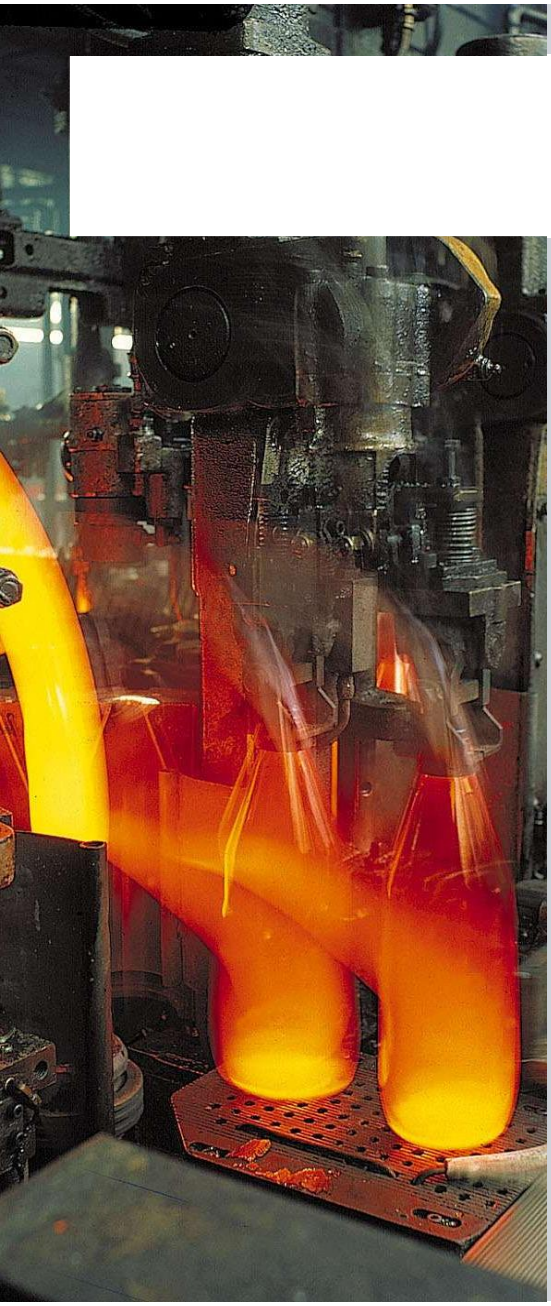

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Energy efficiency thanks to waste heat recovery:
Siemens innovative concept for the glass industry

- Good reasons for invest in waste heat recovery
- Technical concept and typical system configuration
- Siemens portfolio for WHR plants
- References
- Scope of supply and financing offer

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Good reasons for invest in waste heat recovery

Savings

- Heating in winter and cooling in summer
- Increase of productivity
- Reduction of energy consumption costs
- Fast amortization within a few years
  (4 to 6 years based on electricity tariff)
- No additional personal required in control room

Safety of investment

- Less dependency on external sources of energy
- Less dependency on constant rising energy costs
- Installation without influence on the production process
- Installation during line operation possible if bypass is available
- Use of standard components
- SIEMENS with strong experience in power plants

Environmental protection

- Improvement of environmental protection
- Prevention of CO2 restrictions
- Gain in green image

Waste heat to electrical power
Technical concept

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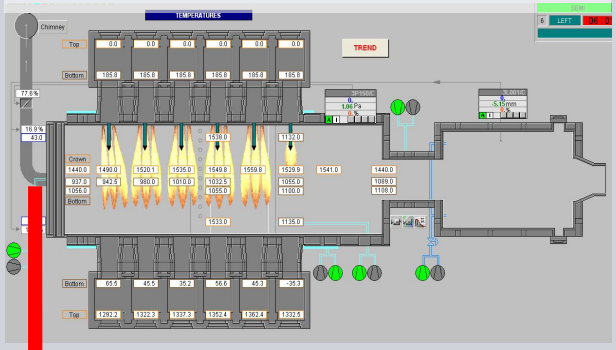
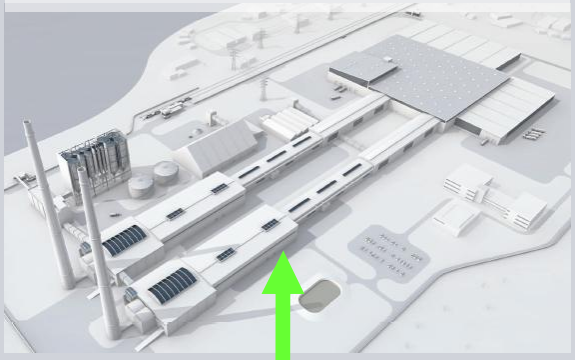
Furnace



