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Innovación y Tendencias
para el mercado eléctrico en Chile 2018

Congreso Bienal CIGRÉ 2011

Santiago, November 2011
By Siemens S.A. Chile Rolf Schumacher

Siemens has the answers to your burning questions

1 **What is the future of Power Generation?**

The world is changing – Siemens has answers to these burning questions

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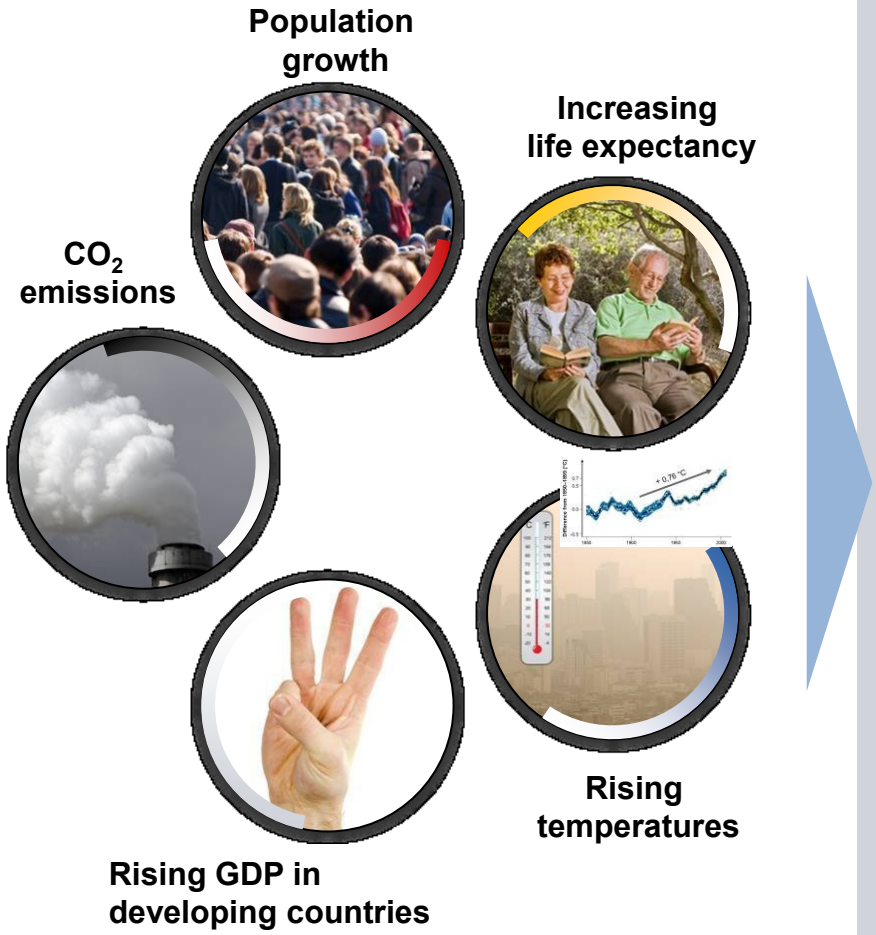

