

# MESY HP Hydrogen Power GmbH

## Presentation of

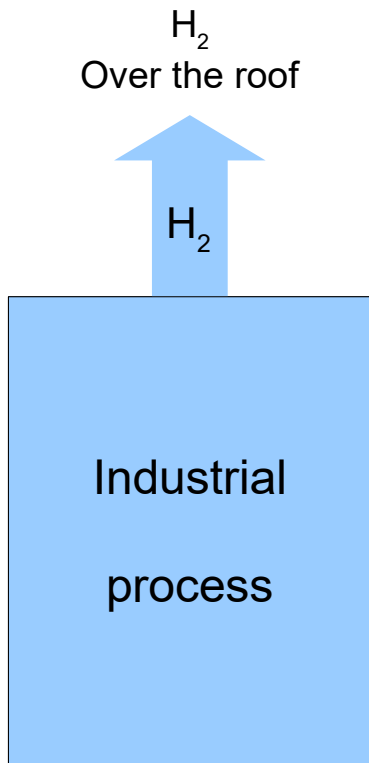
## HYENTRANS for transforming Hydrogen to Business



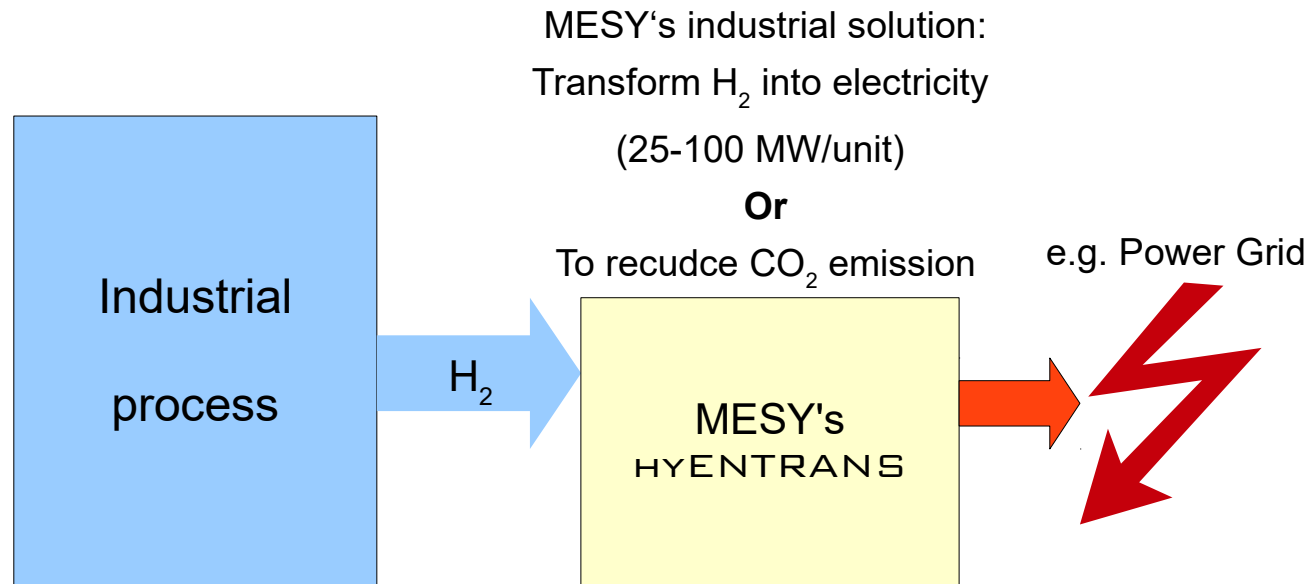
# The Requirement

## Profitable use of H<sub>2</sub>

### Current situation

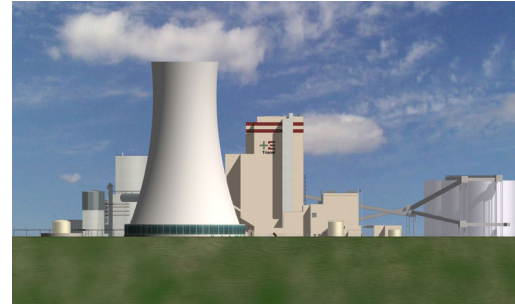


### Our Solution



# Surplus H<sub>2</sub>: possible Business targets

Electricity Production with  
Zero Emission Power Plant



Fossil Energy Production



Refinery

Surplus H<sub>2</sub> to CO<sub>2</sub>-Reduction