Glass Plant



Waste heat recovery power plant

Waste heat flow
……. Nm³/h

Electricity supply
……. KWh

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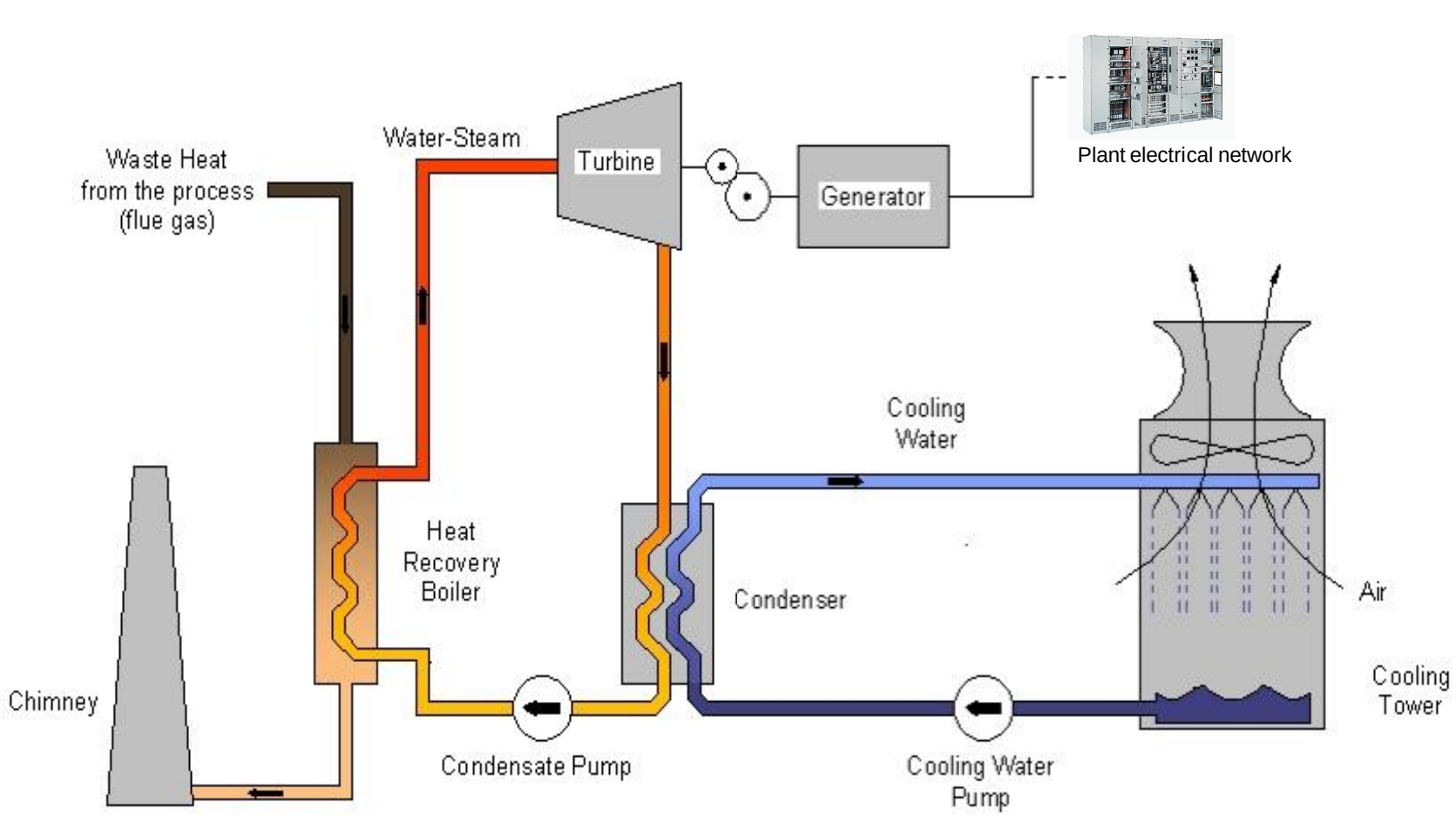
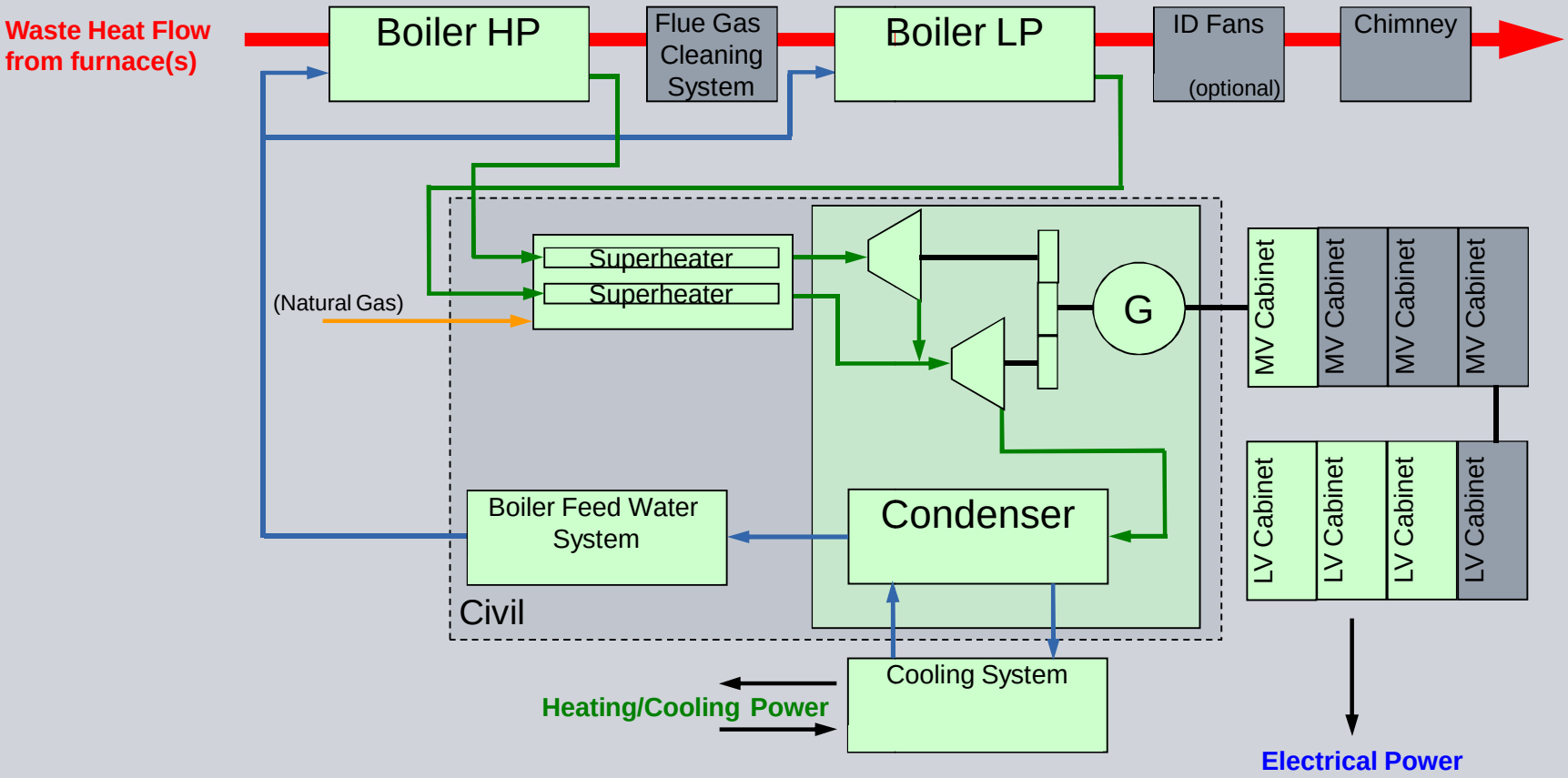
Working principle of an industrial waste heat recovery plant