Industry

We solve the challenges of a booming population

Healthcare

We supply better and affordable healthcare

Energy

We lower CO_2 emissions with our energy solutions

Source: Siemens

A paradigm shift can lead to a sustainable energy system

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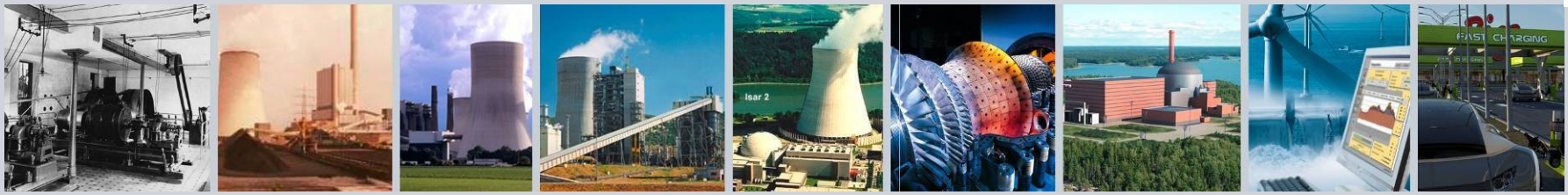
19th century	20th century	Start of 21st century	End of 21st century
Electrification of society "Age of coal"	**Large-scale generation of electrical energy** "Age of fossil fuels"	**Challenges force process of rethinking:** - Demographic shift - Resources becoming scarce - Climate change	**The new power age** Electricity becomes ***the*** form of energy for most applications in daily life.
Energy system not sustainable			**Sustainable energy system**
Generation and load closely coordinated Power supply limited to individual regions or urban areas	**Generation follows load** Interconnected network grids, centralized power generation by "estimated" consumption	**Energy system shifting** Increasingly decentralized, fluctuating power generation through renewable energies	**Load follows generation** Intelligent grids enable high percentage of renewable energies, e.g. with eCars and heat pumps
Fossil fuels, water power	**Fossil fuels, water power, nuclear power**	**Fossil fuels, water power, nuclear power, biomass, wind, solar**	**Renewable energies,** (solar, wind, water power, biomass), **"clean" coal, gas, nuclear power**
No environmental concerns			**Environmental awareness**



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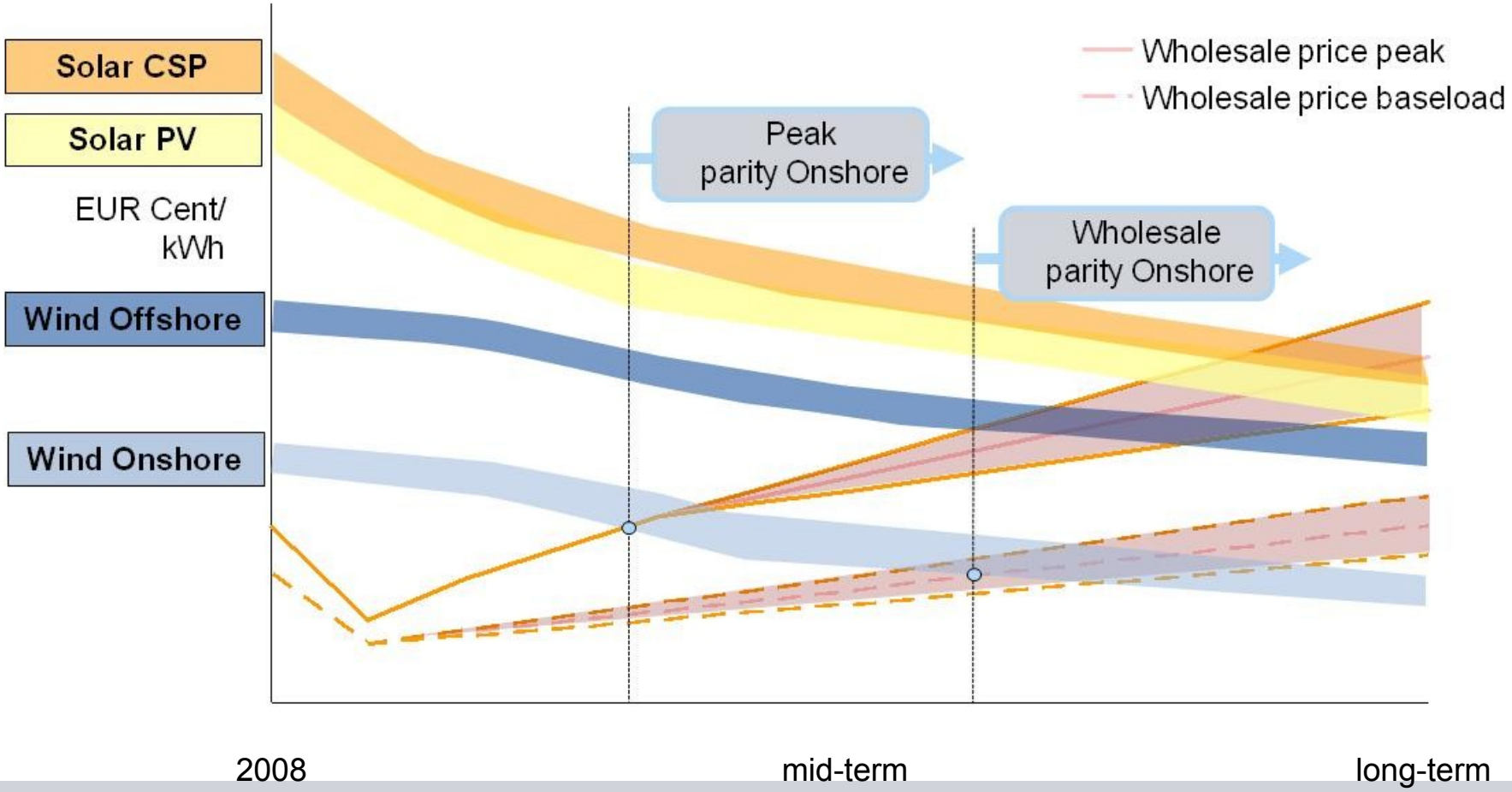
Future Energy Scenario

