# Offshore Wind and Beyond: Holistic Approach and Integrated Solutions for a Sustainable Energy Future

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# A perspective through time…

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| **Now** | Energy Transition, pioneered in Germany, is well underway in Taiwan – with **Offshore Wind Power playing a key role** |
| **Future** | **Energy Stability**, enhanced with integrated technologies, will continue to be a top priority throughout Energy Transition |
| **Beyond** | Reaching a Sustainable Energy Future requires **involvement beyond just the power sector** |

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**As electrification continues to be the dominate driving force of economy, energy usage will continue to rise**

Photo Source: Internet

# How to increase the energy supply in a sustainable manner will be the key focus going forward

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Photo Source: Internet

# Germany initiated its Energy Transition, Energiewende, since early 2000 is a clear leader in this regard

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## Percentage of Renewable Source in Energy Mix

30%

2015

45%

2025

## Grid Reliability

### System Average Interruption Duration Index

(Unplanned Interruption, incl. all events)

13min

2016

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Source: Council of European Energy Regulators: CEER Benchmark Report 6.1 on Continuity of Electricity and as Supply

# Taiwan has declared its intention to increase share of Renewable Energy by 2025

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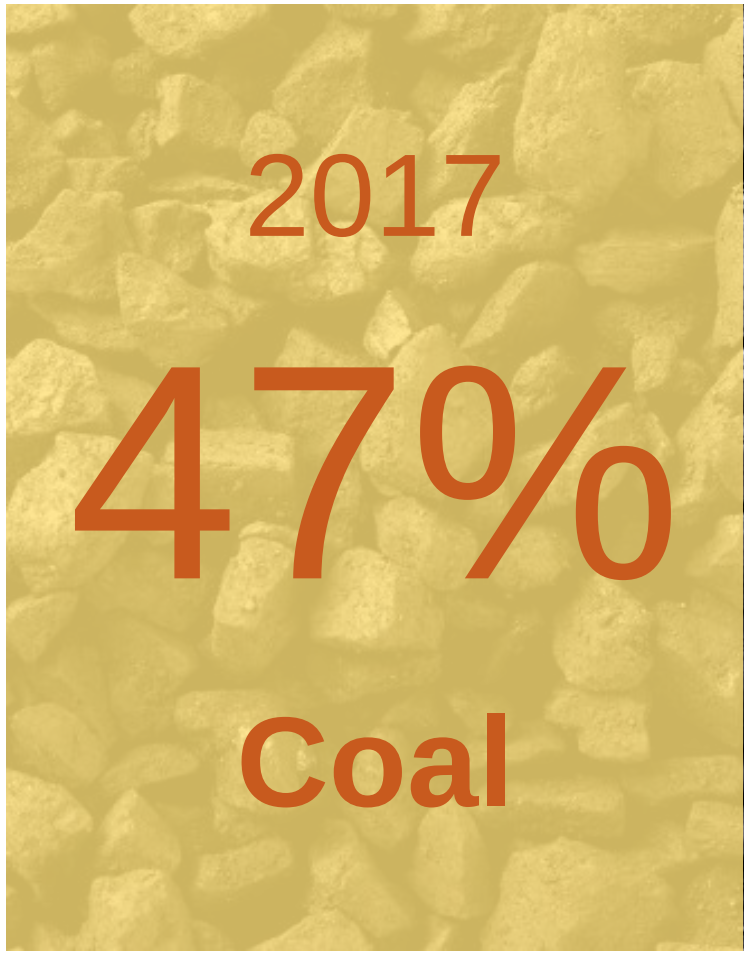

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Photo Source: Internet

Source: Ministry of Economic Affairs, Bureau of Energy

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Photo Source: Internet

Source: Ministry of Economic Affairs, Bureau of Energy

# Taiwan is leading the energy transition effort in Asia and will be viewed as benchmark for the region

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Source: Ministry of Economic Affairs, Bureau of Energy

