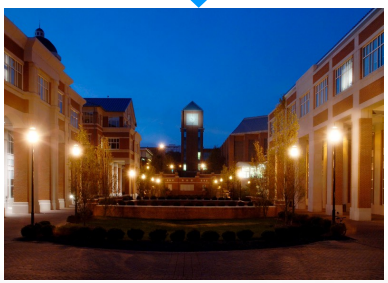
LARET© Electrolyzer

BLUESKY-PIPELINE H_2 and O_2

BLUESKY-REPOWERING ZEPP

Conventional Power Grids

MESY Technology Chain



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

Economy Effects of CER

Benefit for fossil fuel power plant operators

- Reduction in CO_2 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

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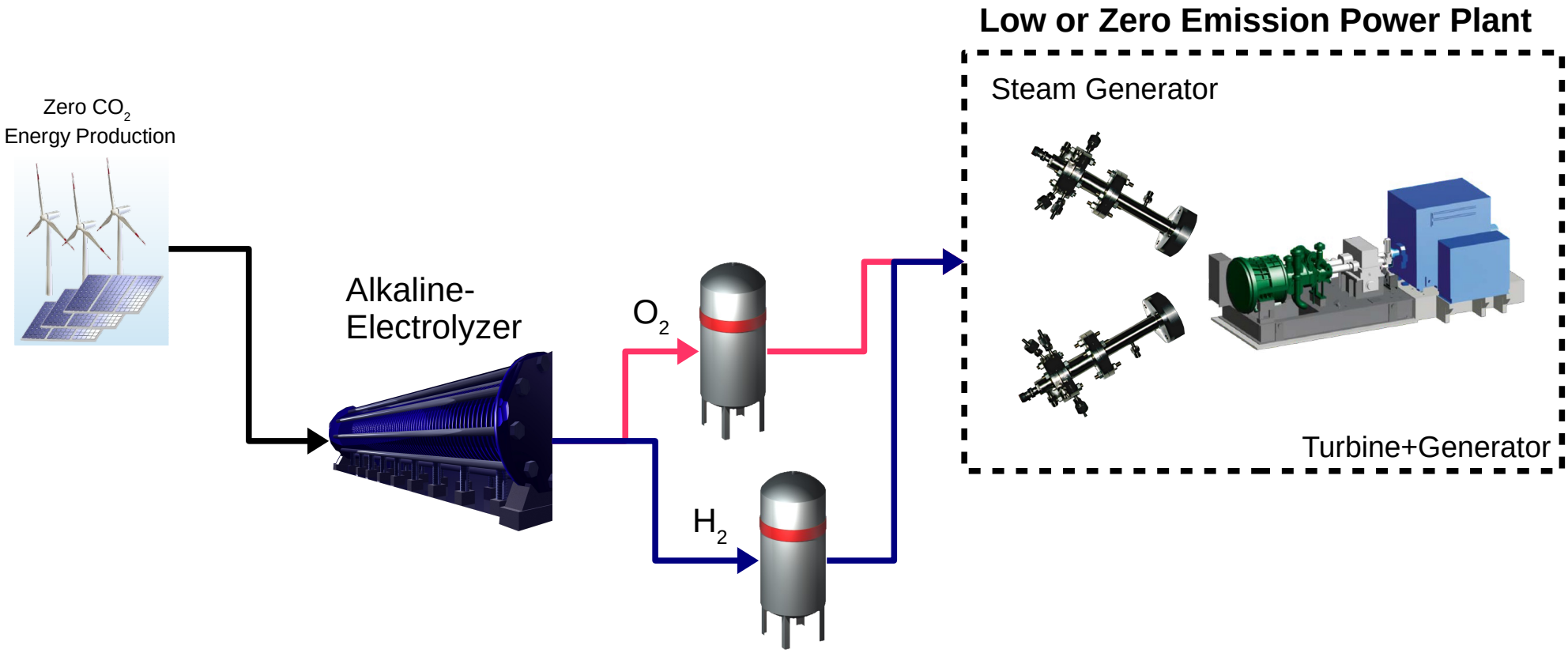
Option for new power plants or installation in existing power plants