Typical technical concept and scope



Flue Gas Flow – Water Flow – Steam Flow

Siemens Scope

existing

Waste Heat Recovery System with various options

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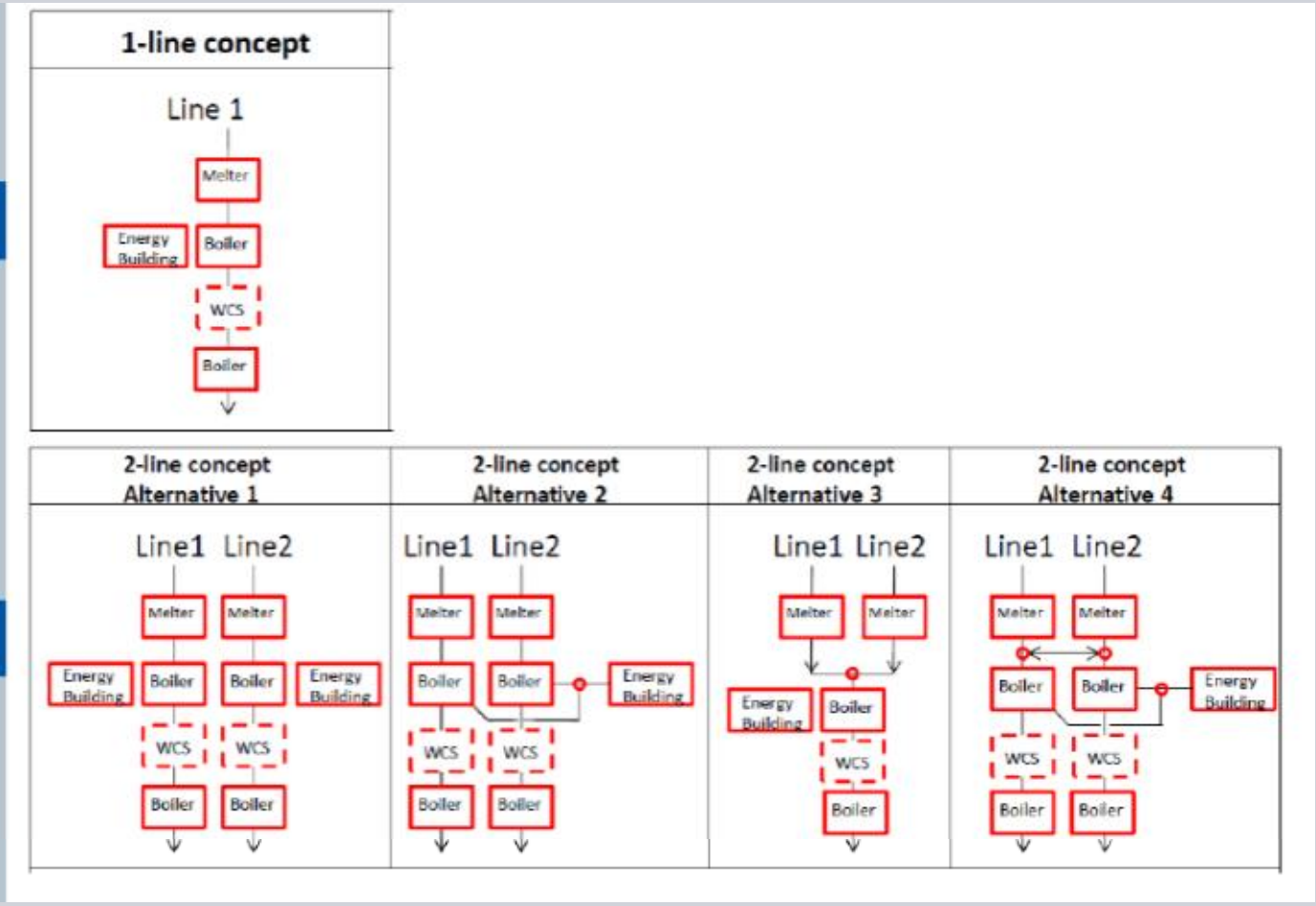
1-line concept