Photo Copyright: Swancor / Formosa Offshore Wind Farm I

# A holistic approach is crucial for a sustainable energy future – Policy, Society and Technology

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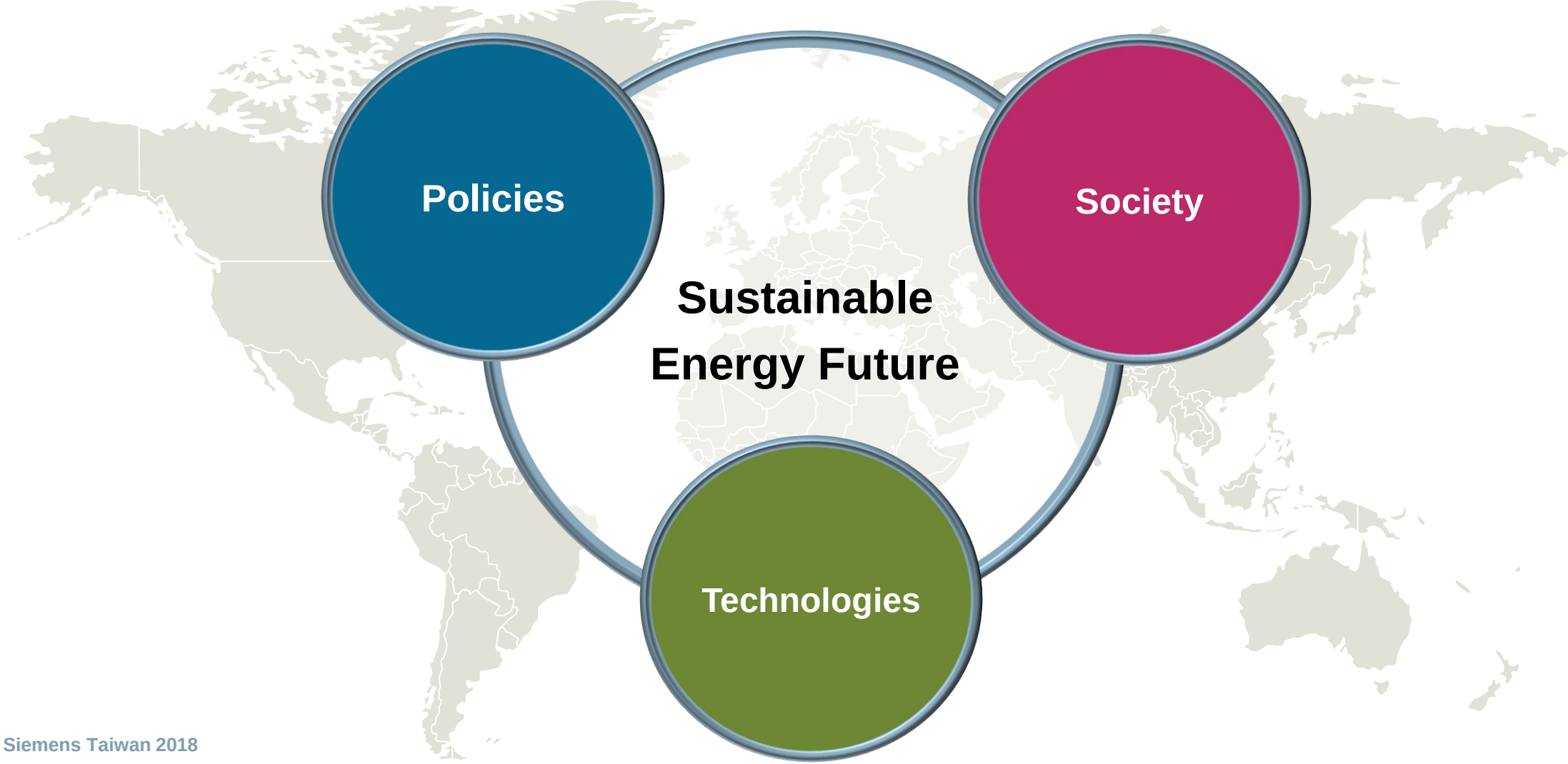


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**Energy stability is top priority.**
**Any disruption may have significant economical and political implications**

Photo Source: Internet

# With more renewable sources in Taiwan's future energy mix, new technologies and solutions are required to ensure energy stability