General World Wide

Average costs of power generation



Siemens has the answers to your burning questions

2 **What is the impact for Chile?**

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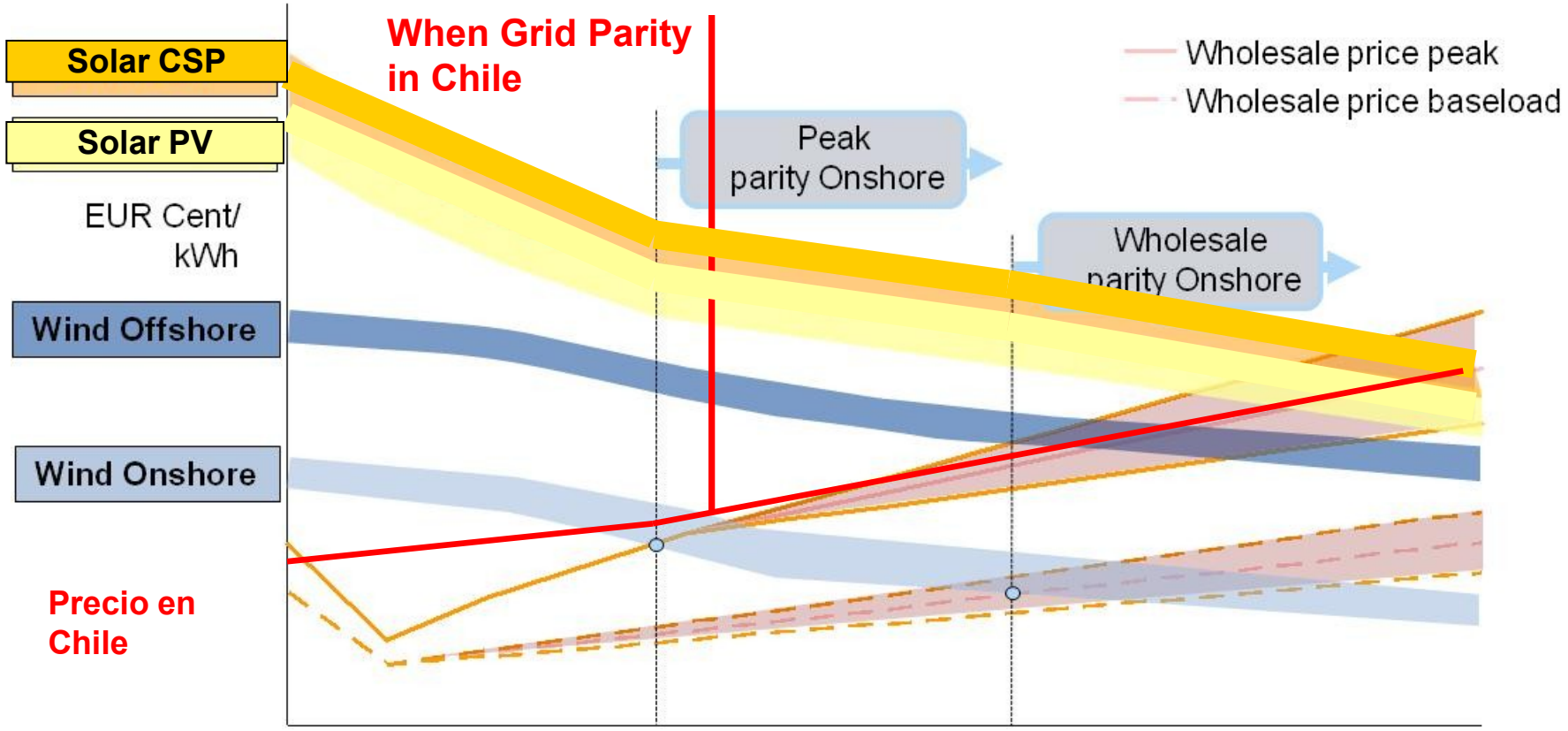
Future Energy Scenario Chile General World Wide