Cement production

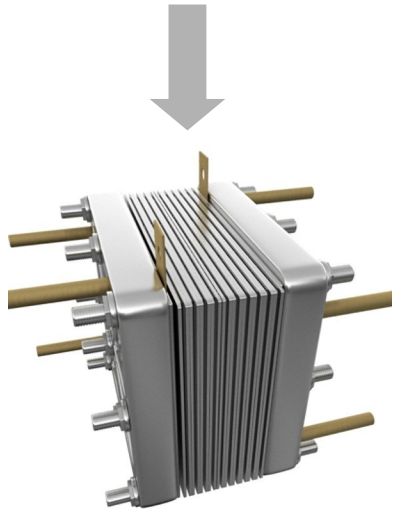


Steel production

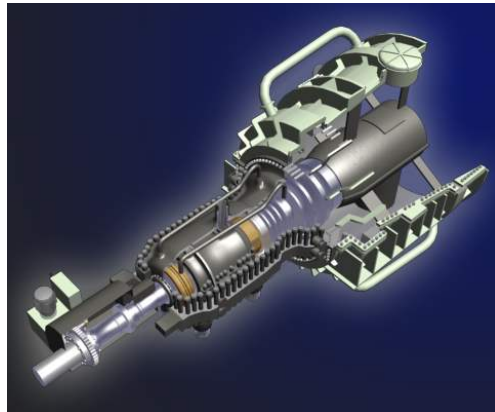


# Available Technologies to transforming Hydrogen

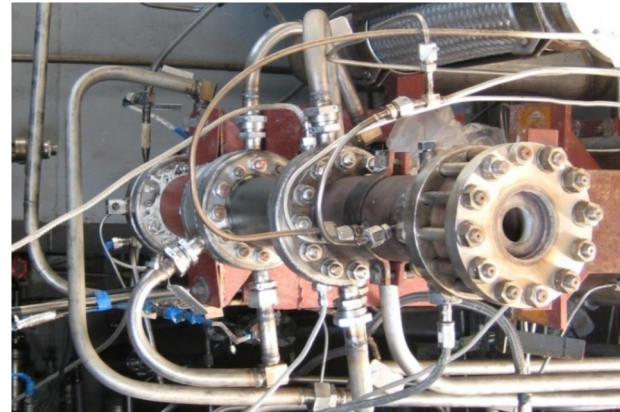
Fuel cell



Special H<sub>2</sub> turbine



High power steam generating



Combined turbine



Efficiency 30-44%

30-45%

98%

40-80%

MESY's technology solutions





# MESY Groups Technology

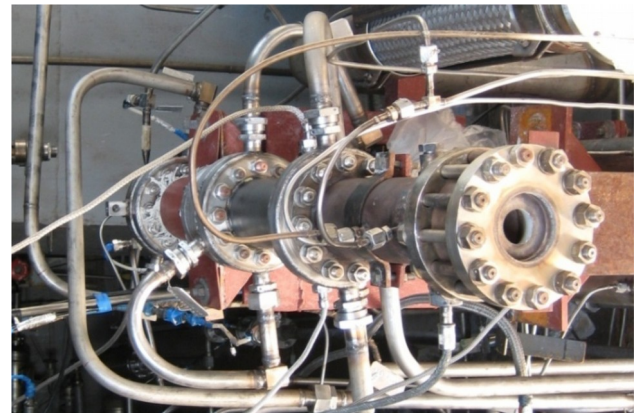
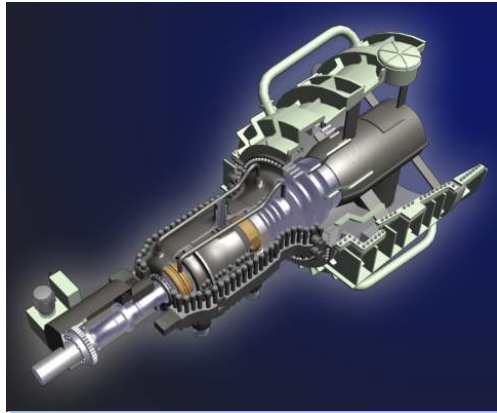
## The H<sub>2</sub> Interface **HYENTRANS**