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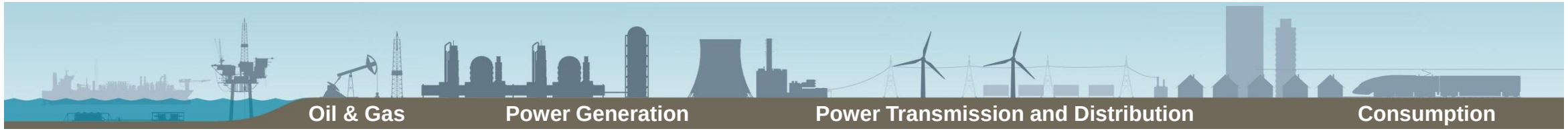


**Advanced Offshore Wind Park Management System**

**High Efficiency Gas Turbine**

**Innovative grid access for renewable energies**

**Distributed energy system design**

**Smart Grid**

**High temperature heat pump**

**Hybrid battery fossil power plant**

**Thermal storage**

**Sector Coupling**

**Virtual power plants**

**Demand Response System**

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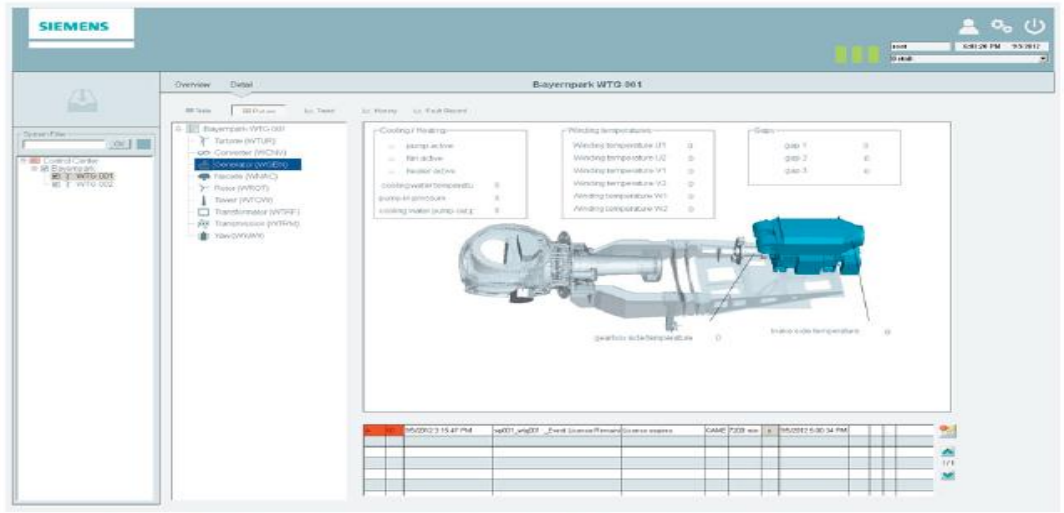
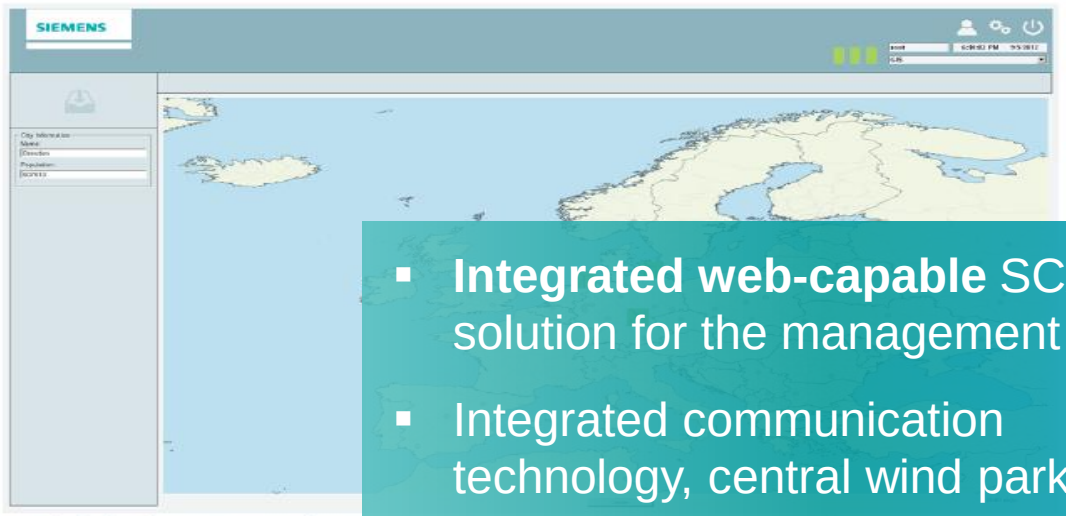
# **Generation Side Solutions –** Advanced offshore wind park management to enhance performance in infrastructure