Multi-line concept



Example of a multi-line concept:
2 glass lines with one turbo generator

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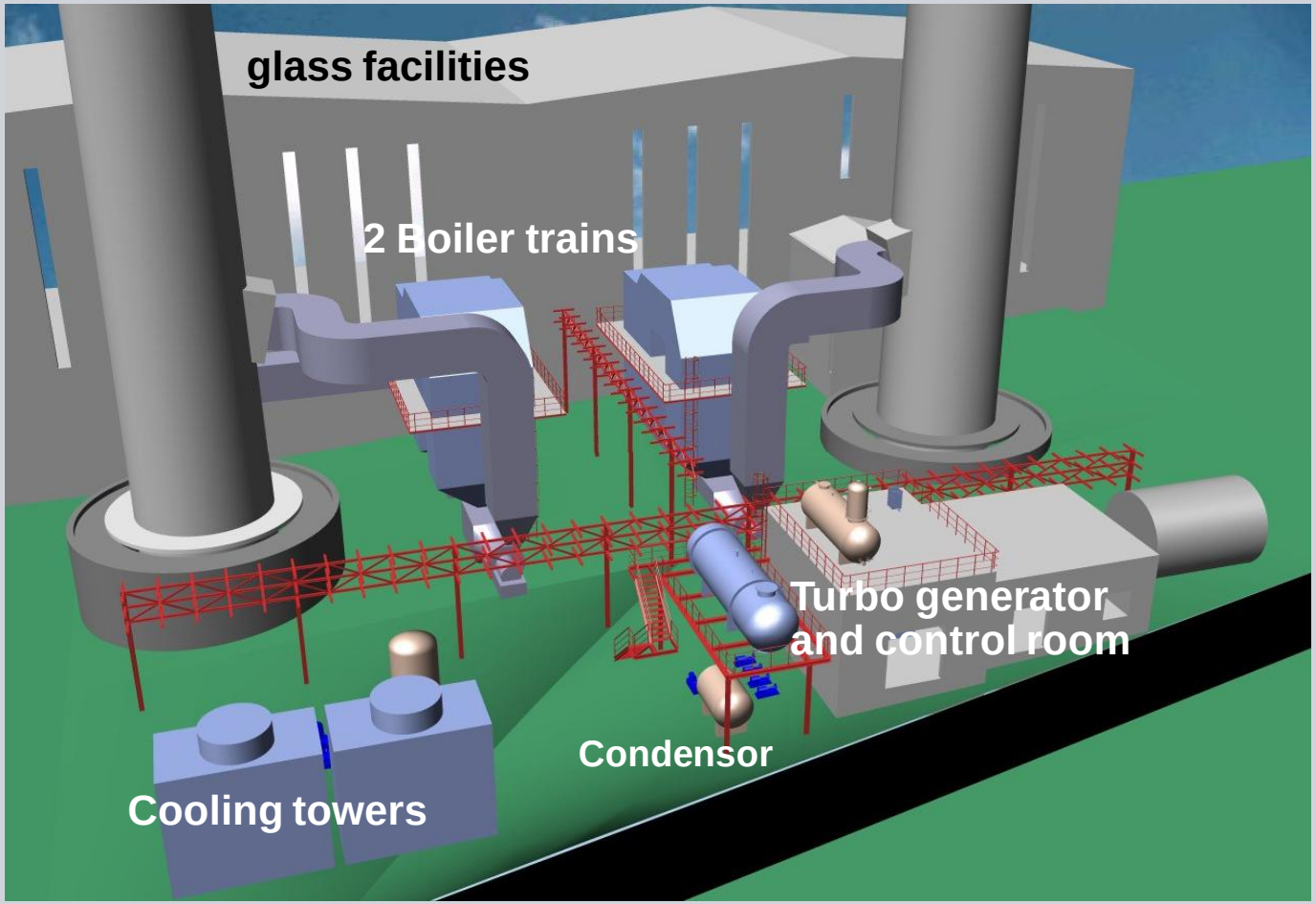

Industrial waste heat recovery solution
Electrical power output for glass plants

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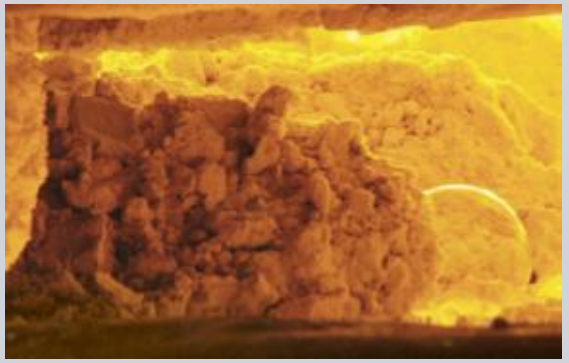
Example for a conventional float glass furnace:

waste heat flow: 80.000 Nm³/h

temperature: 450 ° C

electrical power output: 2 MW



Example for two hollow glass furnaces

(combination of the 2 waste gas flow on 1 boiler, see next slide / 2 lines concept, alternative 3)

waste heat flow: 48.000 Nm³/h + 60.000 Nm³/h

temperature: 400 ° C

electrical power output: 2 MW

Estimated electrical output depends mainly on Waste heat flow and furnace exit temperature