# HYENTRANS

## Cover the economic use of hydrogen

### MESY's HYENTRANS Technology



Energy Production

CO<sub>2</sub>-Reduction, Expansion for Fossil Energy Production, Refinery, Cement Production, Steel Production

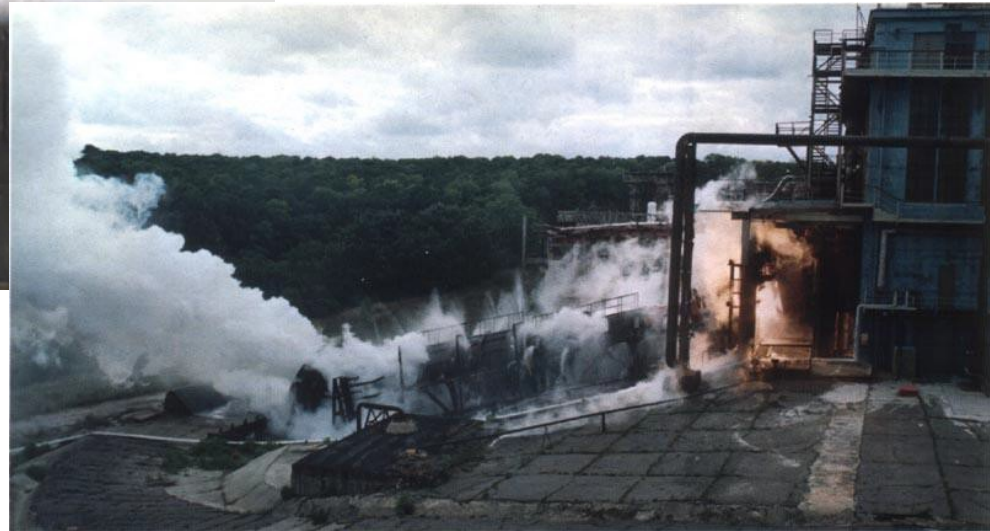
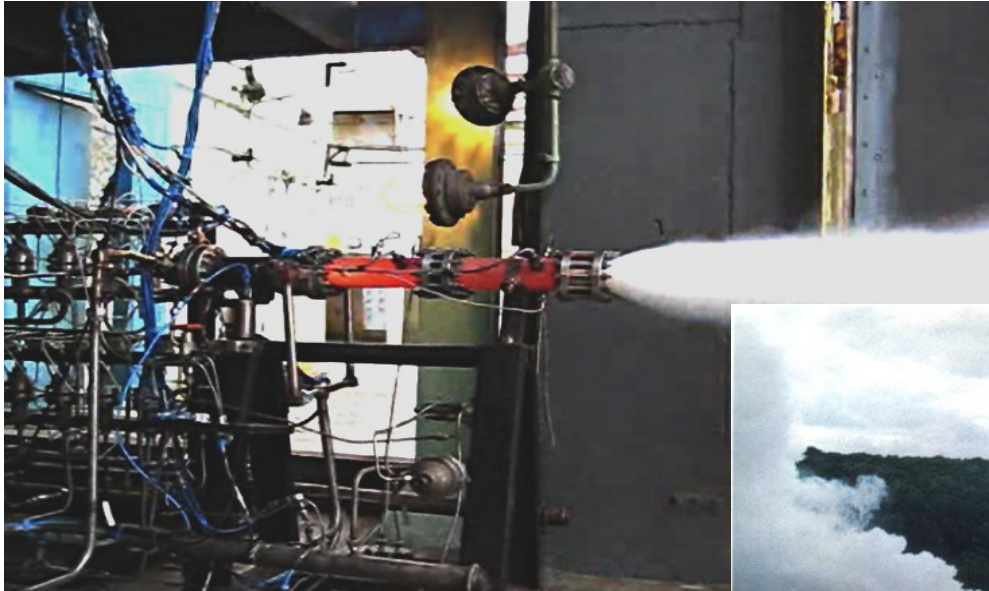


# MESY Groups Technology

Bringing together technology and business !