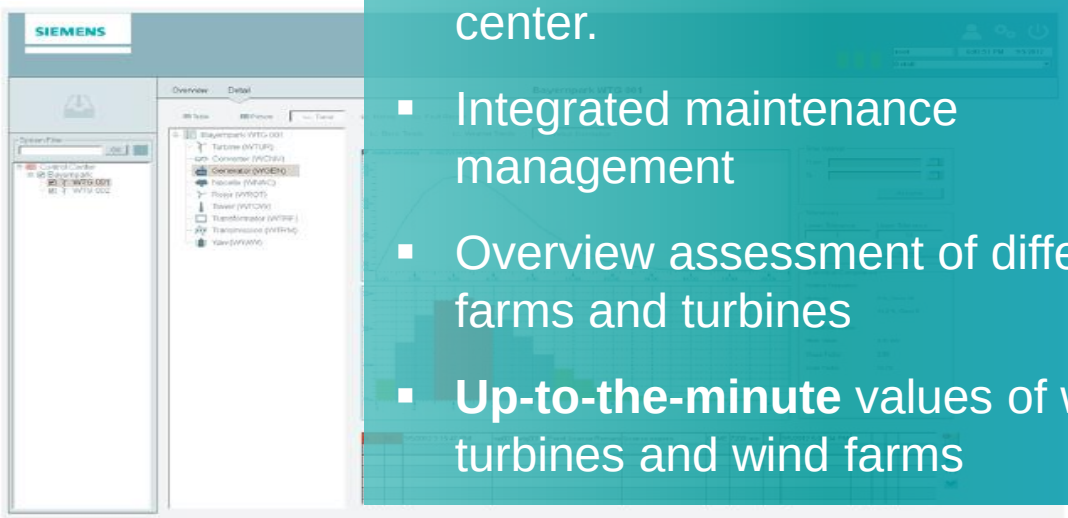



Turbine detail view in spreadsheet and graphic form




Multiple farm overview using

Farm overview with tree structure




Turbine values

- **Integrated web-capable** SCADA solution for the management
- Integrated communication technology, central wind park controller, multi level Wind SCADA center.
- Integrated maintenance management
- Overview assessment of different farms and turbines
- **Up-to-the-minute** values of wind turbines and wind farms

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# **Generation Side Solutions –** Gas-Fired Power Plants as stable base-load and reliable backup to offshore wind power

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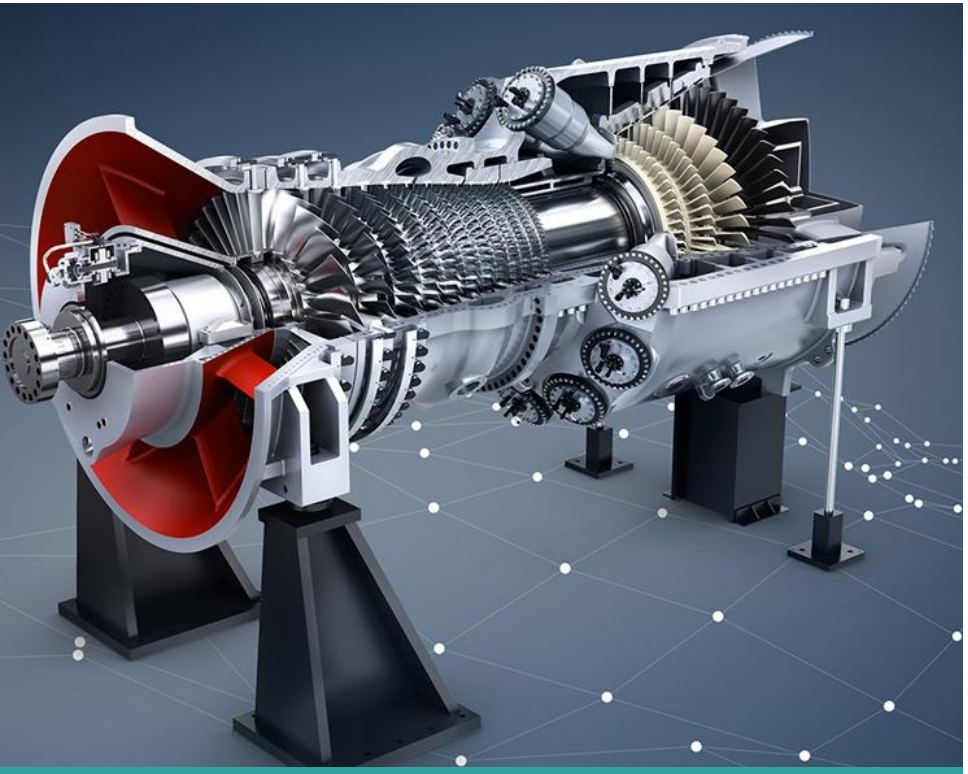

