



Grid Transformation
and Innovation for High
RES Penetration in SEE

Energy Exemplar

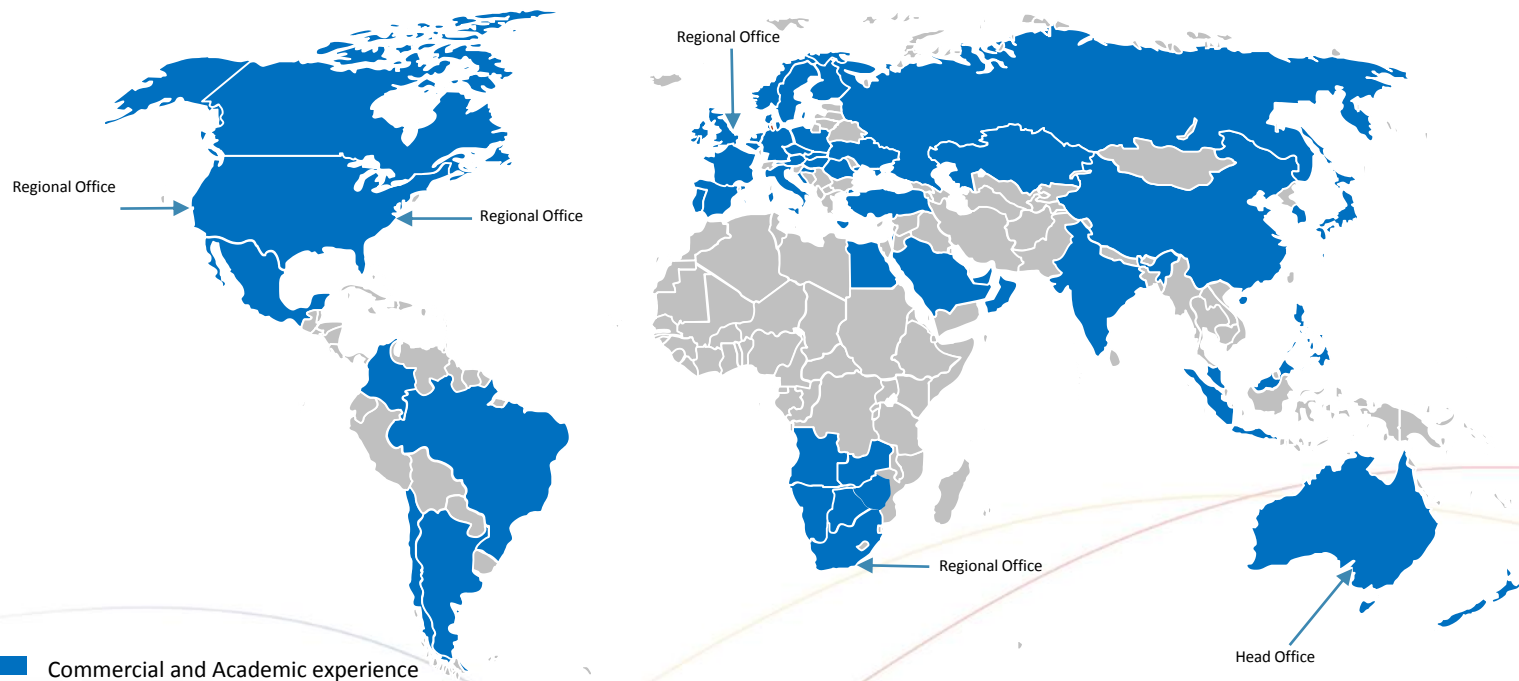


PLEXOS® by Energy Exemplar

GLOBAL LEADER, in Integrated **Energy Systems** and **Energy Markets** Modelling
& Optimisation