# Technology: The HYENTRANS Steam Generator 10 - 200 MW<sub>therm</sub> available !!!

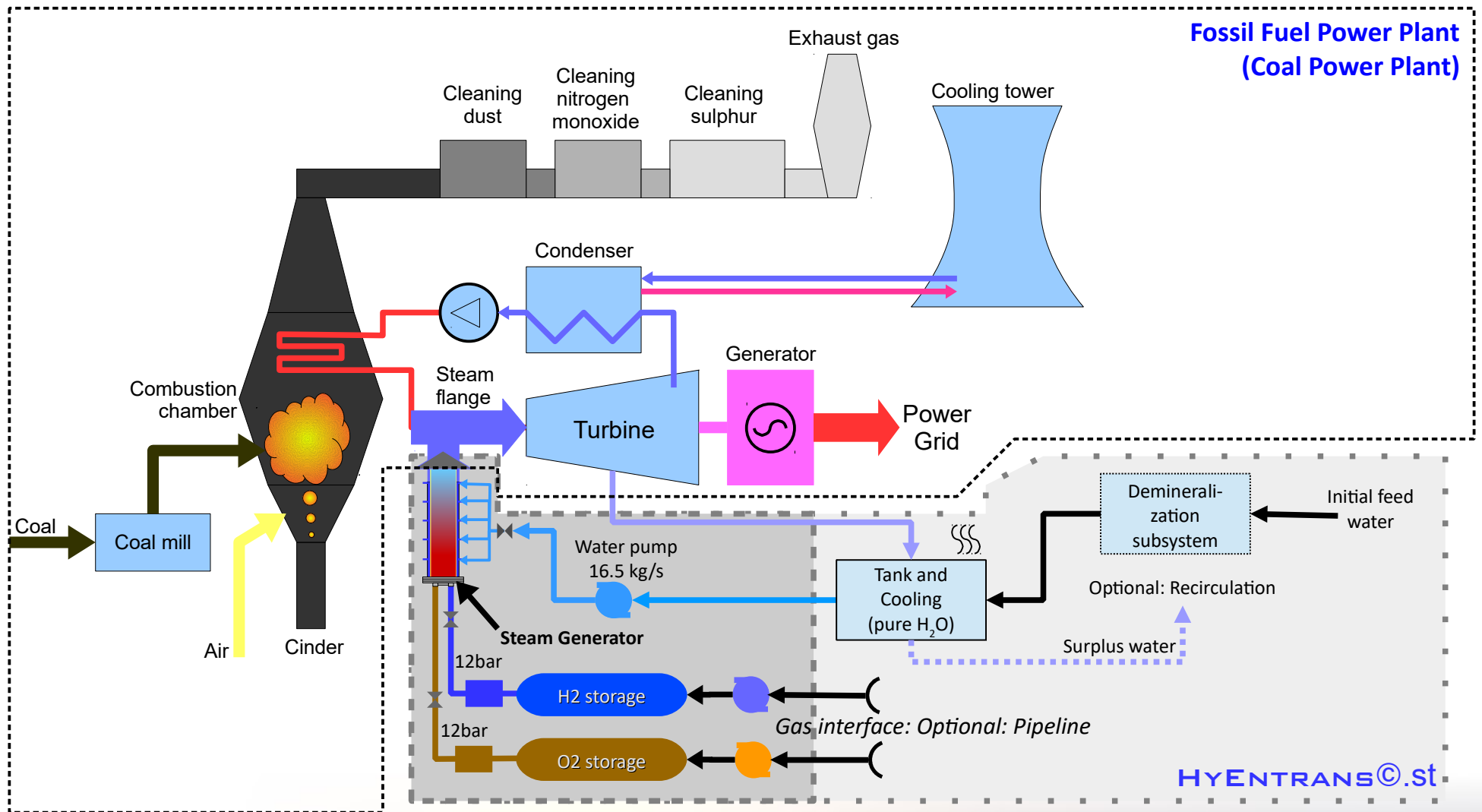


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# Steam Gen. Example: HYENTRANS for CO<sub>2</sub>-Reduction into Coal Power Plants