Average costs of power generation



Combination of different Renewables for Chile
Sustainable and Competitive

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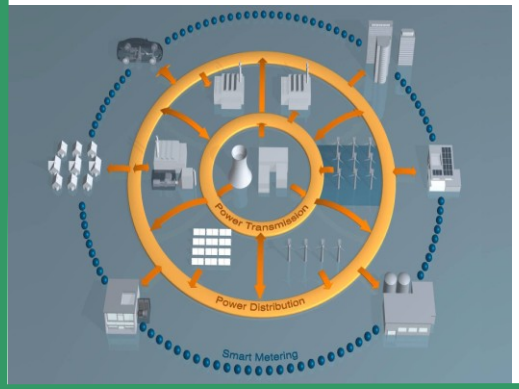
Small Hydro / Pump Storage

Ocean Power Plants

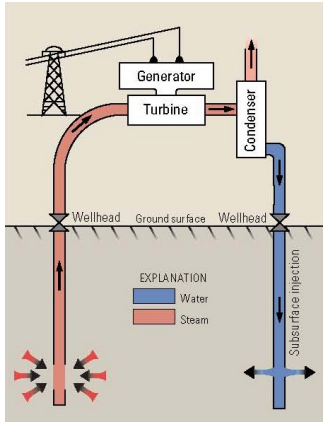
Conexión inteligente Smart Grid



Plantas Fotovoltaico

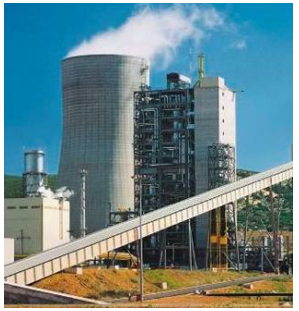
Concentrated Solar Power
Plantas con operación 24/7

Geotermia



Turbinas Eólicas
de alta eficiencia

Biomasa



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Impact of more competitive Renewable Energy in Chile

