



MIAC ENERGY: Fossili vs rinnovabili: quale mix energetico per la cartiera del futuro?

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Assocarta

OBIETTIVI EU E ITALIA

- Obiettivi 2020.
 - -20% CO₂ rispetto emissioni del 1990
 - 20% di RES rispetto a consumi finali
 - 20% di efficienza energetica rispetto a consumi finali
- Obiettivi 2030:
 - - 40% CO₂ rispetto emissioni del 1990
 - 32,5% di efficienza energetica nei consumi finali
 - 32% di RES rispetto ai consumi finali
- Roadmap 2050: ipotesi di percorso per la riduzione delle emissioni dell'80%
 - Prima comunicazione della Commissione del 2011
 - Revisione della roadmap a livello di Commissione in corso

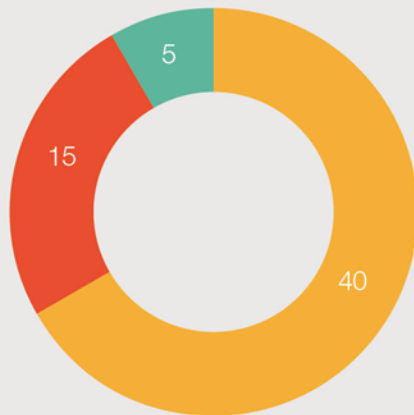
CEPI ROADMAP

- CEPI ha provato a declinare nel 2016 la comunicazione europea della Roadmap 2050
- Nel corso di tale esercizio sono emersi spazi di possibile ulteriori riduzioni di emissioni di CO₂ ma a fronte di una necessità di investimento molto importante
- Il risultato sarà possibile solo se saranno identificate e rese commerciali nuove tecnologie di processo che consentano di ridurre le necessità energetiche
- Le aree di intervento riguardano:
 - Emissioni dirette
 - Efficienza energetica
 - Cambio di combustibile
 - Gestione della domanda in sito
 - Nuove tecnologie
 - Emissioni indirette
 - Trasporti

CEPI ROADMAP

1990

60 million tonnes CO₂



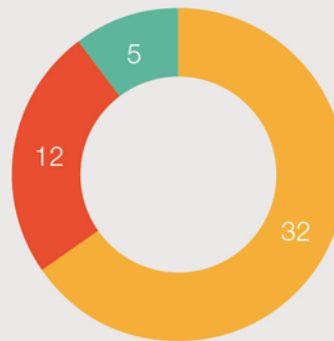
Transport

Direct emissions

Purchased electricity

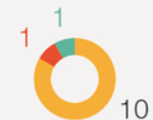
2015

49 million tonnes CO₂

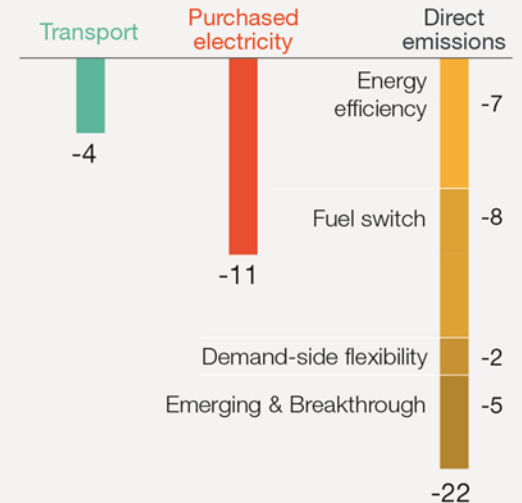


2050

12 million tonnes CO₂



2015-2050 pathways for decarbonisation



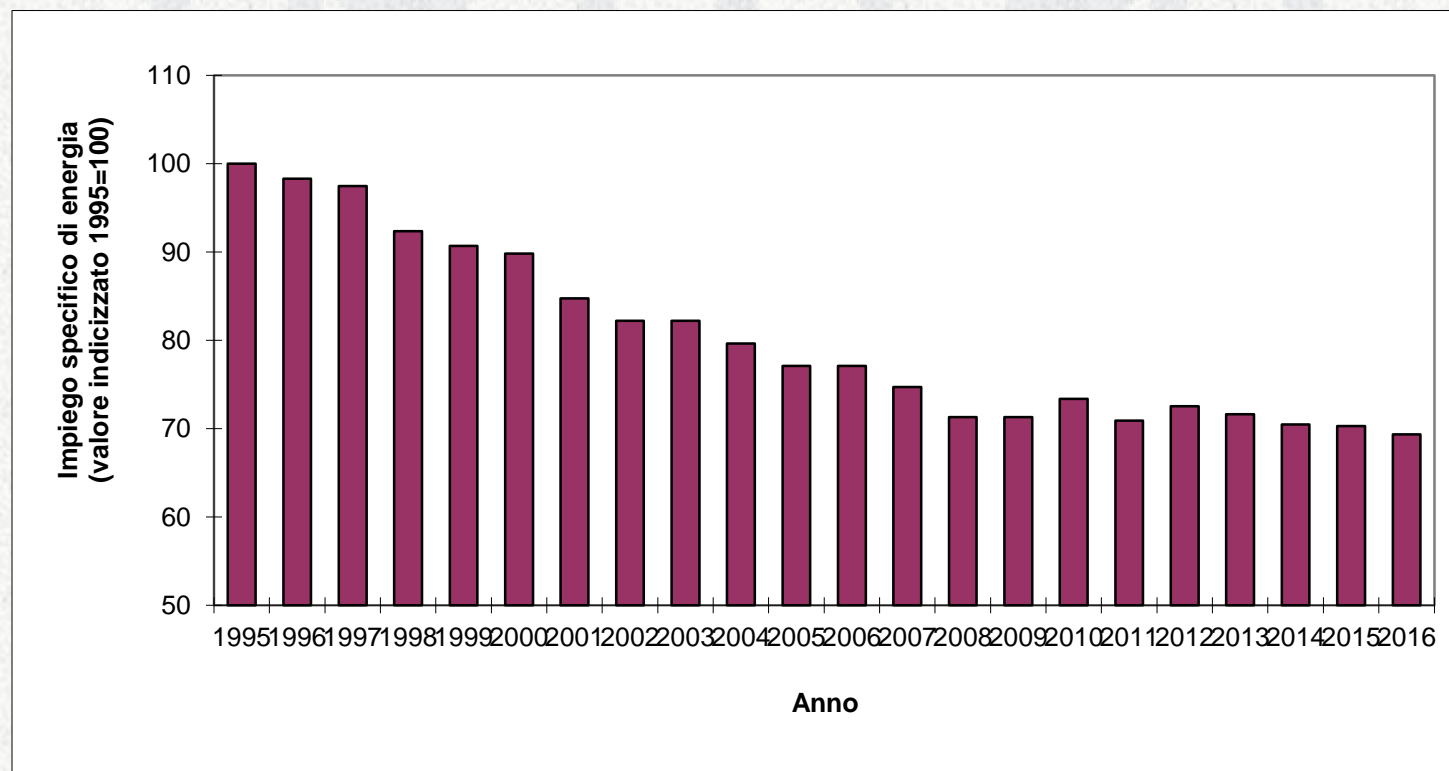
Source: Gaia 2016

LA PECULIARITÀ DEL SETTORE ITALIANO

- Pressoché totale assenza di biomassa se non a livello locale
- Forte presenza del gas per alimentare impianti di cogenerazione ad alto rendimento
- Forte presenza di prodotti che utilizzano carta da riciclo
- Limiti infrastrutturali per elettrificazione