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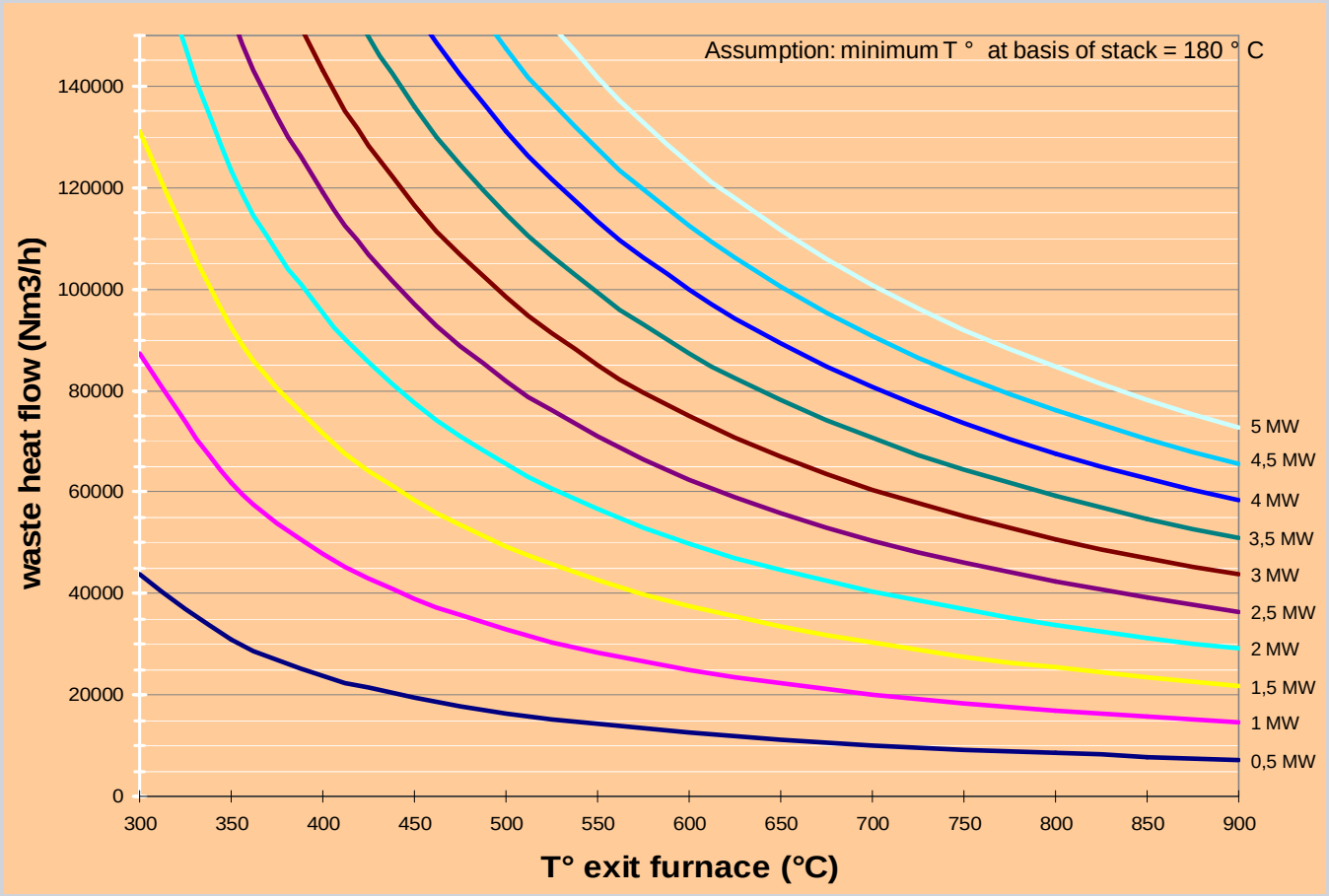
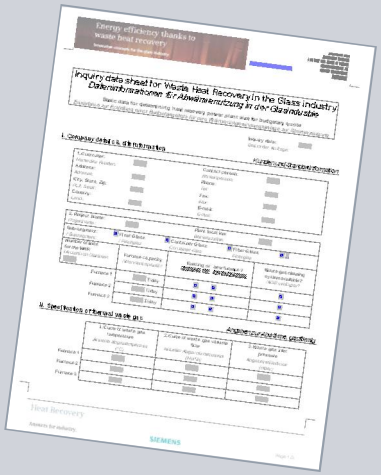
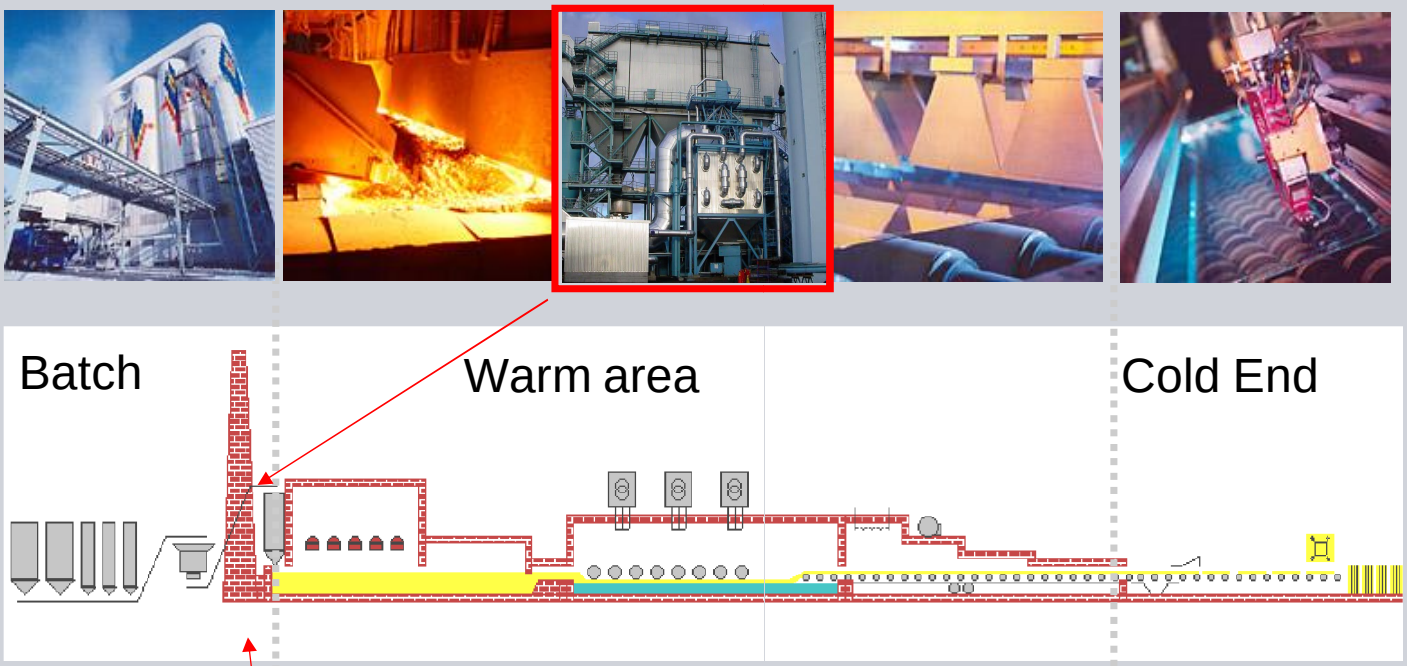


Inquiry data sheet for Waste Heat Recovery in the Glass industry



Feasibility study

WHR as integrated part of a glass plant



Batch

Preparing and mixing raw material

Furnace

Melting process 1560°C

Tin bath

Forming process

Annealing lehr

Cooling process

Cutting line

Cutting

WHR

Waste heat recovery with water steam cycle

Utilities

Energy distribution, Compressed air, water, ...