Clients' Portfolio in all five continents



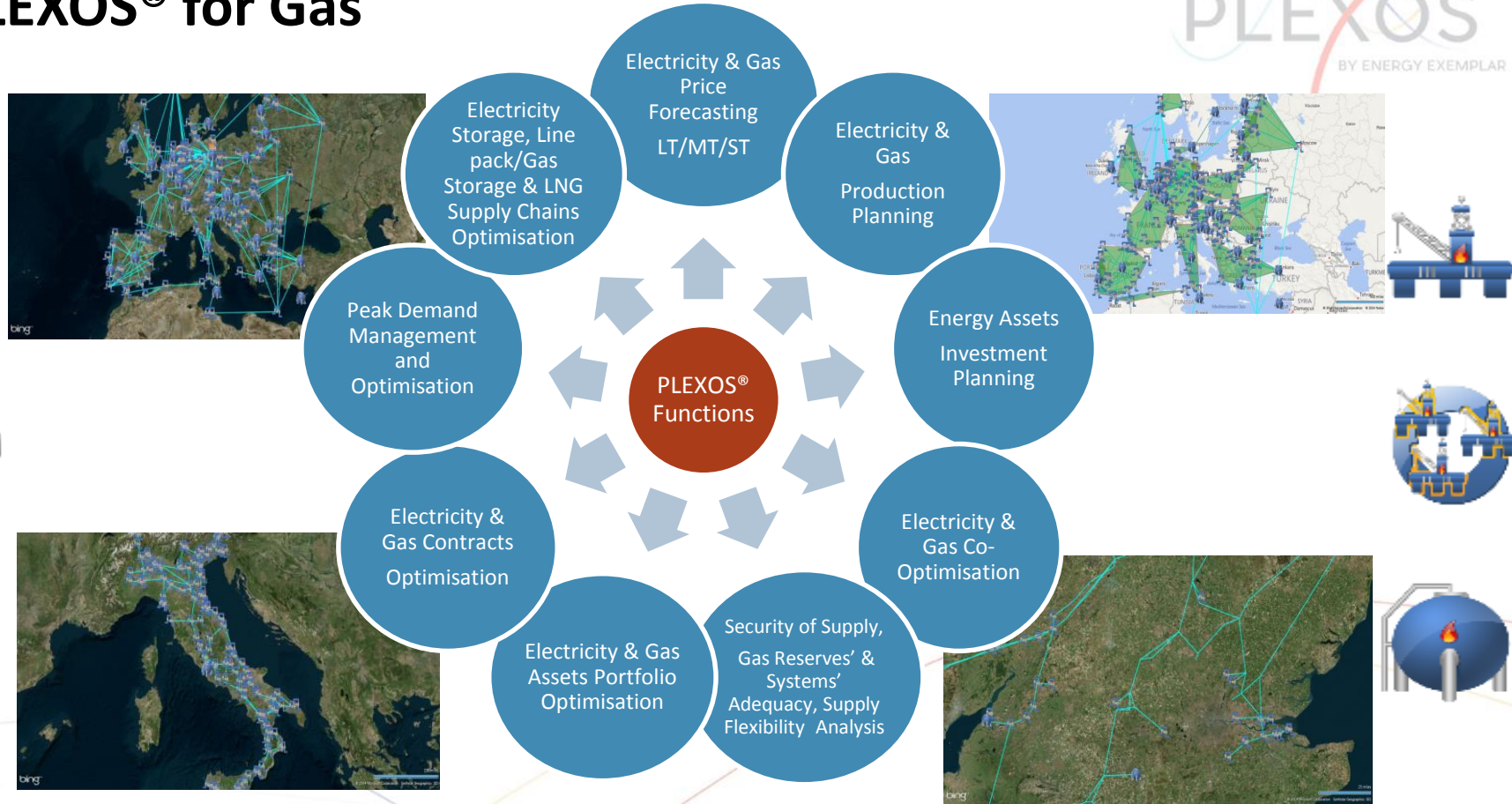
Our Customers & PLEXOS Users

"It's more than software, it's a gateway to a global community in more than 50 countries"



Energy Exemplar-Confidential

PLEXOS® for Gas



Complexity and Uncertainty

- THE WORLD IS CHANGING FAST, REQUIRING MORE COMPREHENSIVE AND FREQUENT INSIGHTS

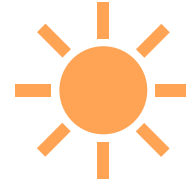
Growth	Polarized growth between developed and emerging markets
Interdependent	Adjacent systems more tightly coupled (water, gas)
Energy Efficiency	Decoupling of GDP and energy usage
Electrification	Electricity increasing in % of total energy usage
New Technology	Storage, renewables and IOT reshaping what's possible
New Entrants	Non traditional players investing heavily across the industry and the rise of the “prosumer”
Regulation	Increasing liberalization of markets and continued decarbonization focus