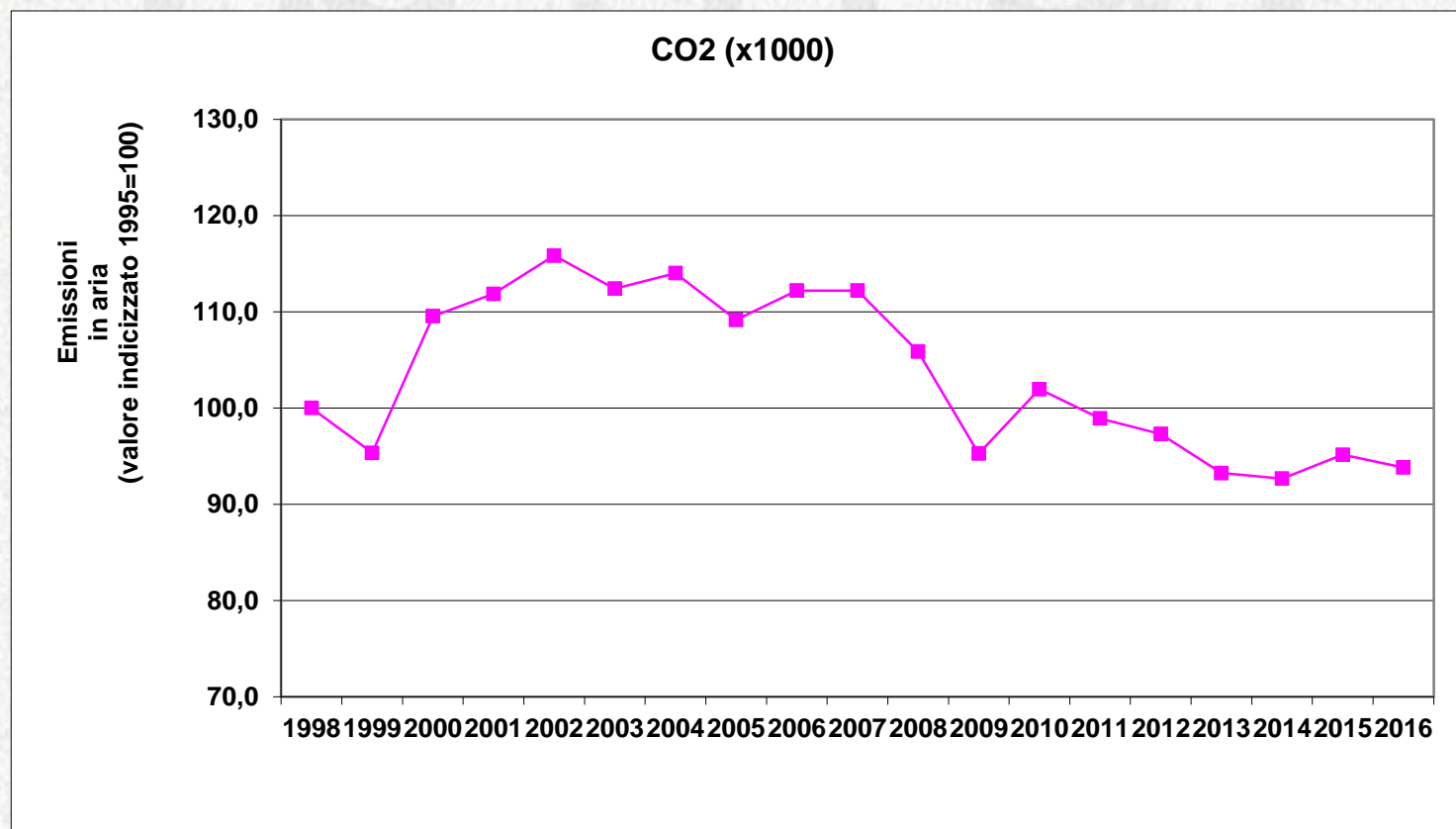
PROGRESSI FATTI FINO AD OGGI -1

- Andamento efficienza energetica del settore



PROGRESSI FATTI FINO AD OGGI - 2

- Andamento emissioni di CO₂ del settore



POSSIBILI SPAZI

INTERVENTI DIRETTI

- Breakthroughs technologies
- Energie rinnovabili disponibili in sito
 - Bioenergie dai residui di processo (fanghi e residui): gasificazione, pirolisi, digestione anaerobica – utilizzo diretto come energia
 - Pompe di calore nuova generazione: sostituire alcune necessità energetiche tramite l'utilizzo di pompe di calore – investire su sviluppi oltre gli 80 °C
 - Sonde geotermiche – solare – vento
- Fuel switch – biomasse: limiti di accesso alle biomasse

INTERVENTI INDIRETTI

- Fuel switch – elettricità: incremento di generazione dall'esterno di 2,5 volte circa
- Decarbonizzazione del gas naturale: power to gas, biogas
- Decarbonizzazione trasporti

SOLAR TURBINES

Benefits for Paper & Tissue Industry

Autumn 2018

Solar Turbines

A Caterpillar Company

Powering the Future

Don't ask us about paper thickness or air flow distribution!

Don't ask us about raw material saving!

.....

You don't need us to make your products

We are a
CATERPILLAR
Company

We produce
Gas Turbines for
power, steam, hot
air and chilled
water generation

BUT.....
please contact us when you want
to REDUCE your ENERGY BILL

Solar Turbines

A Caterpillar Company

THE EXPERIENCE YOU CAN RELY ON

Solar Turbines
A Caterpillar Company



+100

Countries



+13,500,000 h

Gas Turbines yearly operation



+16,000

Gas Turbines population



+98,000,000 MWh

Produced every year in industrial CHP



+1,200

Industrial CHP Customers



> 30%

Saving on utilities cost

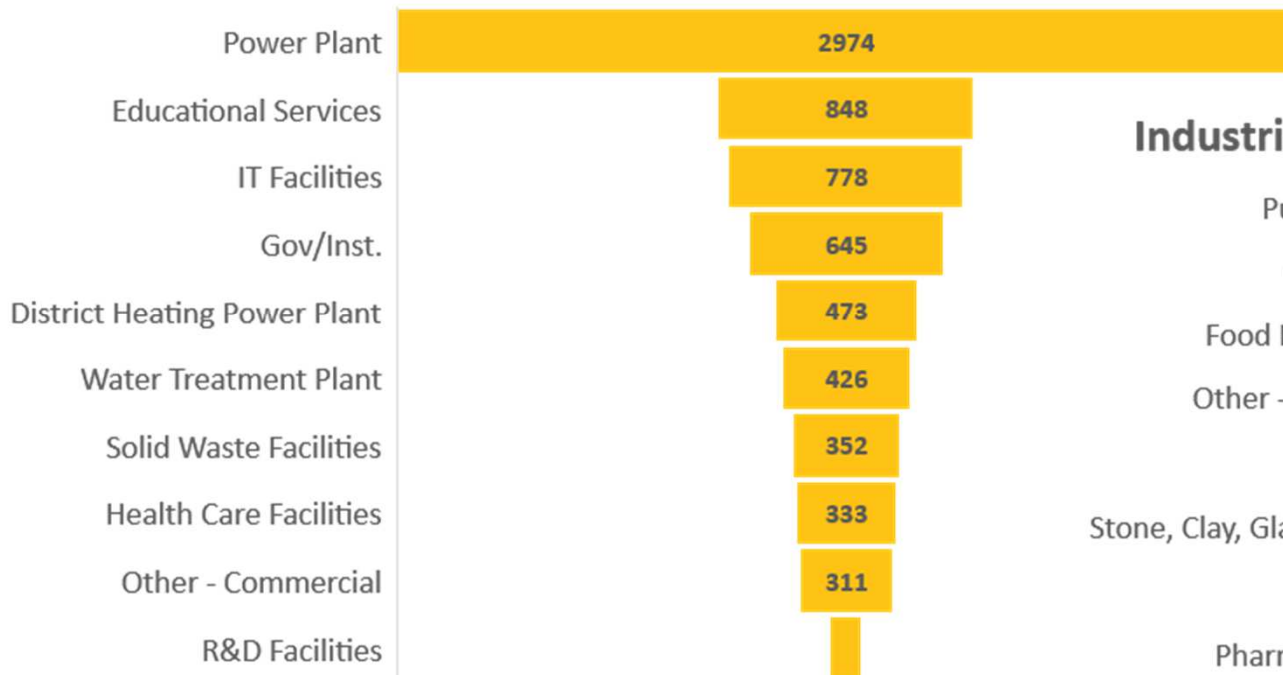


350,000,000 t/y

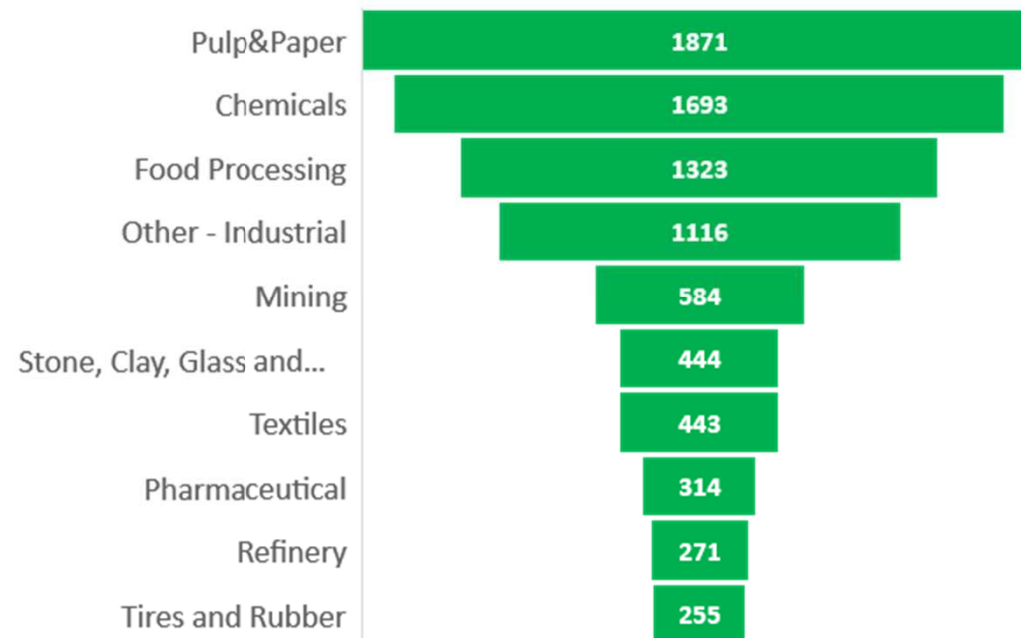
CO2 saved as average (2017)

+15.5 GW GAS TURBINES IN PG APPLICATIONS

Services Sector Experience (Cumulative MW)



Industrial Sector Experience (Cumulative MW)



A man in a dark suit and white shirt is shown in profile, pointing his right hand towards a large, bright screen. The screen displays a blurred image of a city skyline with tall buildings. The scene is brightly lit, with a warm, golden glow emanating from the screen, suggesting a sunny day or a bright indoor environment. The overall composition is professional and modern, emphasizing technology and business.