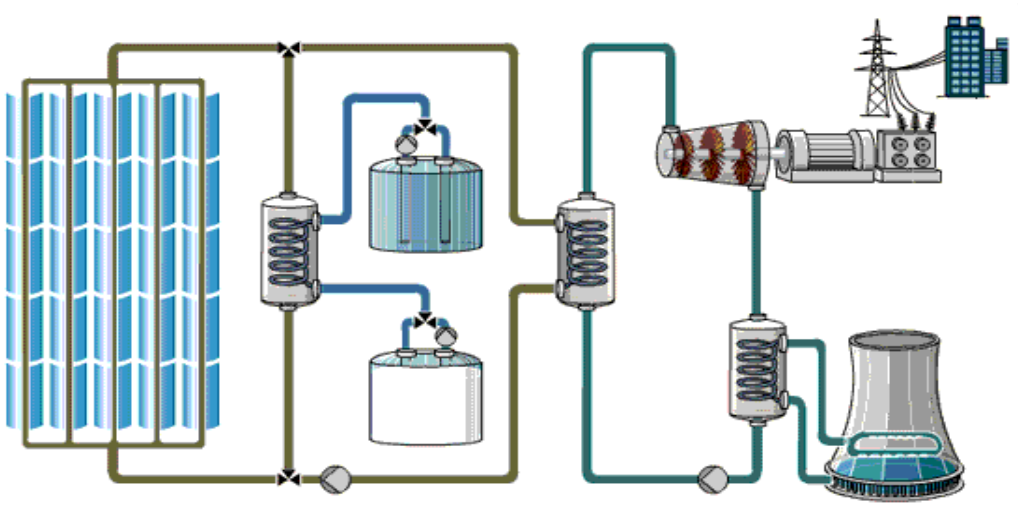
- Renewable Energies are more and more competitive, but
  - Grid stability / Energy Matrix has to be considered
  - The combination of different Renewable Energies will reduce significantly the problem of intermittent supply
  - Regulation in Chile has to be evaluated in order to have influence to the energy matrix
- Technology development in Renewable and Conventional Power Generation is very fast and pro Renewable Energy and should be considered in updated regulation

Siemens has the answers to your burning questions

3 **Siemens Solutions / Best Practice for flexible Power Generation with high Renewable participation?**

CSP Solar Power Generation

Molten Salt storage



- Chile has the best conditions in the world for CSP with highest DNI, cheap land, consumer close to high radiation and financial / political stability
- With a Chile adapted design a CSP power plant with big storage can produce 24 hours per day energy for a significant time of the year (70 % full load hours)
- Optimal solution for grid stability based on thermal system with storage