Further processing

Bending, grinding, ...

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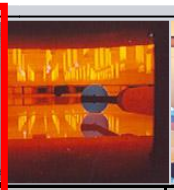
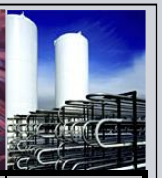
Siemens portfolio for the glass manufacturing



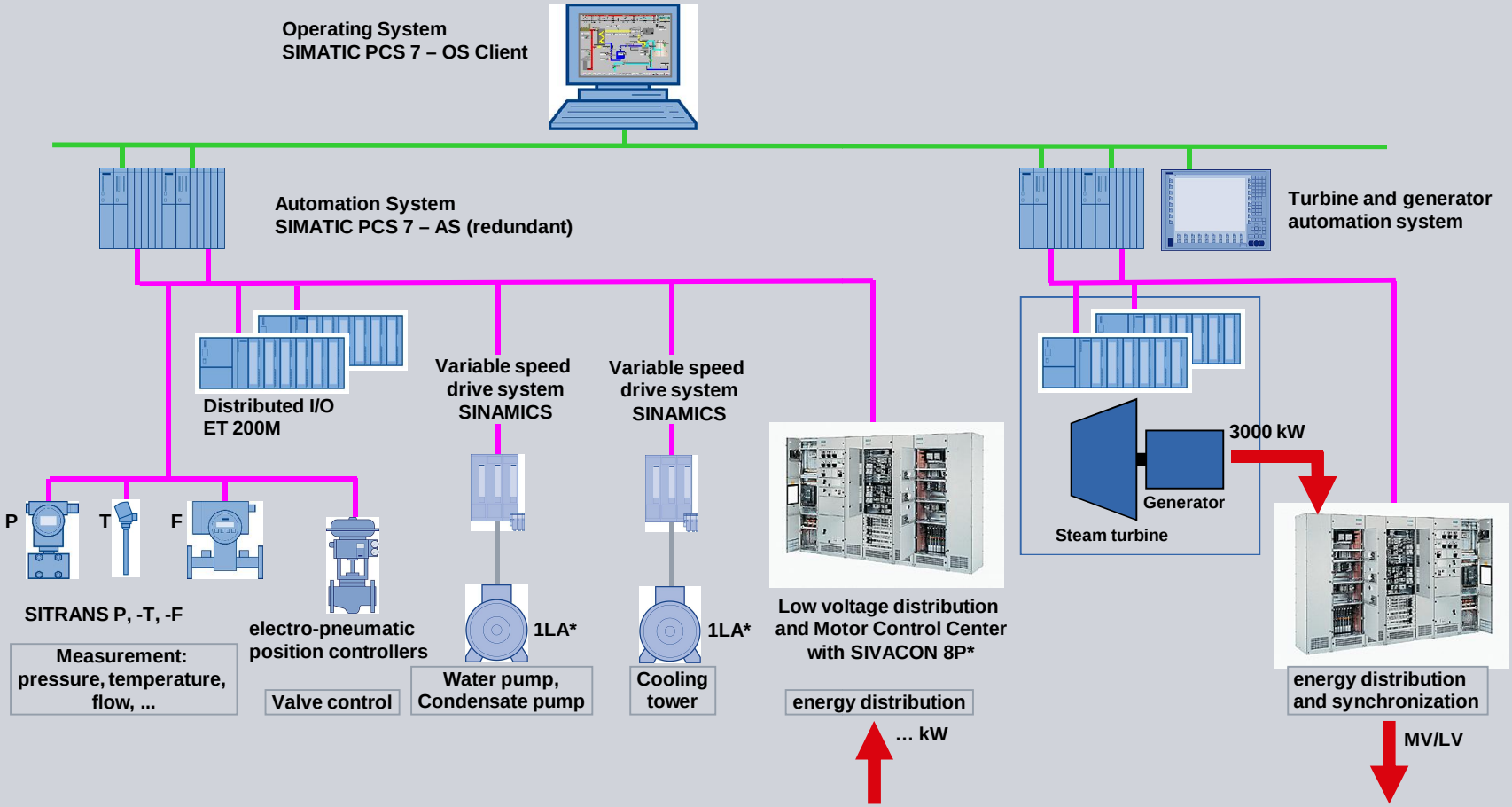




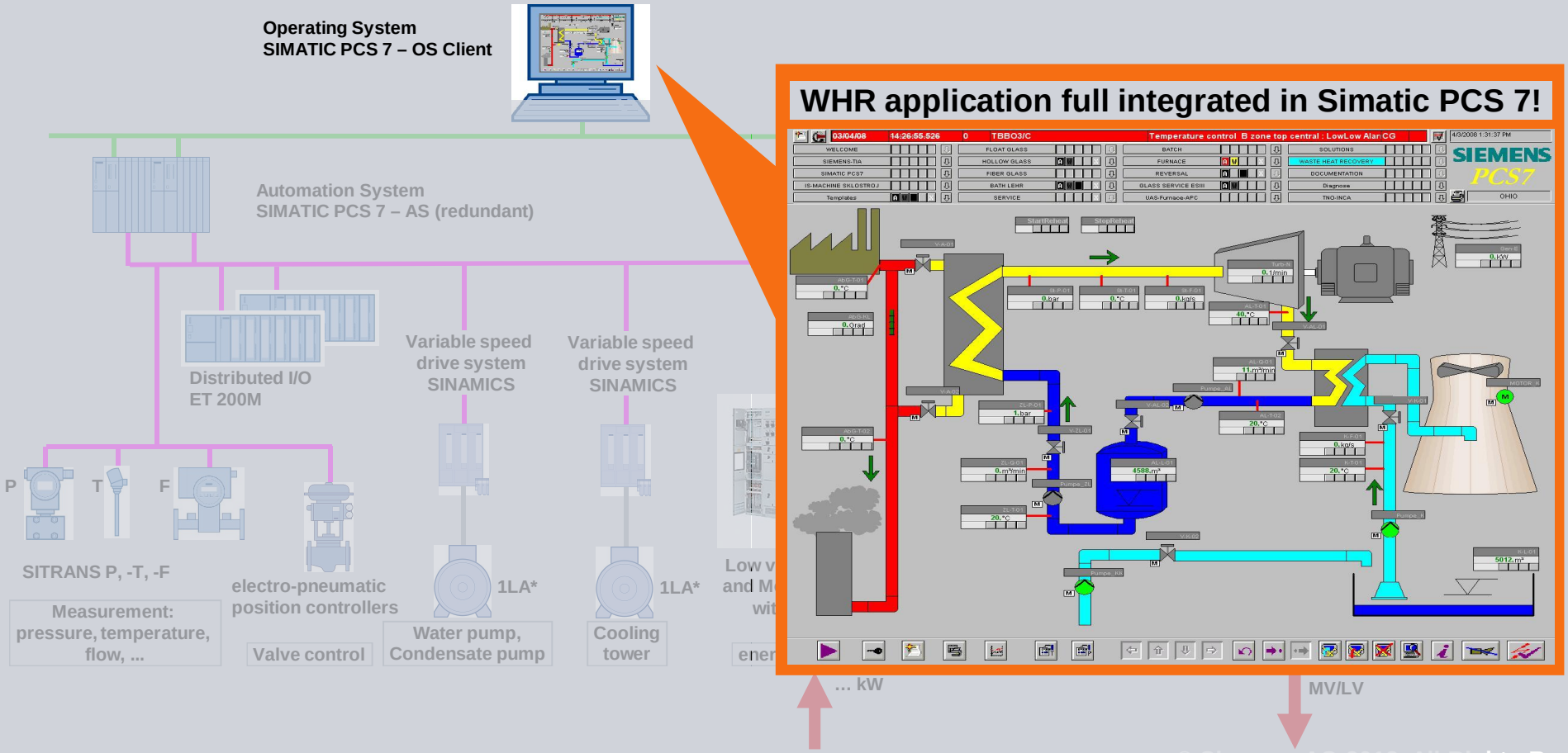
Process / Application	Batch	Furnace	Waste heat recovery	Forming	Cooling	Cold end	further processing	Utilities
MES-solution	☑					☑		
Plant Wide Automation solution	☑	☑	☑	☑	☑	☑	☑	☑
Local operating / Monitoring	☑		☑			☑	☑	☑
Automation	☑	☑	☑	☑	☑	☑	☑	☑