THINKING ABOUT ENERGY NEEDS

means Understand Industry Specific Requirements

SOLAR's Solutions Portfolio

Solar® Turbines

A Caterpillar Company

LEVERAGE THE EXPERIENCES...

SOLAR TURBINES
experience

TURBOMACH
experience

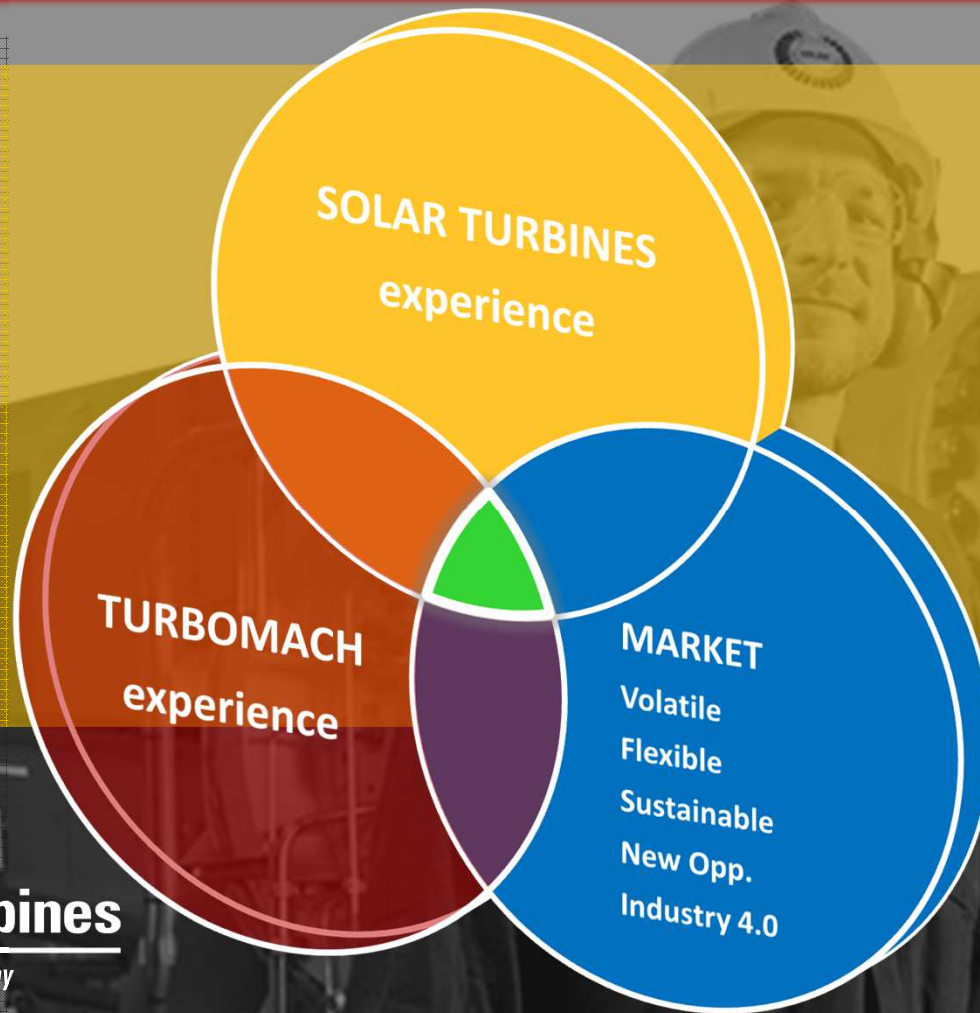
Solar Turbines

A Caterpillar Company

+1200

**GAS TURBINES IN CHP
APPLICATIONS**

... ADDRESSING YOUR NEEDS



Solar Turbines
A Caterpillar Company

KEY DESIGN CRITERIA

- COGEN Design
- Efficient management of the utilities production.
- Reduction of the operative cost.
- Higher UpTime
- Make our customer more sustainable and measure it.
- Advanced connectivity
- Compatible with Industry 4.0
- Modularity and scalability