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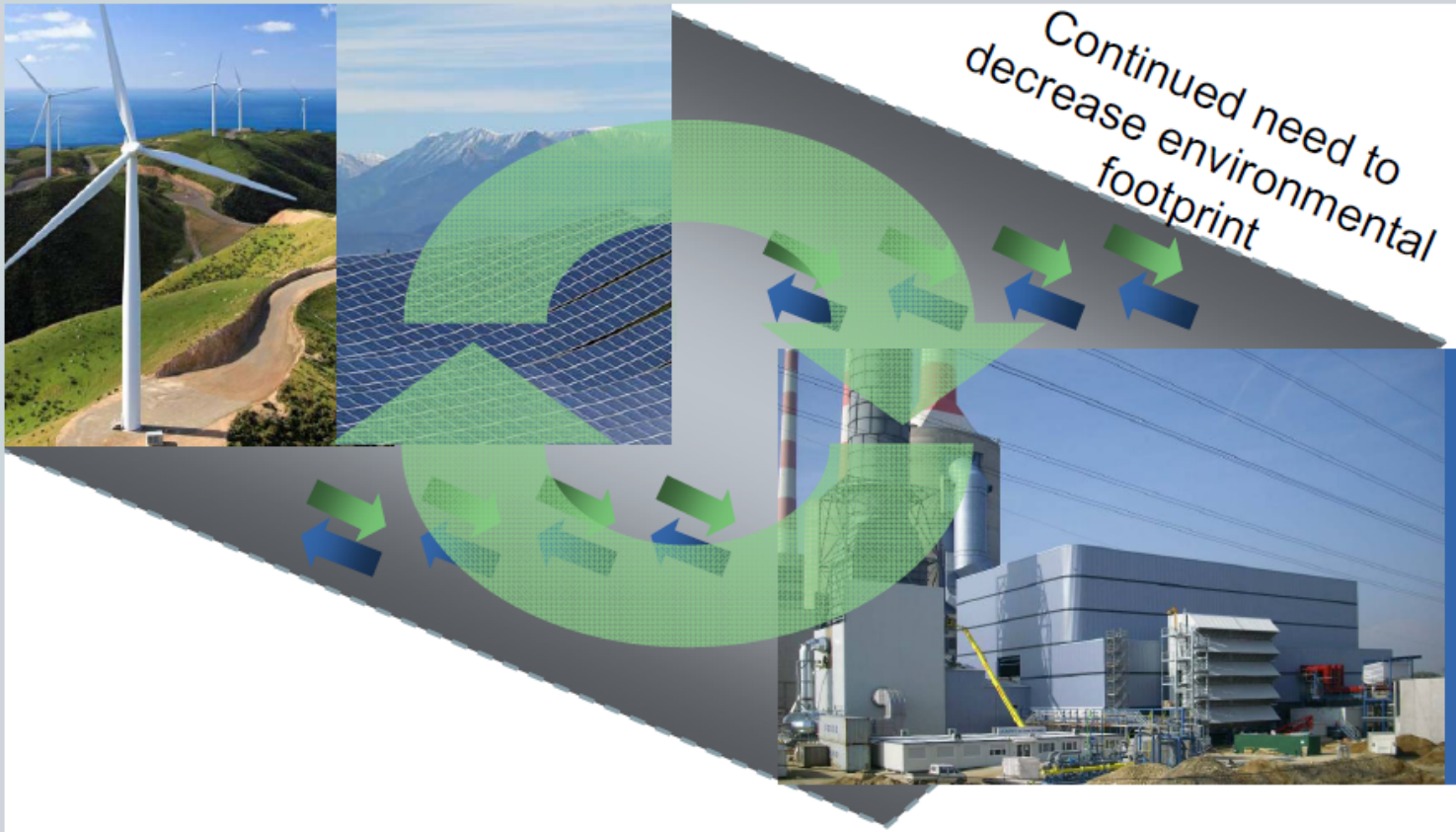
SCC5-8000H 1S – Anticipating the needs of the future

Key drivers for Chilean power generation – High fuel prices and future integration of renewable energy



Siemens' cutting-edge H-class combined cycle power plant proves its world class flexibility at highest performance in Irsching 4

SCC5-8000H - A great option to partner with renewables

Innovative design features and proven technologies enable SCC5-8000H 1S to reach η > 60%

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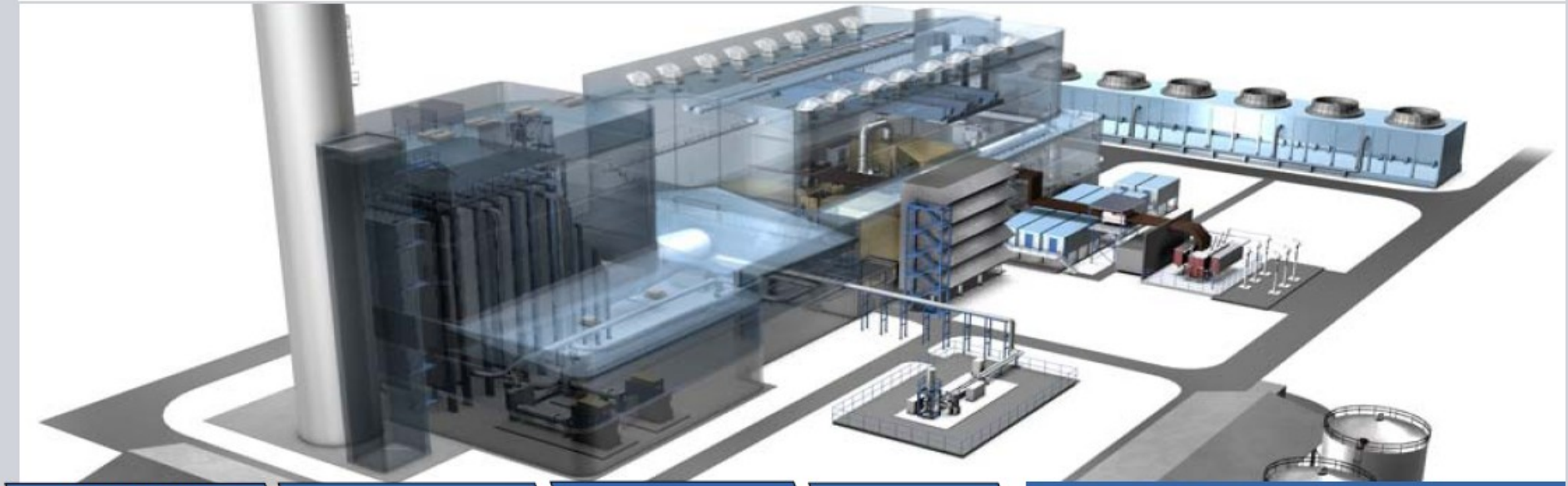