Uncertainty will Continue to grow



Renewable penetration will
continue to grow pushing
out ALL fossil fuels



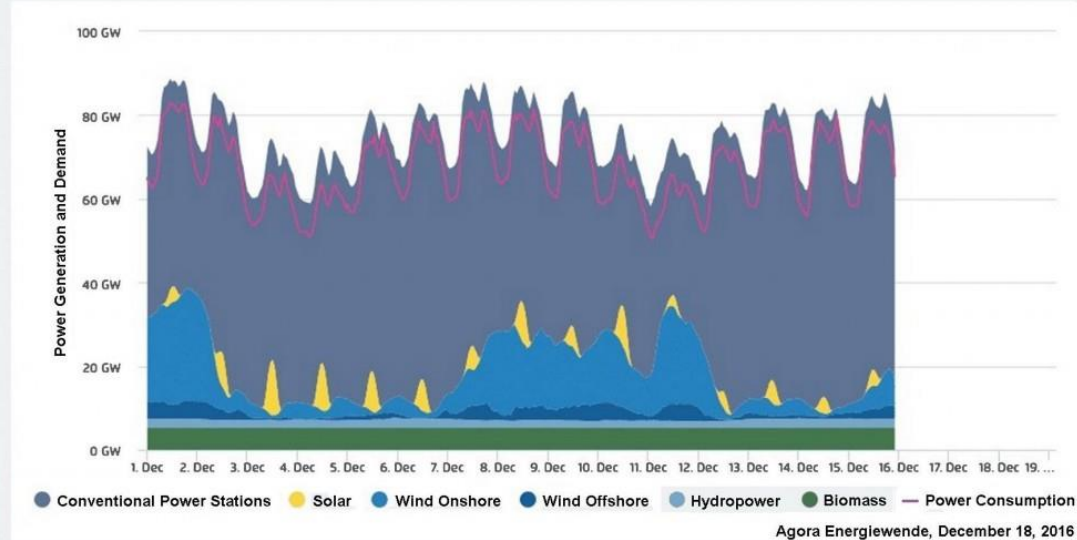
New technologies will
continue to arrive

Energy Markets' Uncertainty might bring MT Operational Challenges...



Energiewende – Some REAL Challenges...

Power Generation and Demand, Germany December 2016



You do not have to be an energy expert to understand the pointlessness behind a 100% Renewables Power System - **The role of Gas!!!!**

At 3 pm on the 12th of December 2018, of power demand totaling **69.0 GW**, just:

- **0.7 GW** was provided by solar energy,
- **1.0 GW** by onshore wind power and
- **0.4 GW** by offshore wind.

At noontime on the 14th of December, **70GW** were consumed, with:

- **4 GW** solar,
- **1 GW** onshore and somewhat over
- **0.3** offshore wind.

“Heiner Flassbeck – The End of Energiewende?”

But Wrong Decisions Can be Costly too...



Optimising Investments & Operations becomes a Complex Mathematical Problem



Advanced Digital IT & Computing Methods
are required to solve it since they are the
ONLY TOOLS we have today to address this
New Era's complexity.

Forecasting...

“Forecasting is the art of saying what will happen, and then explaining why it didn’t, or what will not happen and then explaining why it did happen”

--Anonymous

“It is often said there are two types of forecasts ... lucky or wrong!!!!”

--Institute of Operations Management

“It is far better to foresee even without certainty than not to foresee at all.”

--Henri Poincare in *The Foundations of Science*, page 129.

“It is said that the present is pregnant with the future.”

--Voltaire in *The Portable Voltaire*.

The Future



Digitilisation - Technology Trends

The Future

Cloud
computing



The Future



- Australia's ISO uses 70%!! of country's cloud capacity every Monday at 3pm.
- NREL: One of highest consumers of HPCs in US.
- Electranet run 1000's of sensitivities on the cloud for transmission expansion

The Future



Renewables + AI

The Future

India
175GW!!
(new capacity)
By 2022

In this **New Digital Era** Computer Modeling, Simulation & Optimisation is not simply about Forecasting.

It is about **Knowledge Extraction** from “**BIG DATA**” & the **Safest Preparation** for both any upcoming “**Black Swans**” & “**Dragon Kings**” or else even for the most Unexpected & Complex future.

ADAPTING TO A NEW WORLD !!

In the end, it is all about
ADAPTING to a New World
that is coming
Fast, Furious and Full of
Strategic Risks
&
Opportunities.

Investments and
Financial Planning



**"If you had taken tomorrow's advice
yesterday, you'd be rich today!"**

Thank you for your time and the opportunity



For More Information, please do not hesitate to contact Energy Exemplar (Europe) Ltd.:

Dr Christos Papadopoulos

Regional Director Europe

E-mail: christos.papadopoulos@energyexemplar.com

www.energyexemplar.com