MODULAR PLUG AND PLAY CONCEPT

Package Ventilation Filters

Turbine Air Inlet Filters

Inlet Fans

MCC And On-skid Control Box

Enclosure Structure

Ladders and platforms

PGM Core Module

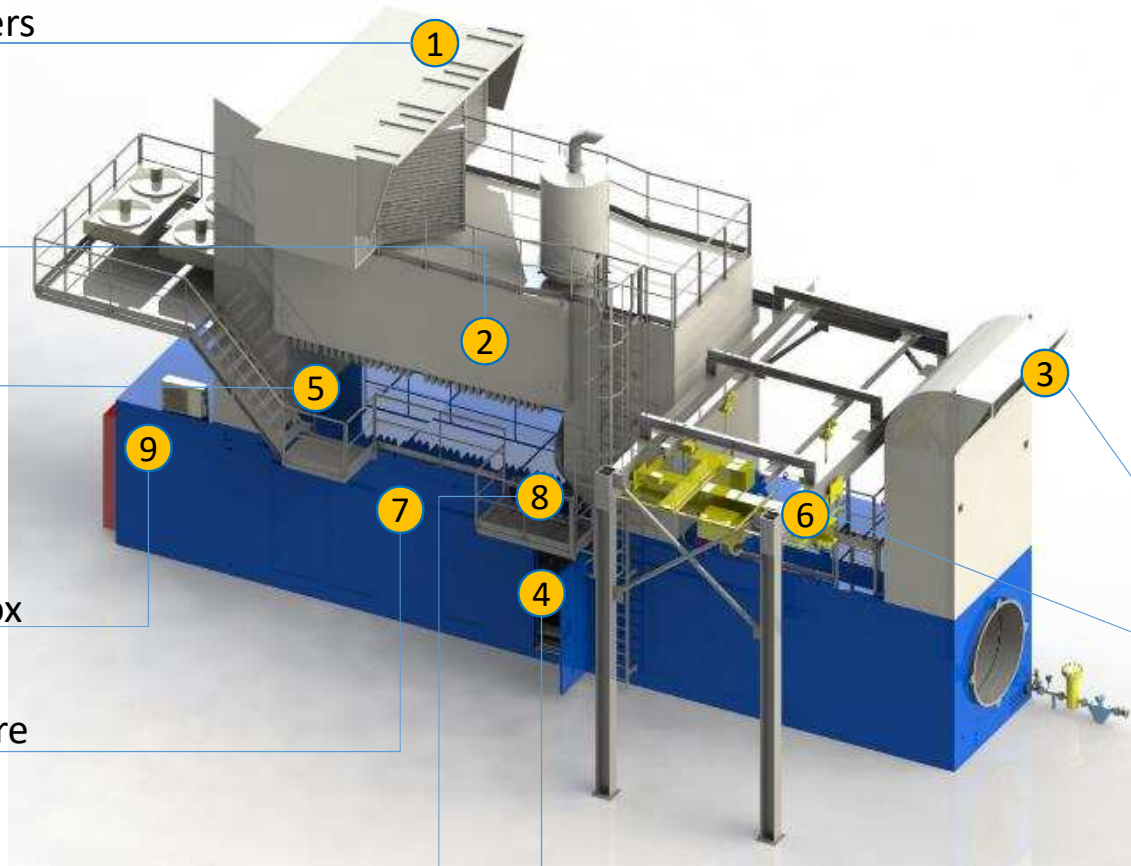
3 – 6.5 MW
C40-C50-T60-T65

7.5 – 8.2 MW
T70

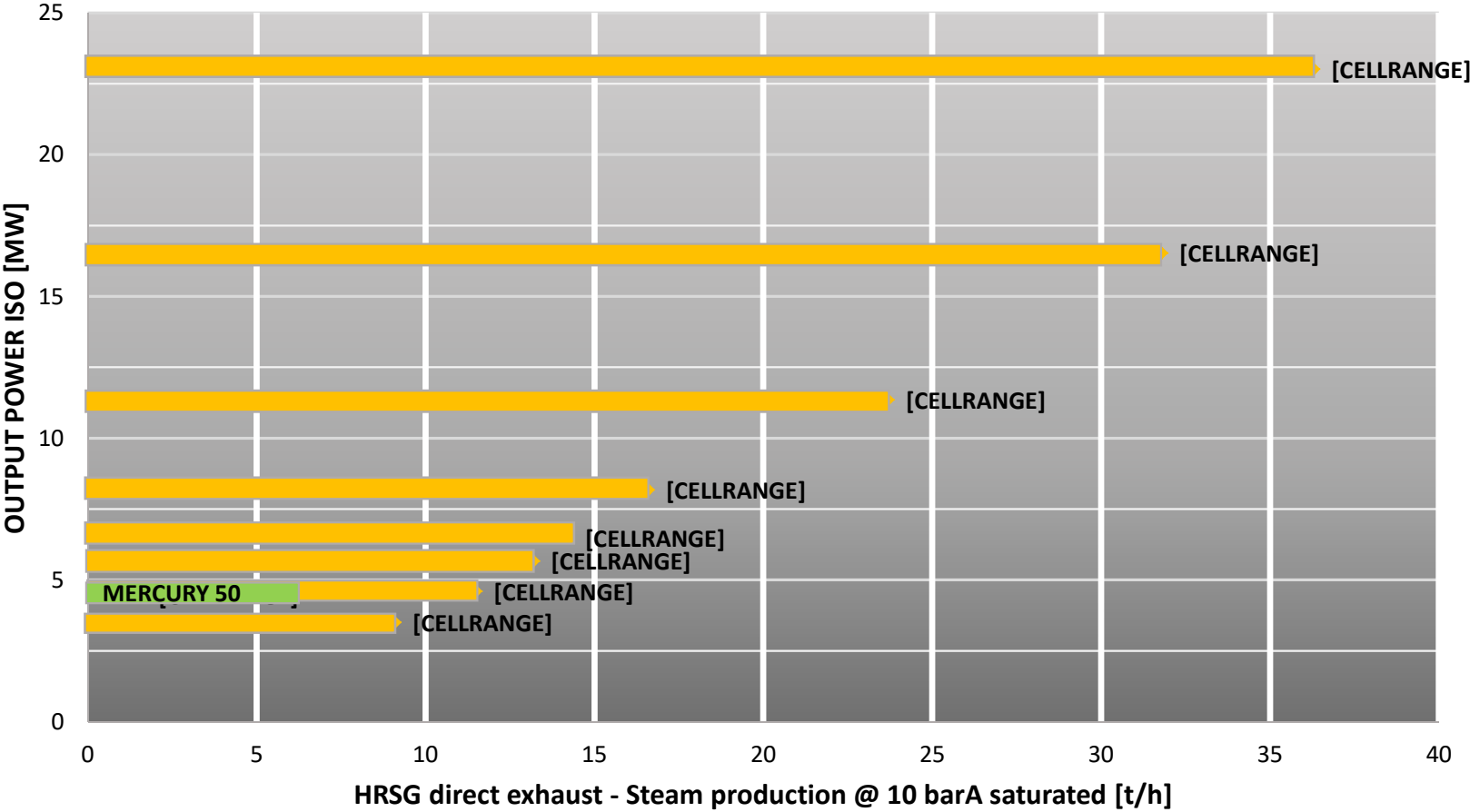
15.0 – 16.5 MW
T130

Package Exhaust

Engine Removal Structure

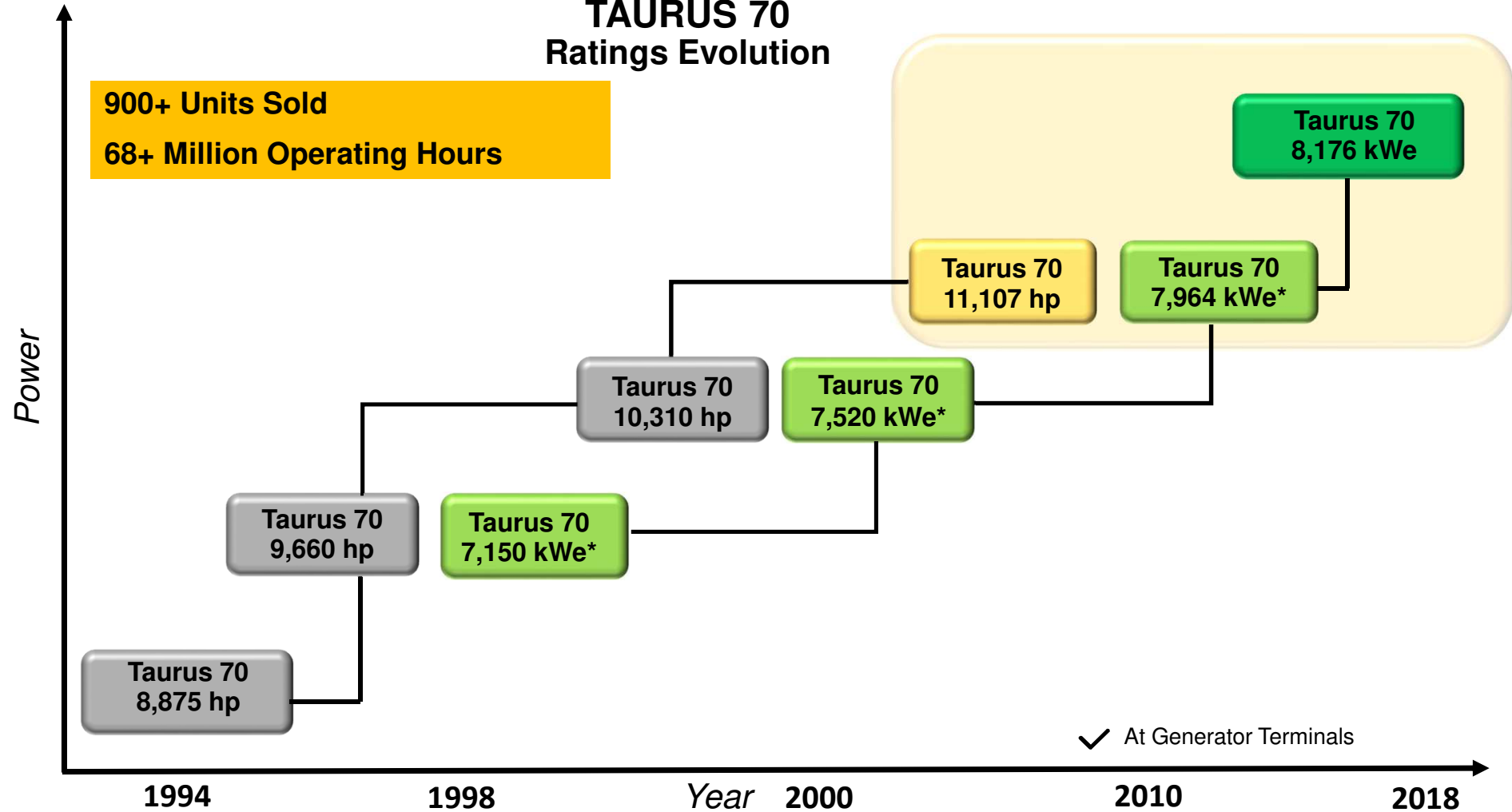


INDUSTRIAL GAS TURBINES FROM up to 23 MW



TurbineType	Steam Production ⁴⁾ @ 10 bar(a) saturated, fired to 800°C
	t/h
CENTAUR 40	21.5
CENTAUR 50	22.2
MERCURY 50	19.8
TAURUS 60	25.3
TAURUS 65	24.5
TAURUS 70	30.9
MARS 100	50.1
TITAN 130	59.0
TITAN 250	80.5

TAURUS 70 Ratings Evolution



CHP design data CASE T70s

Design data

Electrical need:

8,500 kW_e

Steam requirements:

18 t/h saturated (39,683 lbm/h)
10 bar

Electricity cost:

0.098 €/kWh

Gas cost:

0.30 €/Sm³ (0.0309 €/kWh)

