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
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

Furnace

Glass Plant

Waste heat recovery power plant

Waste heat flow
……. Nm³/h

Electricity supply
……. KWh

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Industry Sector
Working principle of an industrial waste heat recovery plant

- Waste Heat from the process (flue gas)
- Water-steam
- Turbine
- Generator
- Plant electrical network
- Heat Recovery Boiler
- Condensate Pump
- Cooling Water Pump
- Cooling Tower
- Condenser
- Air
Typical technical concept and scope

Waste Heat Flow from furnace(s)

Boiler HP

Flue Gas Cleaning System

Boiler LP

ID Fans (optional)

Chimney

Superheater

Superheater

Boiler Feed Water System

Condenser

G

MV Cabinet

MV Cabinet

MV Cabinet

MV Cabinet

LV Cabinet

LV Cabinet

LV Cabinet

LV Cabinet

G

Heating/Cooling Power

Cooling System

Electrical Power

Flue Gas Flow – Water Flow – Steam Flow

Siemens Scope

existing

Industry Sector

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Waste Heat Recovery System with various options
Example of a multi-line concept:
2 glass lines with one turbo generator
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.

Assumption: minimum T° at basis of stack = 180°C

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

- **Warm area**
  - Tin bath
  - Forming process
  - Cooling process

- **Cold End**
  - Annealing lehr
  - Cutting line
  - Cutting
  - Further processing
    - Bending, grinding, ...

- **Utilities**
  - Energy distribution, Compressed air, water, ...

- **Waste heat recovery with water steam cycle**
Siemens portfolio for the glass manufacturing

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Automation architecture and energy distribution

Operating System
SIMATIC PCS 7 – OS Client

Automation System
SIMATIC PCS 7 – AS (redundant)

Distributed I/O
ET 200M

Variable speed drive system
SINAMICS

Variable speed drive system
SINAMICS

Electro-pneumatic position controllers

Water pump, Condensate pump

Valve control

Cooling tower

Low voltage distribution
and Motor Control Center
with SIVACON 8P*

SITRANS P, -T, -F
Measurement: pressure, temperature, flow, ...

1LA*

1LA*

Energy distribution and synchronization
MV/LV

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Industry Sector
Automation architecture and energy distribution

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Measurement:
pressure, temperature,
flow, ...

SITRANS P, -T, -F

electro-pneumatic
position controllers

Valve control
Water pump, Condensate pump

Cooling tower

1LA*

1LA*

WHR application full integrated in Simatic PCS 7!

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Industry Sector
Modular Equipment –
Steam turbine with generator

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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Industry Sector
Waste Heat Recovery Boiler

Total length (L) : Approx. 10m
Total width (W) : Approx. 3,5m
Total Height (H) : Approx. 3,5m
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

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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Industry Sector
Thank you for your attention!

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