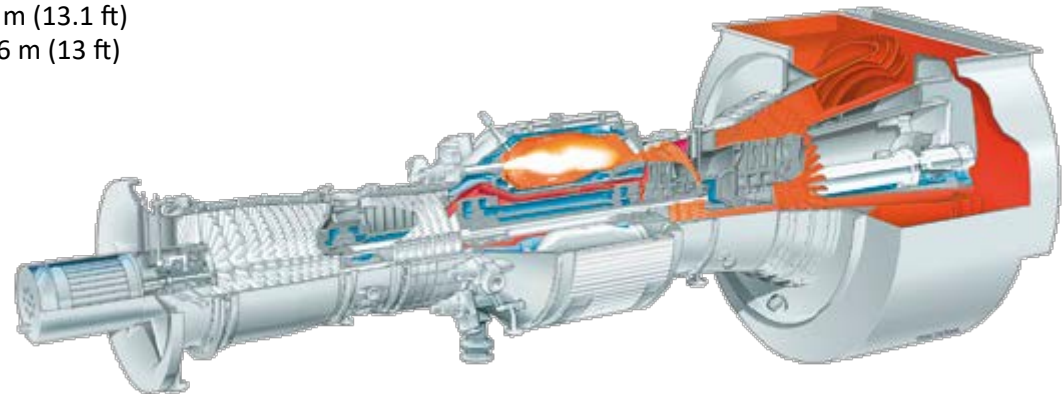
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# H<sub>2</sub>-Gas turbine solution for Low/Zero Emission Power Production

**Power generation package**  
 Approx Weight 210,000 kg (462,970 lb)  
 Length 20.6 m (67.6 ft)  
 Width 4.0 m (13.1 ft)  
 Height 3.96 m (13 ft)

**Mechanical drive package**  
 71,000 kg (176,000 lb)  
 14.1 m (46 ft)  
 4.0 m (13.1 ft)  
 3.96 m (13 ft)



**Example: Simple cycle power generation Mechanical drive applications**

Power output	19.1 MW(e)
Frequency	50/60 Hz
Gross efficiency	33.7%
Heat rate	10,690 kJ/kWh
Turbine speed	3,600 rpm
Pressure ratio	13.0 : 1
Exhaust mass flow	97.9 kg/s
Exhaust temperature	369 °C (696 °F)
NO <sub>x</sub> emissions	≤ 42 ppmvd at 15% O <sub>2</sub> on fuel gas (with DLE)