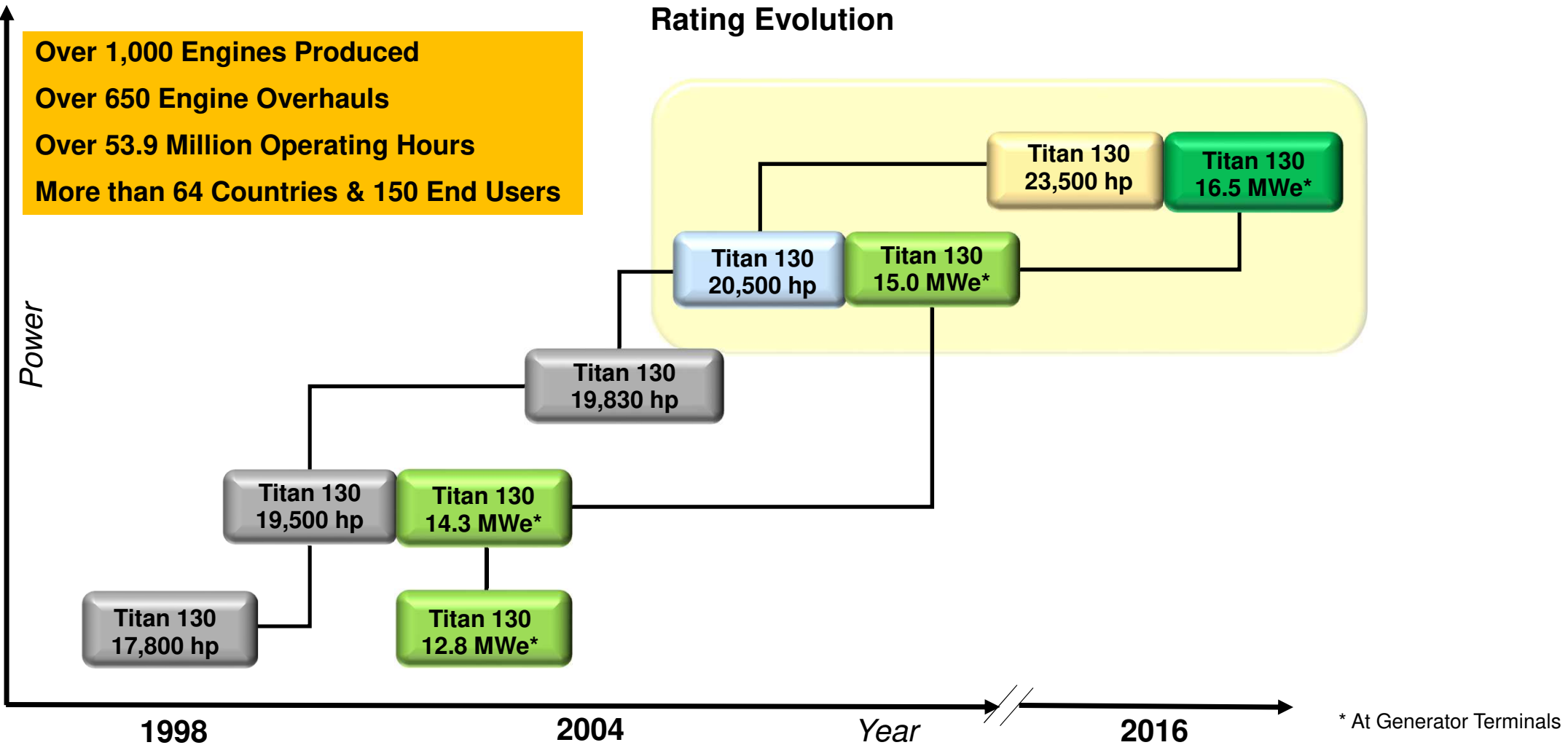
CHP financial performance T70s

Comparison

	T70 – 10800hp		T70 – 11100hp
Electricity from the grid	€/yr	474'463	299'277
Natural gas for boiler _(steam)	€/yr	311'625	219'589
GT operation <small>(Natural gas and maintenance)</small>	€/yr	6'423'958	6'569'712
TOTAL	€/yr	7'210'046	7'088'578
<i>Differential saving</i>	<i>€/yr</i>		<i>Approx 120'000</i>
<i>Differential IRR</i>			<i>+ 2.0%</i>
<i>Differential specific CO₂/ MW_e</i>			<i>- 3.0%</i>

TITAN 130 Rating Evolution

Over 1,000 Engines Produced
Over 650 Engine Overhauls
Over 53.9 Million Operating Hours
More than 64 Countries & 150 End Users



CHP design data CASE T130s

Design data

Electrical need:

17,000 kW_e

Steam requirements:

32 t/h saturated (40,548 lbm/h)
10 bar

Electricity cost:

0.098 €/kWh

Gas cost:

0.30 €/Sm³ (0.0309 €/kWh)

CHP financial performance T130s

Comparison

T130 – 20500hp

T130 – 23500hp

Electricity from the grid €/yr 1'678'869

437'966

Natural gas for boiler (steam) €/yr 545'804

31'943

GT operation (Natural gas and maintenance) €/yr 11'903'843

13'011'905

TOTAL €/yr 14'128'516

13'481'814

Differential saving €/yr

Approx 646'00

Differential IRR

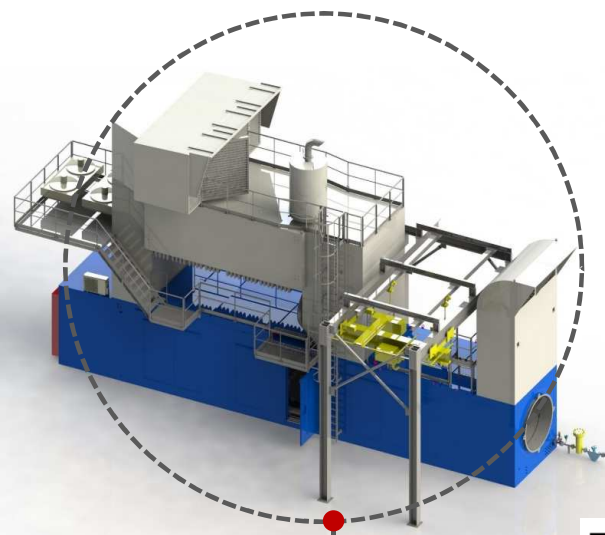
+ 3.5%

Differential specific CO₂/ MW_e

- 23 %

FOCUS ON CHP

Few numbers

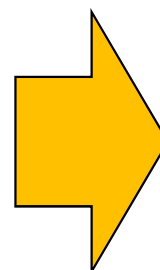


GT Type version	Taurus 70 10800	Taurus 70 11101	Titan 130 20500	Titan 130 23500	
Electrical Power @ ISO	7,960	8,176	15,000	16,530	kW
electrical efficiency @ ref. Temp.	34.3	34.4	35.2	35.4	%
Thermal Power Available @ ref. Temp.	14,776	15,118	26,748	29,187	kW
Steam Production Heat Recovery only	16.2	16.7	28.8	31.8	t/h
Differential CO ₂ reduction	-	-3.0	-	-22.0	%
Differential Saving		120,000		646,000	€/y
Differential IRR		2.0		3.5	%

Extra-cost per day of downtime	€/day	11,500		23,500
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Higher Uptime

Maximize productivity and reduce OPEX



TURBINE PERFORMANCE & INNOVATIVE ANALYTICS

Historic Trend

Live (PCD Prediction)

INSIGHT & ADVANCED
Analytics Innovation
BEYOND the Package

- Live & Historic Views
- Trend Power and PCD Over Time
- Recoverable vs Non-Recoverable
- Optimized Water Wash Schedule

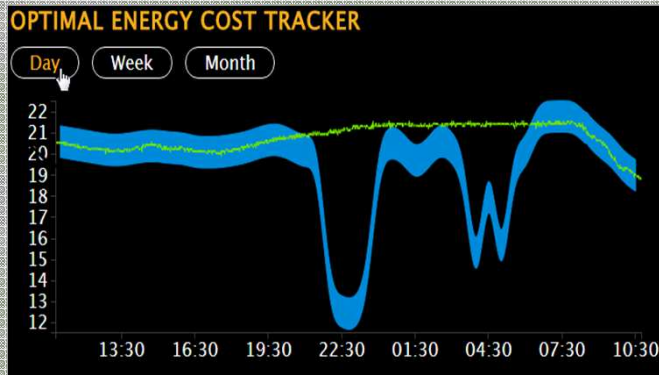
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Caterpillar: Confidential Green

Powering the Future

IDENTIFY OPPORTUNITIES

Analytics Modules



Save \$ in turbine operation from better turbine dispatch and condition based maintenance



Energy Optimization



Analytics & Optimization
Energy Forecasting

Lean Energy Operation
Real Time Capability

IDENTIFY OPPORTUNITIES

Analytics Modules

Energy

Optimization

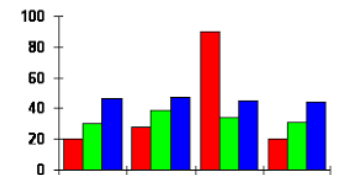
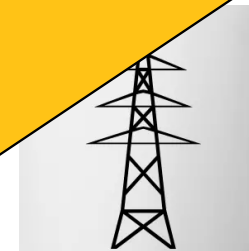
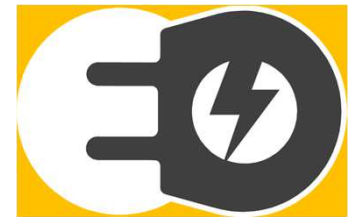


Plant Economics
Plant Data Collection
Analytics & Optimization
Energy Forecasting
Lean Energy Operation
Real Time Capability

Save \$ in turbine operation from
condition based

Demand Response Program

Smart Grid
Load Shifting
Balancing
Energy Storage





MIAC ENERGY – ASSOCARTA CONFERENCE

11 October 2018 – time 14.00/16.45 – MIAC 2018 Conference Room

Energy solutions with and for the Customer

Paolo Della Negra
Manager, Sales Department

Energy solutions with and for the Customer

Approximately 70% of the energy used in a tissue mill goes to the drying process (Yankee hood and Yankee dryer) and this means that there is a great potential for energy savings.



Valmet experts with their skills - together with Customer's experience and knowledge of their own machines - lead to the best WIN/WIN solutions.