Proven cycle concept *Triple pressure reheat cycle*

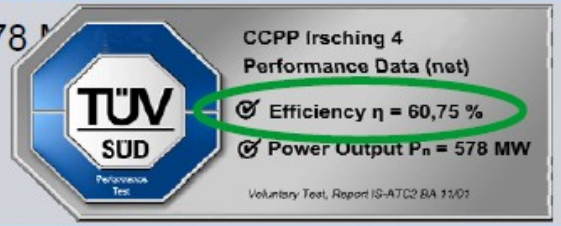
Low complexity *(No GT external cooling interface)*

Advanced steam parameter *Up to 600 °C*

FACY *Fast Cycling*

Specific features included in our advanced 8000H plant cycle design for most flexible and reliable operation

- World record tested net efficiency of 60.75% and net power output of 578 M
- Highest operational flexibility with fast start-up time below 30 min
- Highest starting and operation reliability already in commissioning



SCC5-8000H 1S outstanding performance at highest flexibility enables our customer to run the plant profitably in a daily cycling operation regime

SGT5-8000H and SCC5-8000H 1S - recognized as cutting-edge technology

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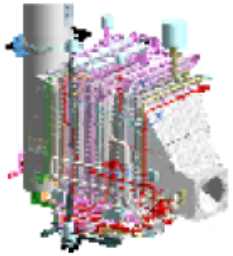
Best economic and ecological solution for Chile



Proven Benson Design Concept

Siemens Benson HRSG design, 19 units built, e.g. Malzenice, Gönyü, Severn Power, Sloe Centrale…

(*) Siemens is owner of the Benson™ patent

Siemens Design Principles

SGT5-8000H

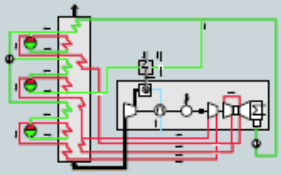
Based on F-class technology as executed in e.g. Karstoe, Simmering, Timelkam

Proven Cycle Concept

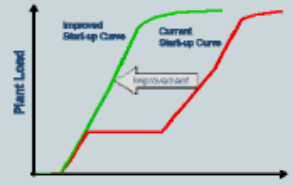
SCC5-8000H 1S

Plant ramp down to min. load at 100 MW (~ 20%) or shut down in less than 30 minutes, e.g. Irsching 4

Highest efficiency



Operational flexibility



HRSG + Plant Development in one Hand

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Innovation based on proven technology and materials

SCC5-8000H 1S successfully introduced in the 50Hz market

Conclusion

- Renewable Energies

  Past: **Ecological** motivation
  Future: **Ecological** and **Economical** motivation

- In Chile Renewable Energy will be most economical power generation in near future (high costs for fossil conventional generation and extreme positive conditions for Renewable Energy, fast cost decrease)

- From technical perspective a high Renewable Portion possible

- Regulation has to be evaluated in order to have influence to Energy Matrix

- Positive influence of renewable energy to national economy to be considered (long term very cost efficient, high local value generation with Renewable Energy)

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Thank you & Discussion