**Siemens HL-class gas turbines**

Output > 550MW; Efficiency > 63%

1. **Fossil power generation will remain as a stable base-load in the foreseeable future.**
2. **Within the fossil power sector, gas is cleaner than coal.**
3. **Gas is a flexible backup to renewables and can help secure a reliable power supply.**

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# Reliable partnership as basis for our success – Fast-track record-breaking mega-CCPP projects

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- Completion of world's largest combined-cycle power plants in record time – **27 months!**
- Plants add **14.4 GW** capacity to Egypt's national grid
- Enough power to meet the electricity needs of **40 million people**
- Over **$1 billion** annual fuel costs savings
- **12 H-class** gas turbines with over **61%** efficiency

# **Transmission & Distribution Solutions –** Connecting turbines to grids via Offshore Substation

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- New offshore substations provide highly cost-effective ways for connecting renewable generation to the power grid
- **One-third less** weight and volume than a conventional AC platform
- Simple design, with no moving parts
- More **environmentally friendly**, by making the use of mineral oil obsolete
- We did >8GW Siemens Grid access in Europe, ex. London Array, 630MW

# **Transmission & Distribution Solutions –** Smarter grids to enable secure, stable and efficient power transmission from offshore wind

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- Siemens is a **global leader in offshore wind connection** and has extensive experience in grid access.
- **Flexible AC Transmission Systems (FACTS)** provide better utilization of the network, increased availability and reliability
- To date around **6.5 GW of offshore wind power** has been connected to the grid by Siemens; a further **4.5 GW is contracted.**