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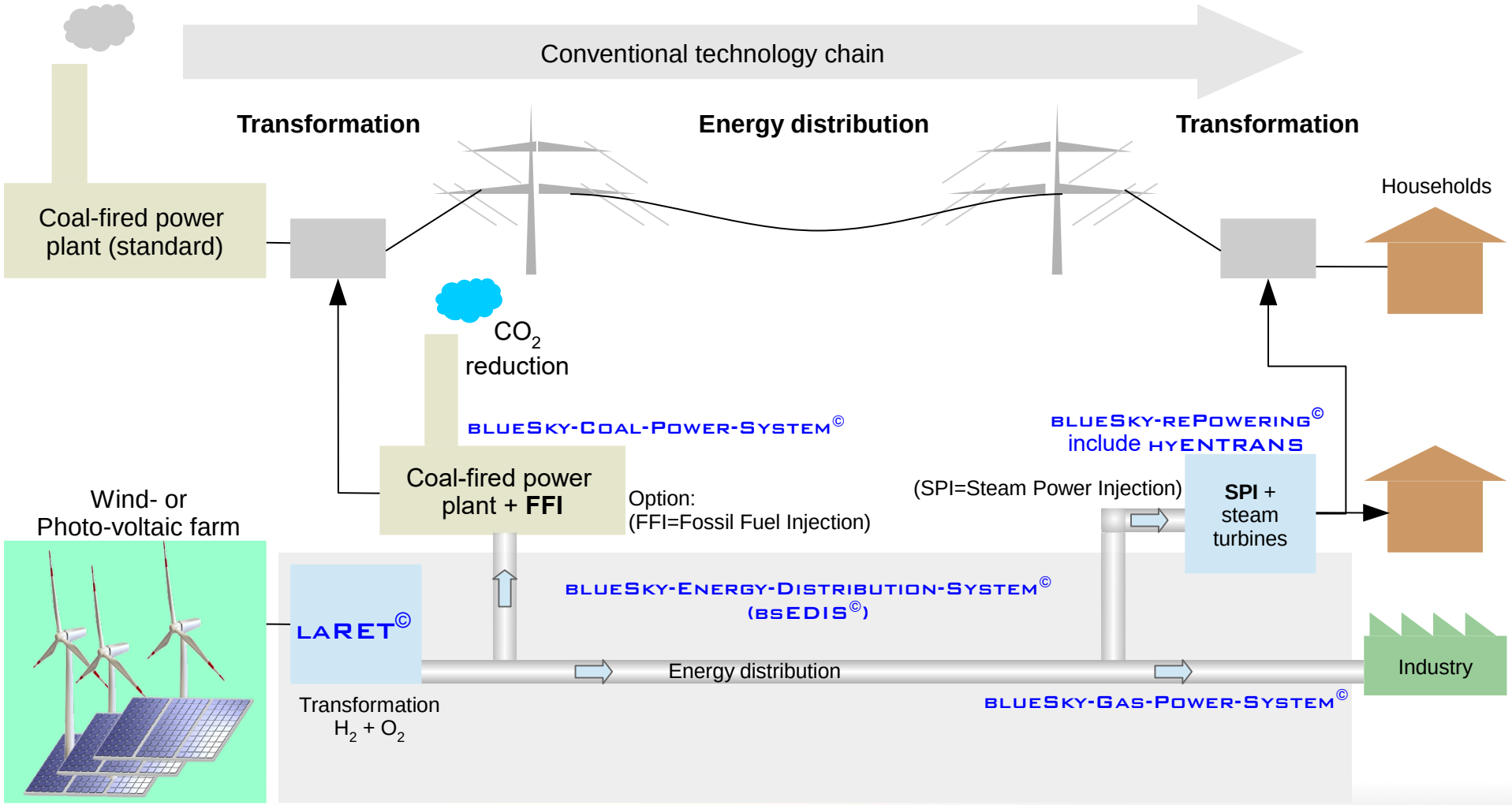
Infrastructure and full Overview



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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©

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Basic Data

Transformer Infrastructure LARET©

- Typically Investment Transformer: 600-900 €/kW
- Connecting power per unit: 50 MW
- Energy purchase cost limit ~ 3 cent €/kWh or lower
- H_2 gas production only 6.300 tons per year

HYENTRANS Steam Substitution and repowering

- Typically Investment BLUESKY-HYENTRANS©: ca. 120-160€/kW

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