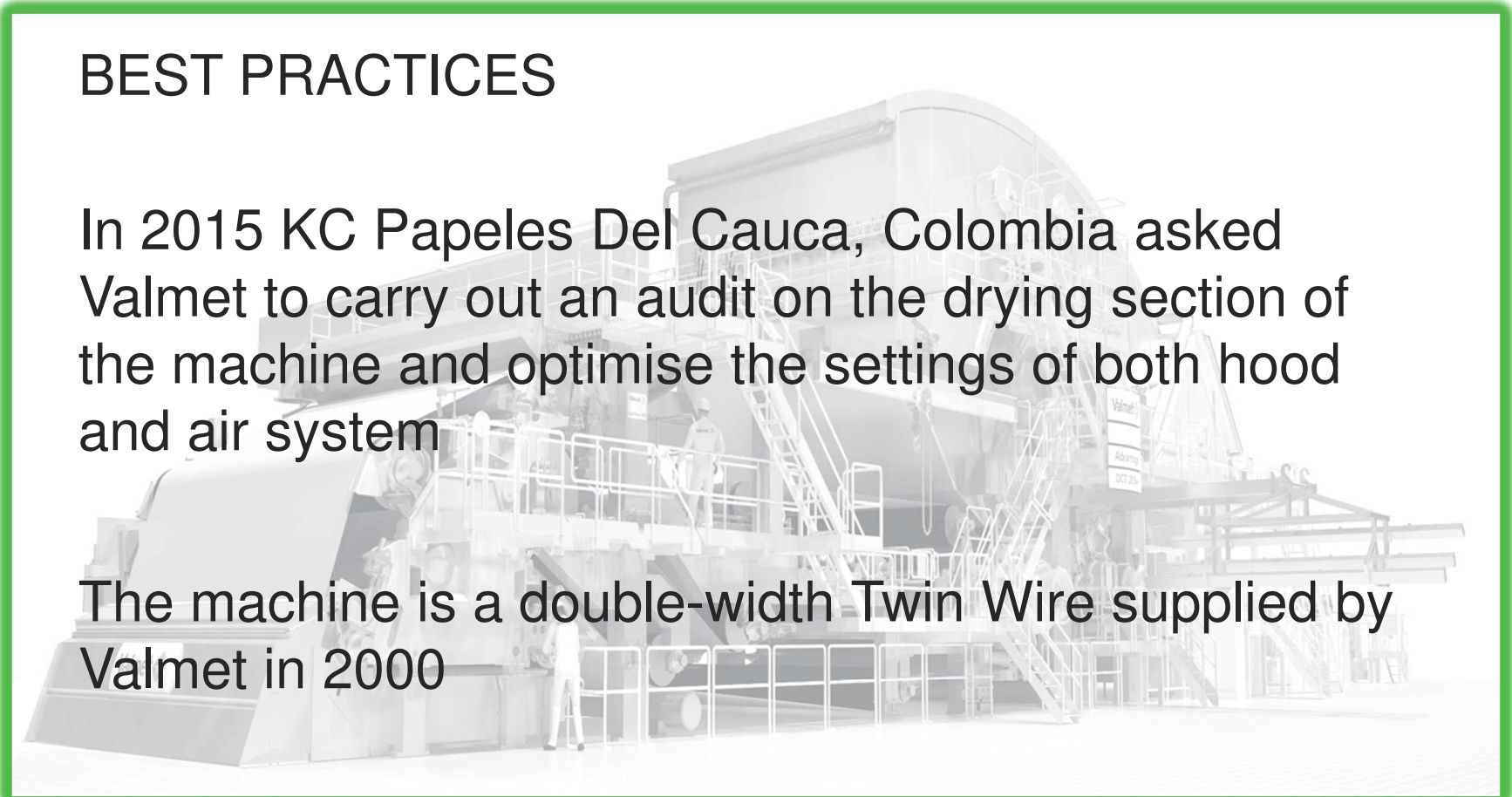
**Respecting the environment
while increasing profitability!**

Energy solutions with and for the Customer

BEST PRACTICES

In 2015 KC Papeles Del Cauca, Colombia asked Valmet to carry out an audit on the drying section of the machine and optimise the settings of both hood and air system

The machine is a double-width Twin Wire supplied by Valmet in 2000



Energy solutions: the starting point

DRYING ENERGY AUDIT: A
TAILORED ENERGY ANALYSIS
ON THE DRYING SECTION OF
THE TISSUE MACHINE



STEP 3

- Report of results and identification of realistic potential improvement areas and proposal of a clear **Road Map** with short, medium and long term improvements

STEP 2

- Direct on-field adjustments based on audit results, with immediate savings from system optimisation

STEP 1

- Dialogue with the Customer to define critical issues, objectives and expectations
- Process measurements and testing at mill site, comparing results with TM benchmarks

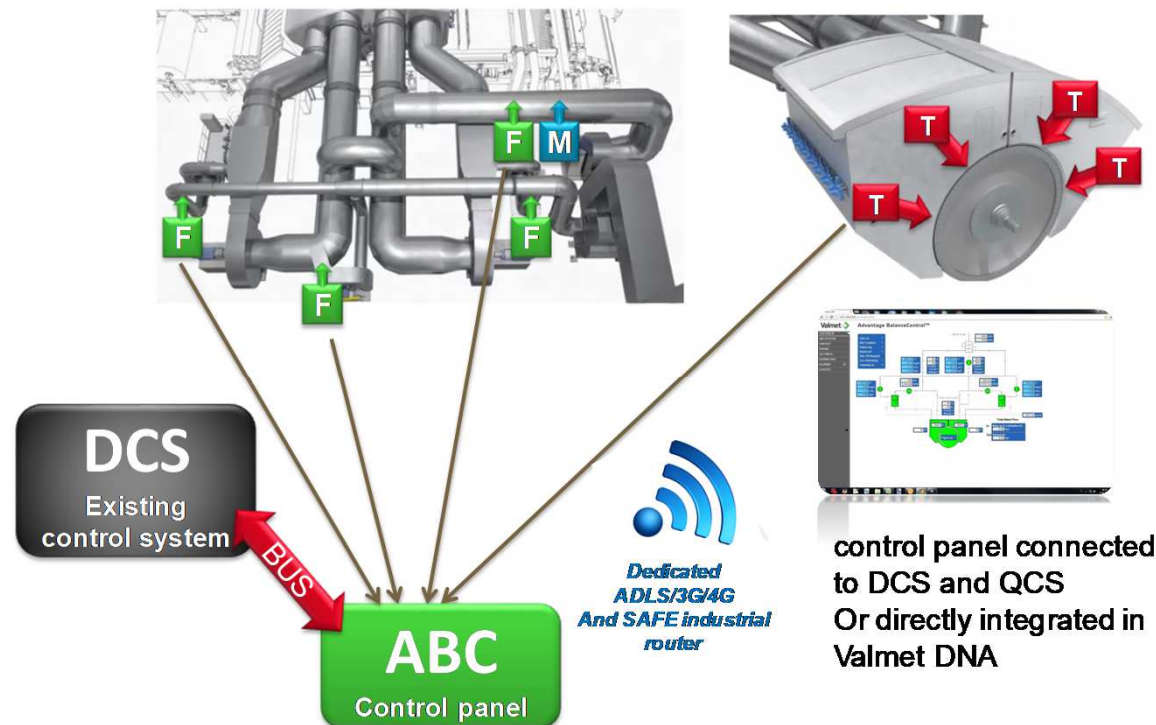
Energy solutions: results and outcomes

- Customer was looking for an energy/drying benchmark with other similar Tissue Machines
- Overview of potential realistic projects to be implemented in order to improve energy efficiency was their priority
- Energy Audit carried out in 2015: immediate results from optimisation of air system and hood settings. Gas consumption for burners was decreased from 415 Nm³/h to 340 Nm³/h: **-19%!**
- Road Map built together with Customer based on Valmet Best Available Technology that was applicable to their machine, such as:
 - ✓ Advantage™ BalanceControl™
 - ✓ Combustion fans for pre-heated air
 - ✓ Waste Heat Steam Generator
 - ✓ Advantage™ ReDry™



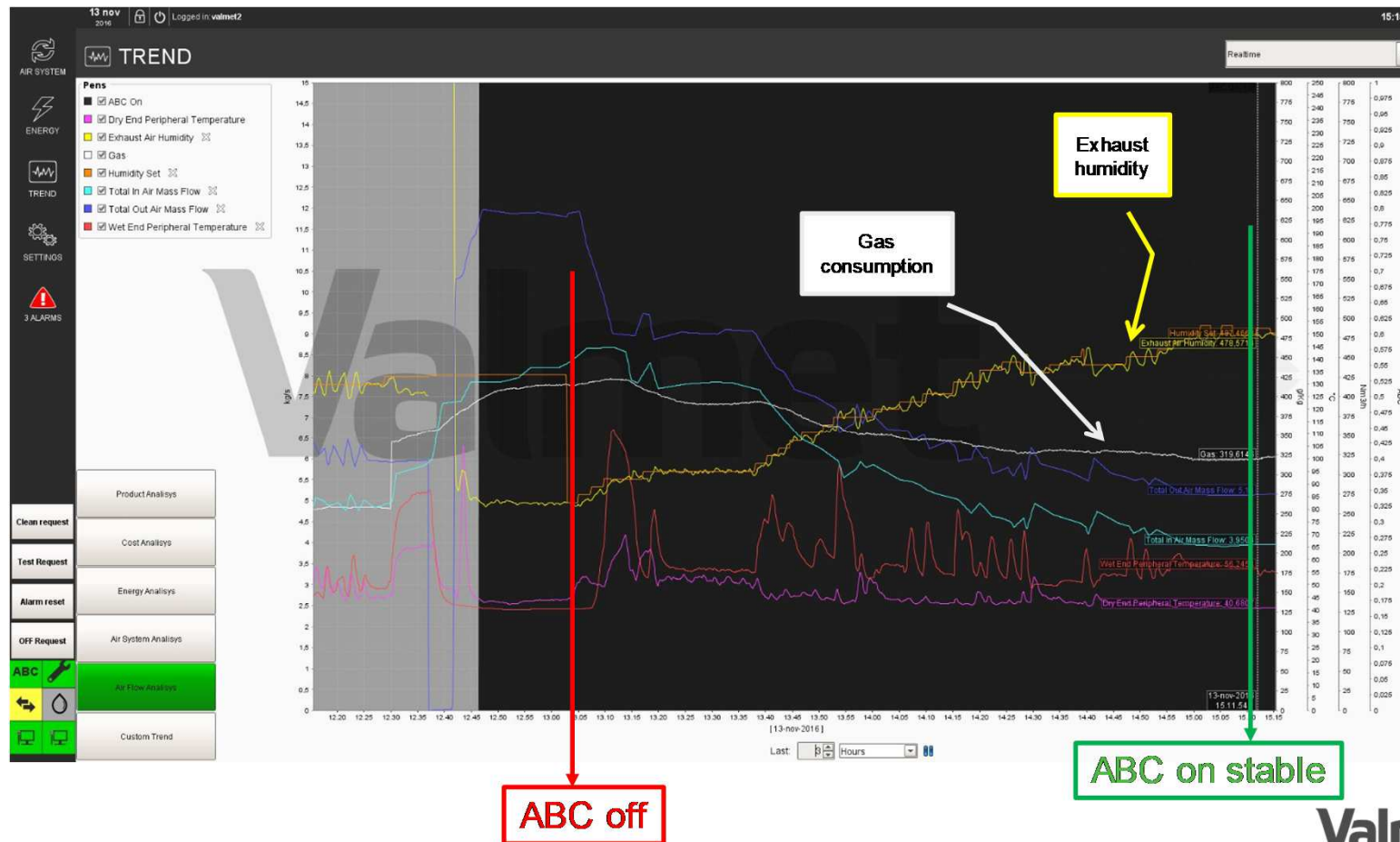
Energy solutions: Advantage™ BalanceControl™ - ABC