Field instrumentation	☑	☑	☑	☑	☑	☑	☑	☑
Drives, Motion Control	☑	☑	☑	☑	☑	☑	☑	☑
Medium and Low voltage distribution incl. MCC	☑	☑	☑	☑	☑	☑	☑	☑
Turbine and generator system			☑					

APC: Advanced Process Control
SPC: Statistical Process Control

Automation architecture and energy distribution



Automation architecture and energy distribution



Modular Equipment –
Steam turbine with generator

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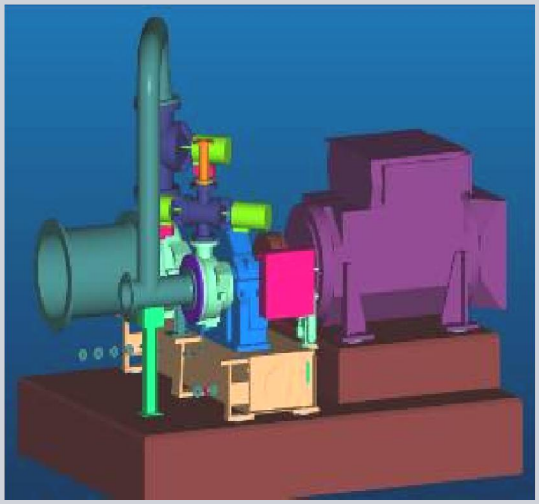
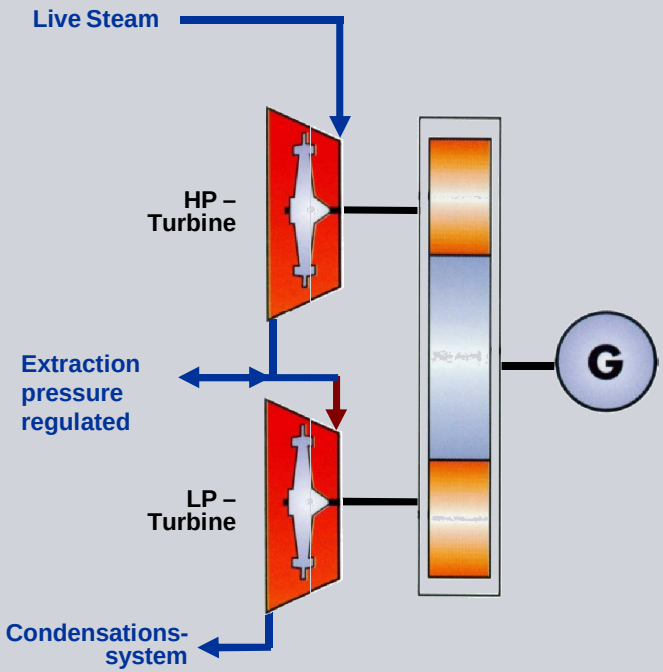
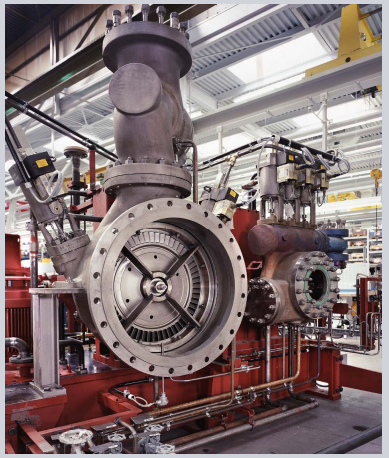