# **Transmission & Distribution Solutions –** Energy storage to provide stable and reliable power supply

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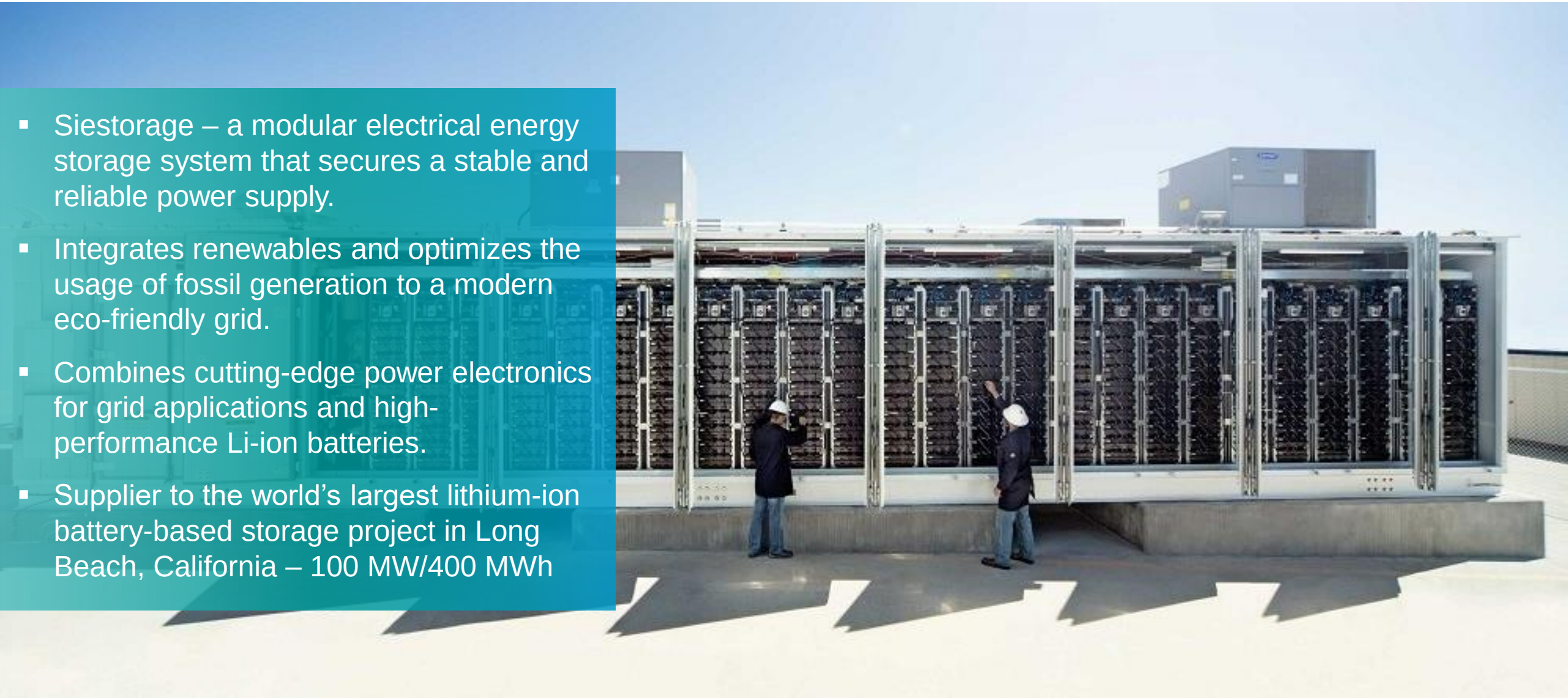
- Siestorage – a modular electrical energy storage system that secures a stable and reliable power supply.
- Integrates renewables and optimizes the usage of fossil generation to a modern eco-friendly grid.
- Combines cutting-edge power electronics for grid applications and high-performance Li-ion batteries.
- Supplier to the world's largest lithium-ion battery-based storage project in Long Beach, California – 100 MW/400 MWh



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# Effects of Global Warming is no longer a distant threat – it is happening now