- At the end of 2015 KC Papeles del Cauca decided to go ahead with the implementation of the Valmet Advantage BalanceControl system
- Purpose:
 - ✓ consolidate the optimisation achieved on the air system
 - ✓ obtain further benefits from the ABC with the optimal and automatic settings and fine-tuning of the air system



Energy solutions: Advantage BalanceControl - ABC

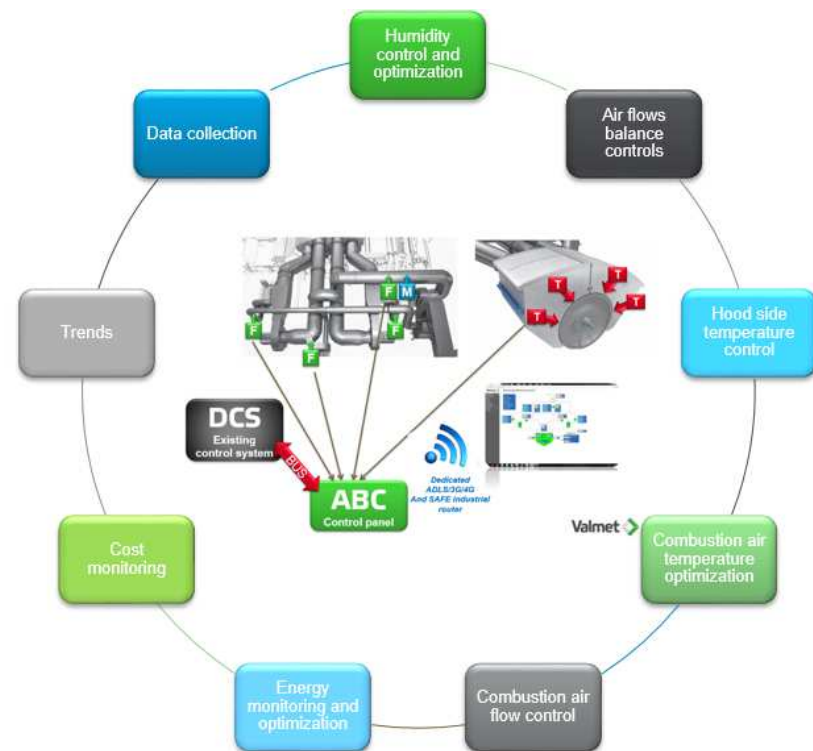
- Autumn 2016: the ABC was successfully installed and started-up
- Since then on the reference grade: gas consumption is constantly below 325 Nm³/h



Energy solutions: Advantage BalanceControl - ABC

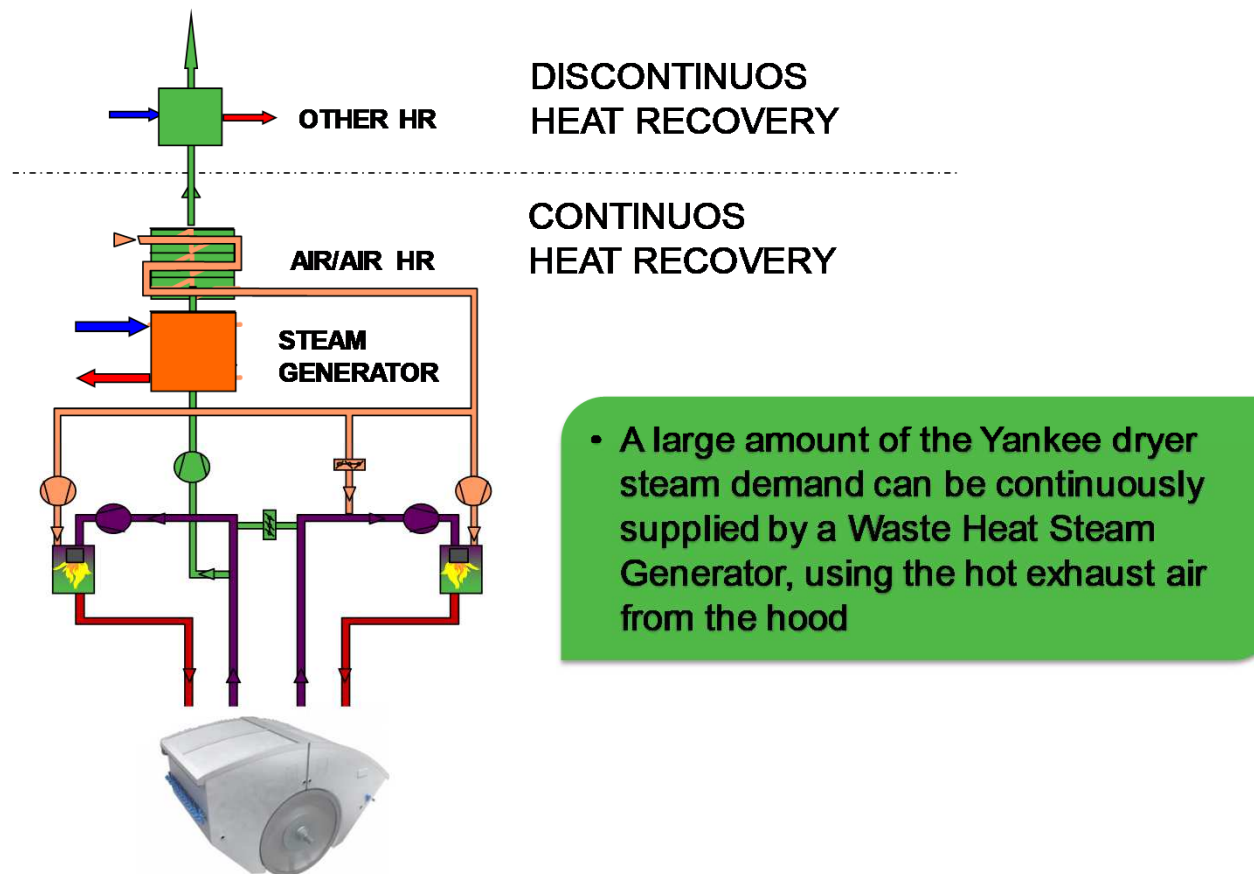
FURTHER BENEFITS

- Optimal settings
- Evaluations based on actual data in real-time
- Local and remote access
- Better safety and comfort level for operators and equipment
- Easy and fast remote assistance service



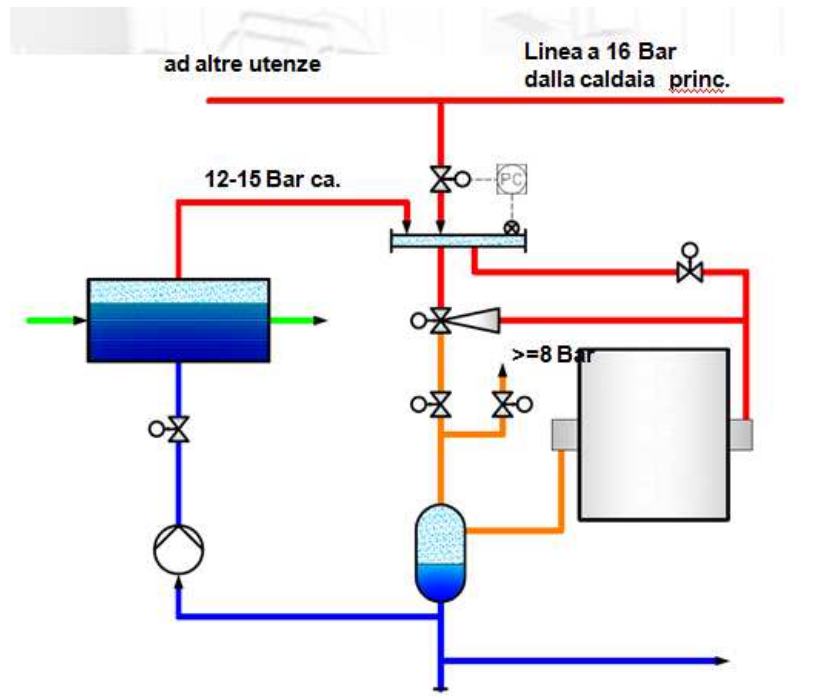
Energy solutions: Waste Heat Steam Generator