TWIN-TURBINE





Project: Glass Factory Magdeburg

Steam Turbine Type: SST-110
(former TWIN CA 56)

Start-up : 2009

Live Steam Pressure: 40.00 bar
Live steam temperature: 380 - 424 ° C
Intermediate Pressure: 1.21 – 8.00 bar
Exhaust Steam Pressure: 0.20 – 0.35 bar
Electrical Output: 3170 kWe

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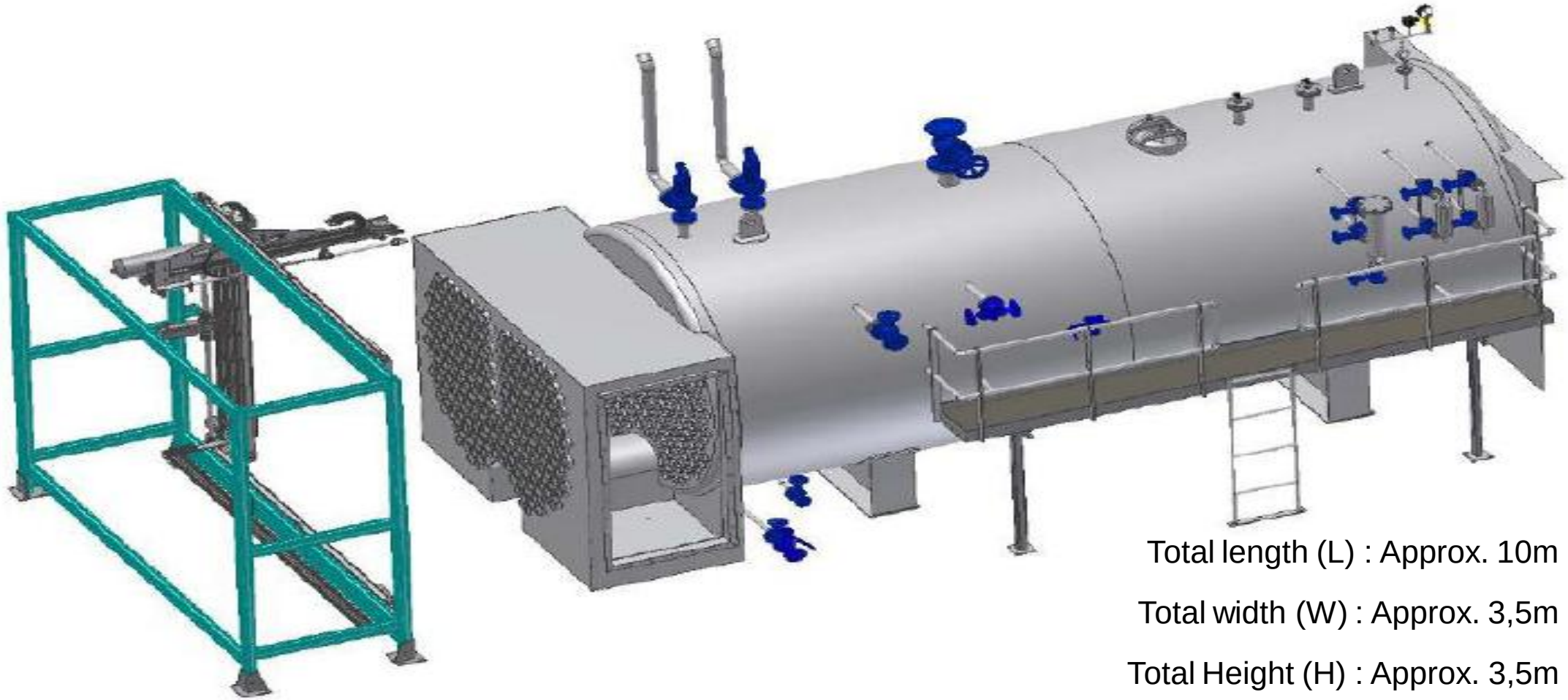
Waste Heat Recovery Boiler



Total length (L) : Approx. 10m

Total width (W) : Approx. 3,5m

Total Height (H) : Approx. 3,5m

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WHR plants in operation with SIEMENS products

Germany

- Float Glass: Euroglas in Osterweddingen,
  3 MW electrical power

- Float Glass: F-Glass in Osterweddingen,
  2.5 MW electrical power

Belarus

- Float Glass: Gomel,
  3 MW electrical power

Waste heat recovery plant with 2.5 MW electrical power output f|Glass, Germany, Float glass 700 t/day

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60 % of electricity produced by furnace waste heat flow !

Highly advanced energy recovery and reliable control technology

One of the project partners was Siemens. The company supplied automation technology for the plant and the turbines for energy recovery. Osterweddingen is one of the first glass plants in the world to recover a large part of the process waste heat using a modern heat recovery system. The system's most important component is a compact Siemens industrial steam turbine with a rated capacity of 2.5 megawatts, which f | glass uses to generate electrical energy from the waste heat in the process exhaust air. The energy recovery system not only saves energy, but, according to Räbiger*, "the energy recovery process also helps ensure process security. By producing 60 percent of the electricity required for the float-glass plant ourselves, we are better able to cope with a power outage, for example."

* CEO Dr. Ing. Wolfgang Räbiger in Glassfocus 2010

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Thank you for your attention !

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