Photo Source: Internet

# Action needs to be taken NOW to effectively reduce carbon emission

Photo Source: Internet

# It has been proven that just adding renewable energy sources is not enough to reduce carbon emission

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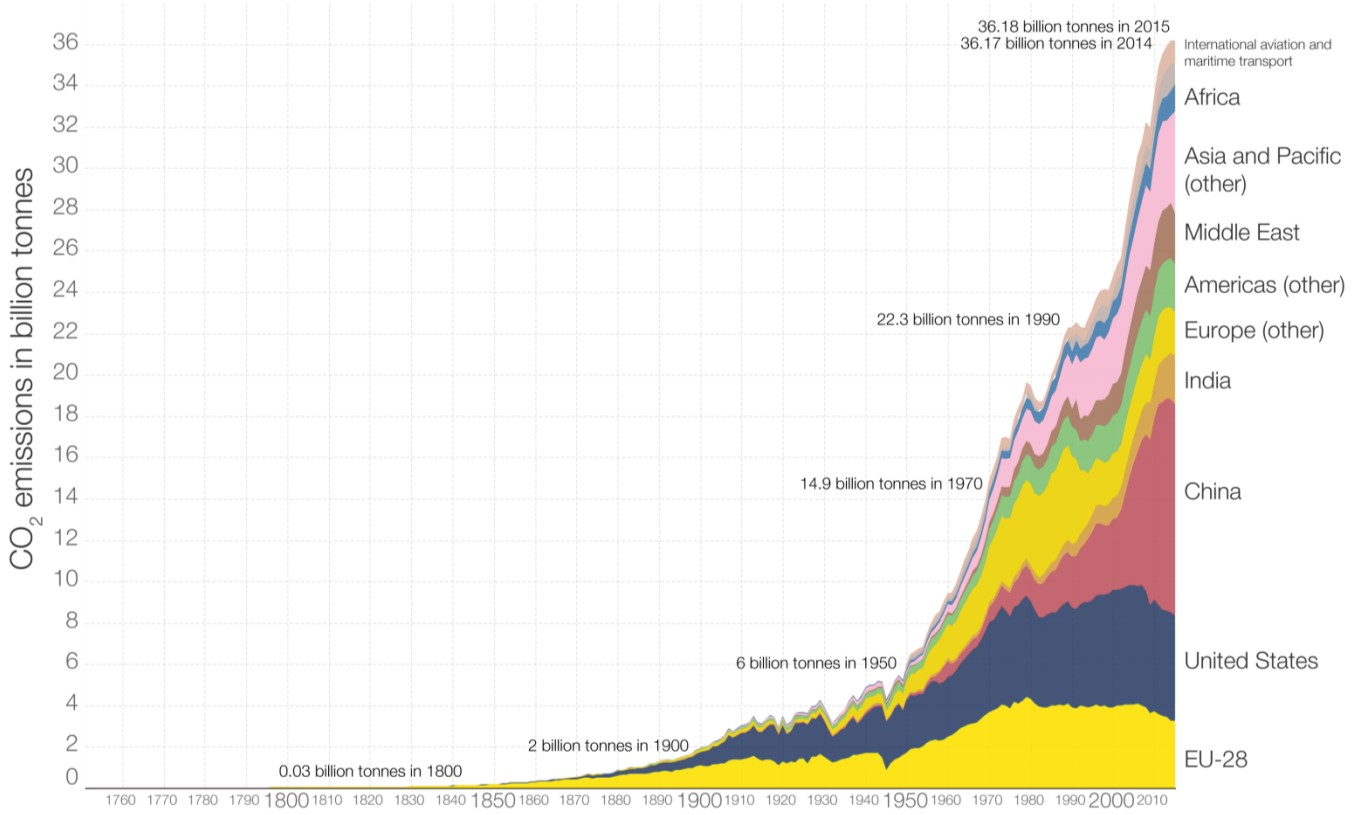
## Global CO2 emissions by world region, 1751 to 2015

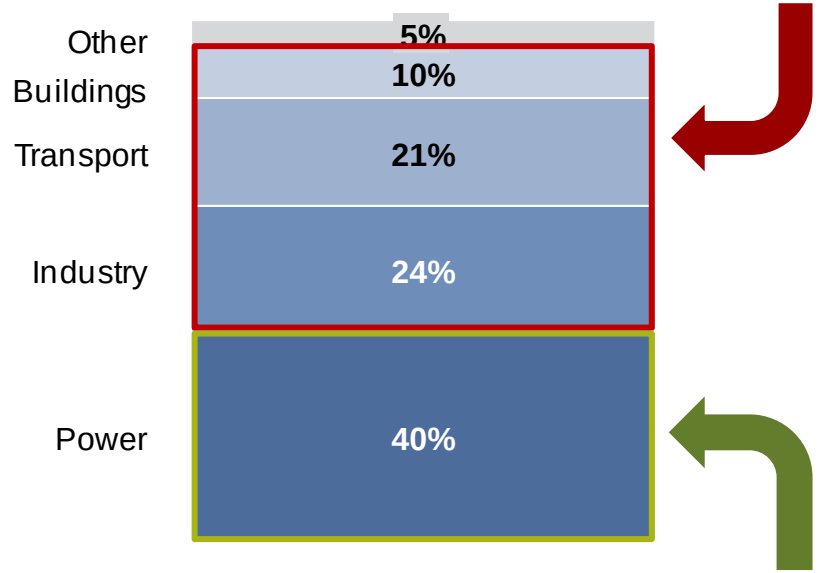



Source: Carbon Dioxide Information Analysis Center (CDIAC), aggregated by Our World in Data