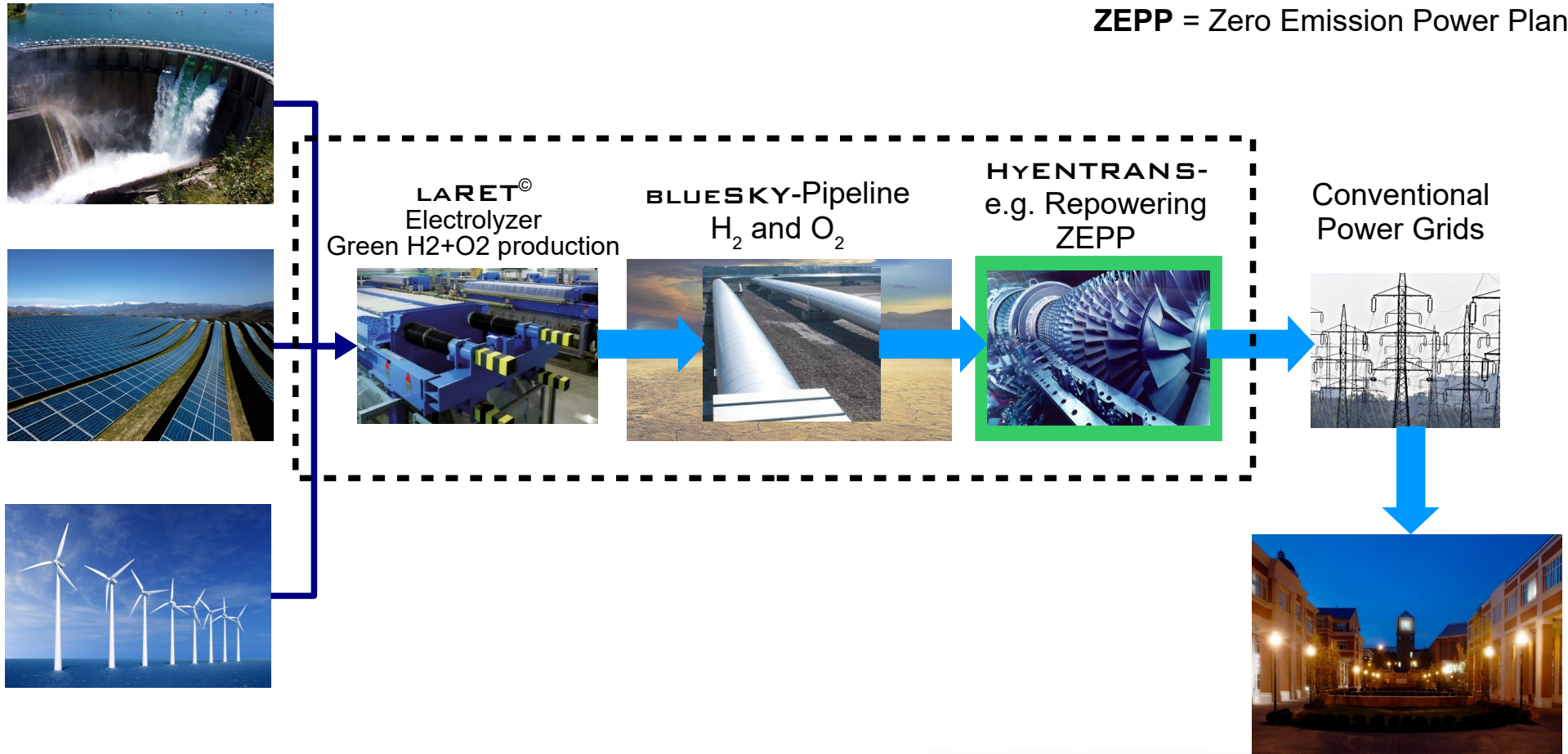
# MESY Groups Technology

## Overview of Technology Chain



# MESY's Technology Chain (overview)

ZEPP = Zero Emission Power Plant

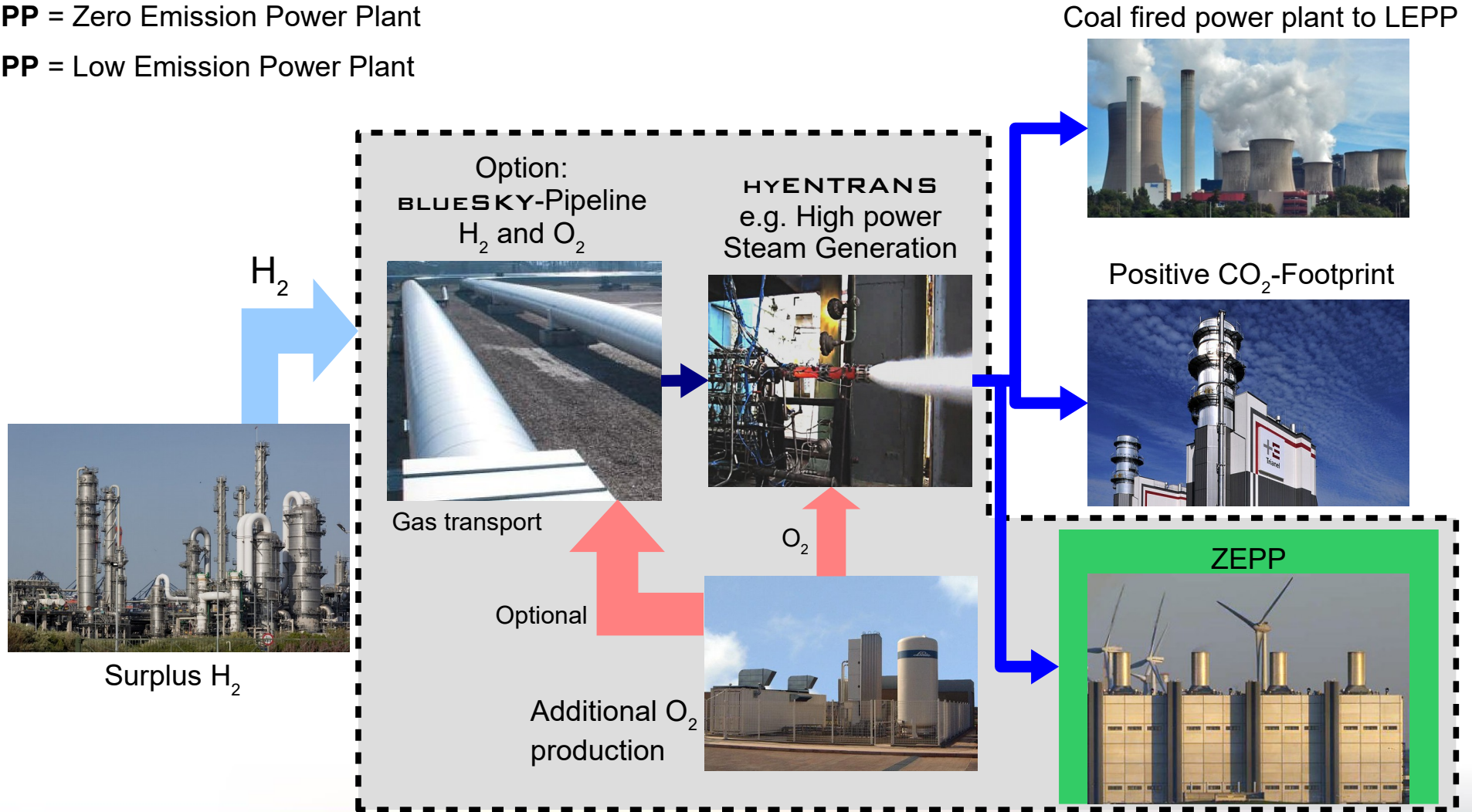




# Examples CO<sub>2</sub>-Reduction with surplus H<sub>2</sub>

**ZEPP** = Zero Emission Power Plant

**LEPP** = Low Emission Power Plant



# MESY Groups Technology

## Economy example



# Example: Specific steam power calculation of 20000 Nm<sup>3</sup>/h H<sub>2</sub>

HYENTRANS Specific Data				
Steam turbine data				
Output pressure (steam generator)	bar	1	100.000	p (Pascal)
Process temperature (steam gen. Output)	°C	369	642	k (Kelvin)
Steam Recombination Energy	MJ/s	60,500		
Steam Process Energy	MJ/s	57,621		
			kg/h	Nm <sup>3</sup> /s
H2 input	g/s	500	1800	5,56
O2 input	g/s	4000	14400	2,80
H2O output steam super heat (sh)	g/s	4500	16200	
<b>Total steam mass flow rate</b>	g/s	27548	28	kg/s
<b>Steam volume (Exhaust mass flow)</b>	m <sup>3</sup> /s	<b>82</b>	648381	klb/hr (KiloPount/hour)
<b>Steam Process Energy (MWh<sub>therm</sub>)</b>	MWh	<b>58</b>		
Economic appraisal				
Add-on: Overall efficiency turbine-generator unit	%	33	19	MW <sub>el</sub>
Add-on: Sales of energy	€/kWh	0,09		
Theoretical sales per year	Mwh/year	142888	<b>13</b>	Mio. €/year

# Economy Basic Data

## Transformer Infrastructure LARET

- Investment Transformer: **500-800 €/kW**
- Connecting power: 50-65 MW
- H<sub>2</sub> gas production only 72 Mio Nm<sup>3</sup> > ~ 6500 tons per year
- O<sub>2</sub> gas production only 36 Mio Nm<sup>3</sup> > ~ 52000 tons per year
- Average sales price >= 6 €cent/kWh<sub>term</sub>

## HYENTRANS Steam Substitution and repowering

- Investment HYENTRANS<sup>©</sup>: **ca. 120-340 €/kW**

All data are samples and depending of real environment conditions.





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