In 2017 we worked together with the Customer to define the technical feasibility and the ROI calculation for the installation of a Valmet Waste Heat Steam Generator



Energy solutions: Waste Heat Steam Generator

PATENT GRANTED



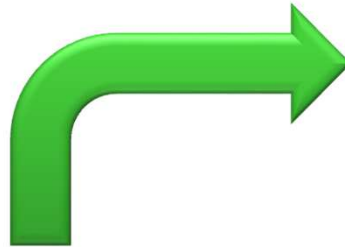
Steam is generated at intermediate pressure between main line and Yankee cylinder

Pressure of the motive steam is controlled in a collector based on Yankee cylinder pressure

Always keep the needed blow-through steam speed
AND MAXIMISE STEAM PRODUCTION!

Up to 20% more steam when working with Yankee cylinder at low pressure

Energy solutions: Waste Heat Steam Generator



The data collected during the energy audit, together with those stored by the ABC were used to run an energy analysis for all possible conditions and set-up of the air system

	Yankee speed [mpm]	Consumption for drying				Hood temp [°C]	Exhaust temp [°C]	Exhaust humidity [gW/kgDA]	Exhaust flow [kgDA/s]
		Steam [kW]	Gas [kW]	Electrical [kW]	TOTAL [kW]				
X DE 75 g/kg									
t hood 400°C	1740	3914	5983	913	10810	400	279	209	14,9
t hood 450°C	1740	3446	6657	700	10803	450	301	220	14,1
t hood 500°C	1740	3024	7192	558	10775	500	323	229	13,4
X DE 100 g/kg									
t hood 400°C	1740	3963	5652	969	10584	400	282	249	12,3
t hood 450°C	1740	3511	6337	707	10555	450	307	262	11,6
t hood 500°C	1740	3104	6911	557	10572	500	331	274	11,0
X DE 200 g/kg									
t hood 400°C									
t hood 450°C	1740	3672	5725	814	10211	450	315	401	7,3
t hood 500°C	1740	3341	6307	624	10272	500	339	408	7,1

	x DE = 75 gW/kgDA			x DE = 100 gW/kgDA			x DE = 200 gW/kgDA		
t hood [°C]	500	450	400	500	450	400	500	450	
Exhaust mass flow[kgDA/s]	13,41	14,12	14,87	10,99	11,56	12,27	7,12	7,25	
Exhaust temperature IN [°C]	323	301	279	331	307	282	339	315	
Exhaust humidity [gW/kgDA]	229	220	209	274	262	249	408	401	
NET Steam flow [kg/h]	2973	2394	1761	2786	2228	1613	2250	1791	
Recovered energy [kW]	1989	1601	1178	1864	1491	1079	1505	1198	

Energy solutions: Waste Heat Steam Generator



- ✓ best way to operate the air system after installing the Steam Generator to maximise the energy efficiency of the whole system (air system + steam generator + additional heat recovery systems for make-up and combustion air)
- ✓ obtain the lowest drying energy costs (based on given specific energy costs)
- ✓ define and optimise the WHSG size

Expected energy savings after the start up of the WHSG have been calculated at approximately

440 kUSD/year

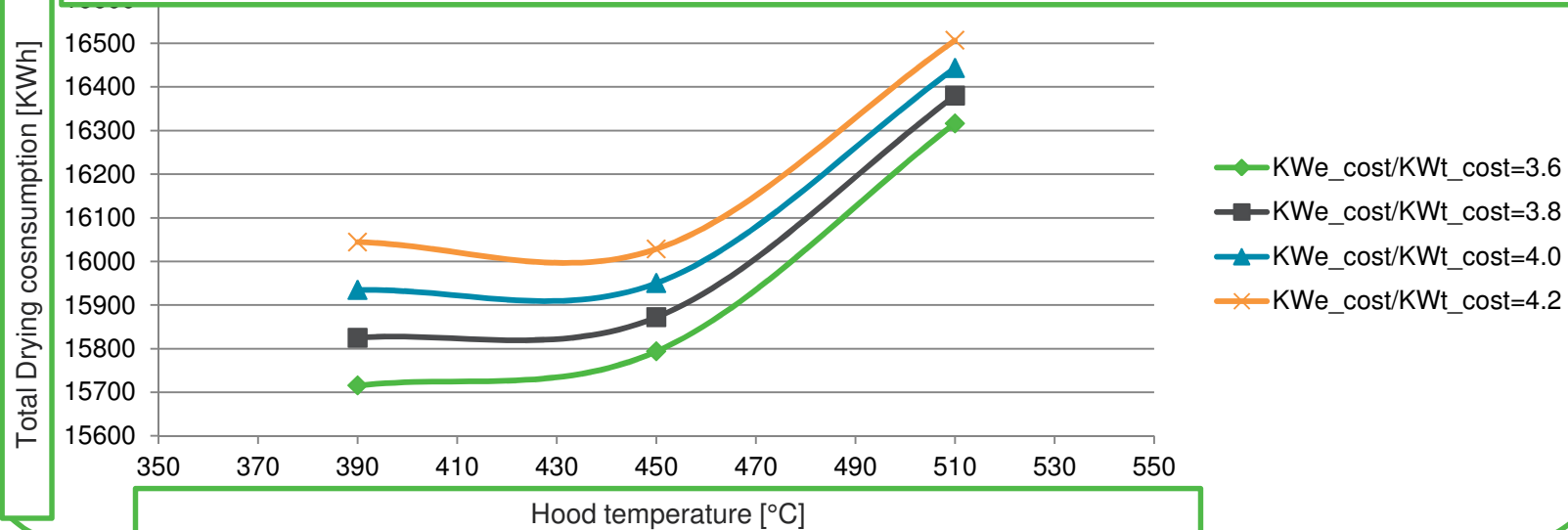
Energy solutions: Waste Heat Steam Generator

Total drying cost depends on the **cost ratio** between **gas and electricity**

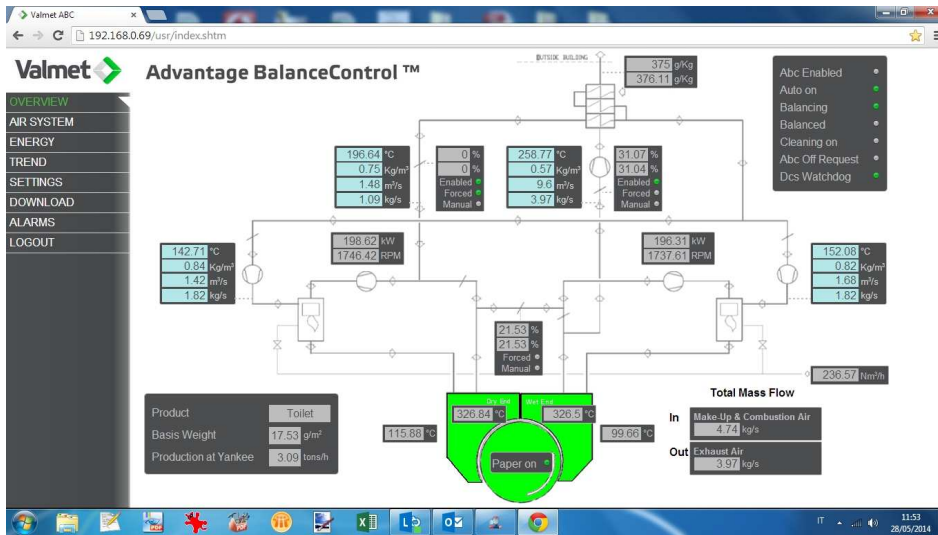
The optimal working point can be different for every machine/production/energy cost

Total drying consumption calibrated to gas/electricity cost ratio

$$\text{Gas} + \text{Steam} + \text{Elect} * (\text{Kw/h.e_cost} / \text{KW/h.t_cost})$$



Energy solutions: ABC for WHSG



A new routine for the ABC will be loaded for the automatic control of the «energy drying cocktail»

The ABC will control the settings for the impingement temperature and circulation fan speed - including those for the exhaust humidity - for the best energy efficiency of the whole system (WHSG + air system + heat recovery systems)



Energy solutions with and for the Customer

IN SHORT:

- **Synergy** between KC Papeles del Cauca and Valmet was the key to implement shared improvement paths and obtain outstanding results
- Energy solutions to be implemented are based on specific machine features. Energy study is the essential tool to define achievable goals
- Improvements are based on Best Available Technology and high level of control and automation to reach and maintain optimal and long-lasting results