## Shares in global CO2 emissions by sectors

**Share on $CO_2$ emissions: 55%**
**Share of Renewables: 8%**

**Mostly disregarded**




**Share on $CO_2$ emissions: 40%**
**Share of Renewables: 22%**

**Main focus so far**

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# Sector coupling – an integrated energy system based on renewable electricity

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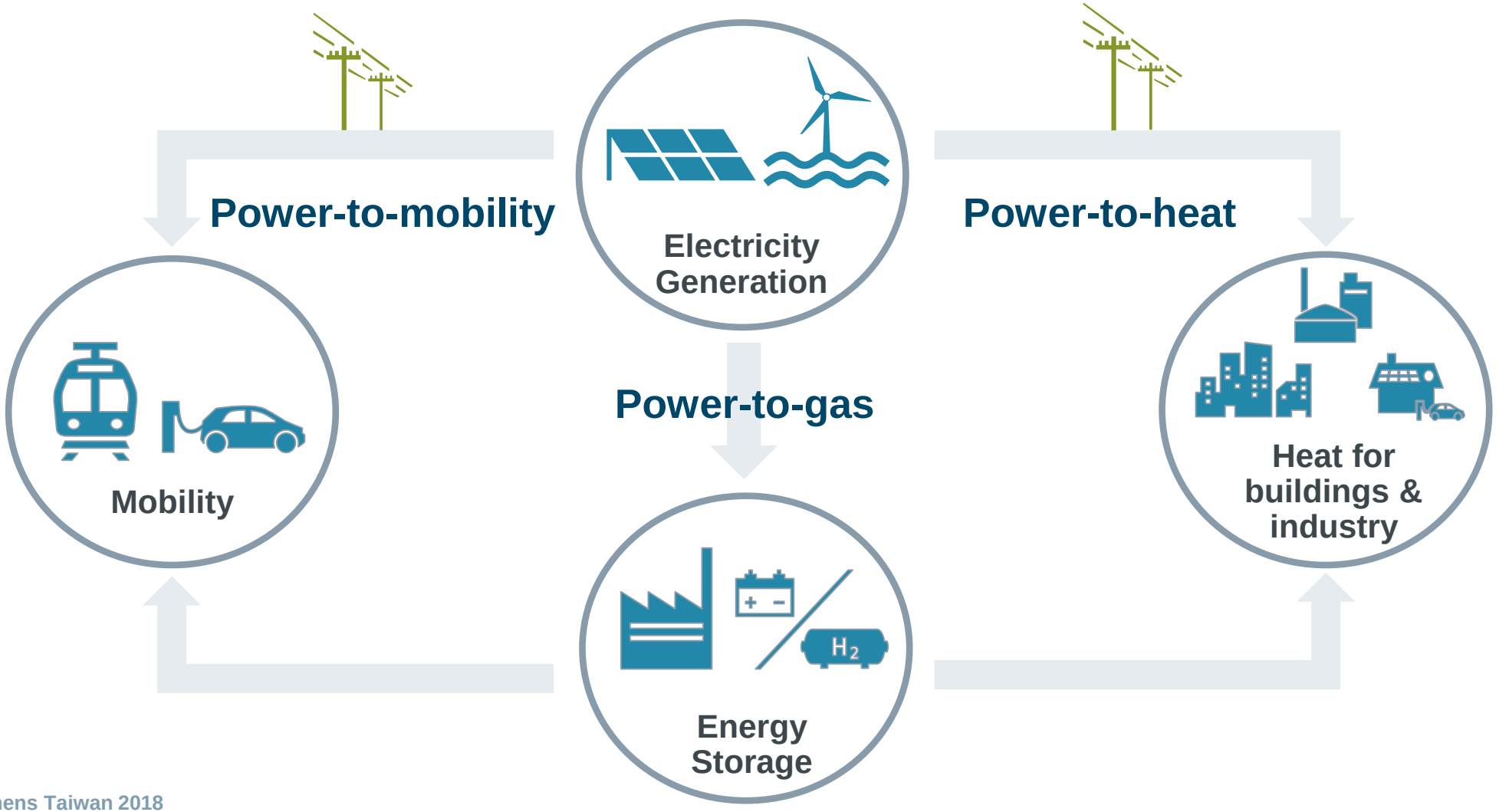


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