Global Clean Energy Technology

Governments and market players across the globe are exploring technologies to achieve a low carbon future. Clean technologies will play a key role in shaping the transformation of the energy industry and supporting the decarbonization of all sectors of the economy.

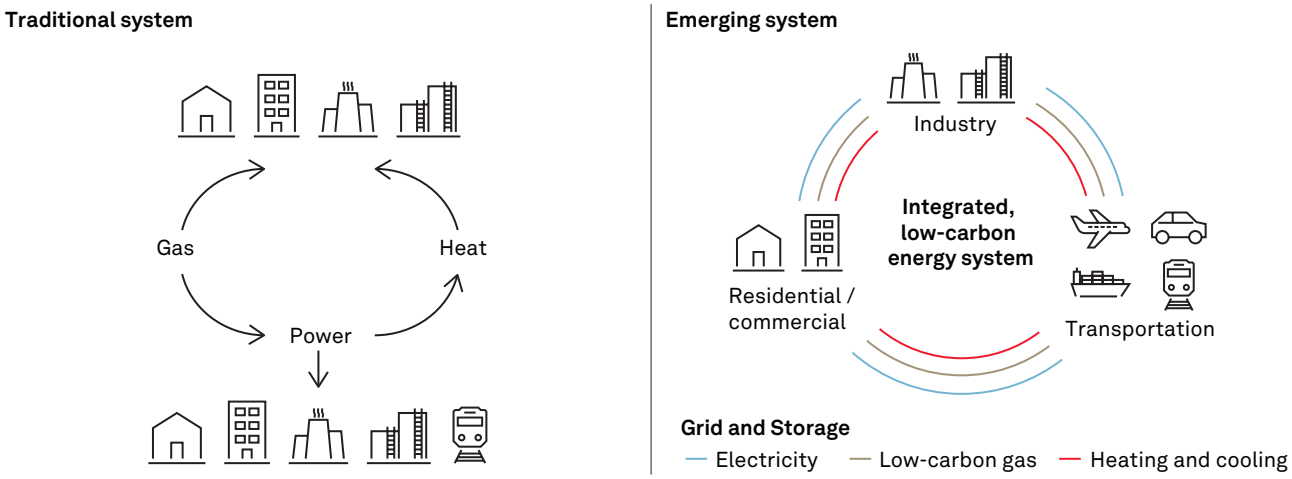
S&P Global
Commodity Insights

As the energy system decarbonizes it is becoming more complex and more interconnected.

In the traditional energy system, gas, power and heat grids operated in a one-way fashion providing energy to the consumer; the links between different sources of energy were limited to the power generation sector.

The energy system that is emerging today is fundamentally different.

The transformation of gas, electricity and heat systems



While many uncertainties underlie the future path of the energy system, electrification will continue and energy storage, low-carbon gas (hydrogen and renewable gas), solar and wind will grow. The growth of these four technologies will be driven by the following:

- **Continued electrification.** In 2020, global electricity demand was nearly 27,000 TWh and electricity accounted for over 20% of final energy consumption. This was more than double the consumption in 1990 (12,000 TWh and 14% of final energy consumption). Rapid growth will continue and moves to deep decarbonization will hugely increase electricity demand. In a Net Zero Carbon world as much as 60% of final energy consumption could come from electricity.
- **Wind and solar will dominate global power generation capacity additions.** Since 2015 renewable capacity additions have exceeded conventional additions globally. Through 2030, we anticipate annual additions of nearly 80GW of wind and 150GW for solar. This growth will drive technological advances and significant investment in the manufacturing supply chain.
- **Electricity storage to enable high renewables penetration and system resilience.** Pumped hydro has traditionally dominated electricity storage. As costs have fallen, and large amounts of wind and solar have been deployed, Li-ion batteries have become a major provider of flexibility to the power system. Nearly 620 GWh of grid-batteries will be connected to the grid in the coming decade. The build out will be dominated by Li-ion batteries. However, other battery chemistries and alternative non battery technologies will also play specific roles and offer opportunities for investment.
- **Gas will remain an essential component of the energy mix, but it will decarbonize.** Hydrogen can be used as fuel in the transport sector, or heat generation in industrial, residential, and commercial sectors, as well as power generation. If produced from hydrocarbons, with carbon capture and storage, or water electrolysis with renewables it can decarbonize end-use sectors. Annual global investment in electrolysis is anticipated to increase 20-fold by 2023 and work is underway to use low-carbon gas to decarbonize the first industrial clusters by the mid-2020s.

The **Global Clean Energy Technology** service provides in-depth coverage of the supply chain economics and outlooks for batteries and energy storage, carbon sequestration, hydrogen and renewable gas, solar and wind. New areas of research under development include geothermal and heating and cooling.

Clients receive a continuous cycle of data and analytics-driven research covering:

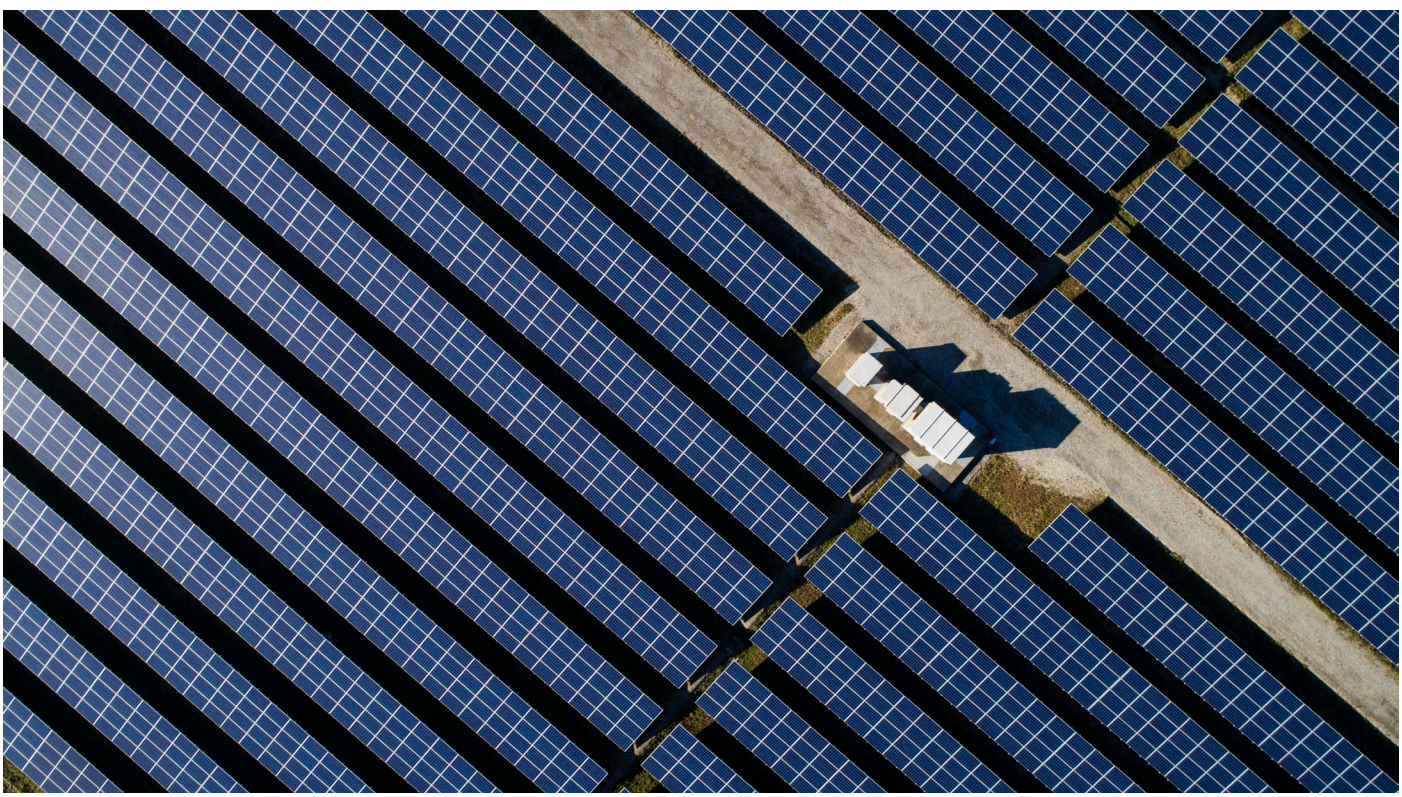
- Policy, technology, market issues and drivers
- Capex, opex and cost for key technologies
- Levelized cost of electricity for solar, wind, and solar plus batteries
- Levelized cost of hydrogen and renewable gas production
- Capacity outlooks for power generation, solar PV, onshore and offshore wind installations, storage and hydrogen production
- Emerging trends: drivers and inhibitors on the outlooks
- Corporate strategies and business models
- Global databases of projects

Clients of the service include:

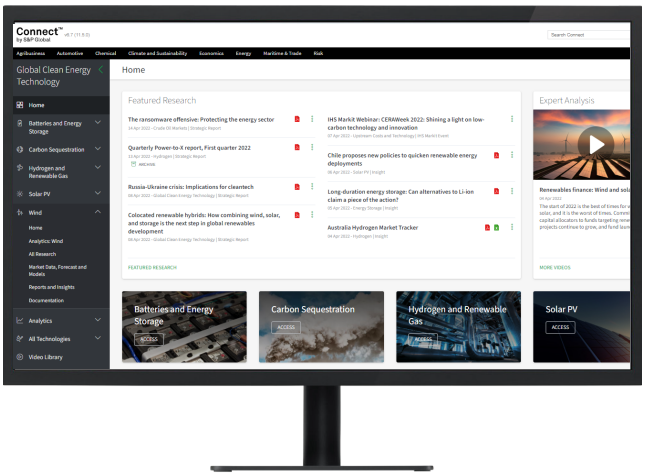
- Oil & Gas
- Utilities/IPPs
- Mining companies
- Chemical producers
- Automotive manufacturers
- Technology suppliers/OEMs
- EPC companies
- Large energy consumers
- Energy service providers
- Regulators and government agencies
- Financial institutions

Key functions include:

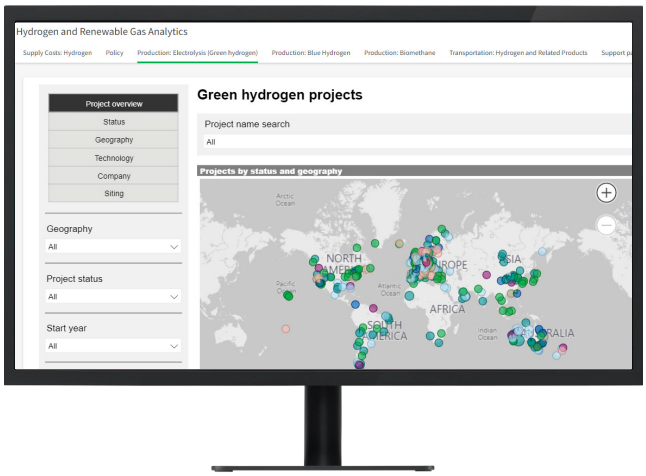
- Strategic/corporate planning
- Portfolio planning
- Forecasting and market analysis
- Business development
- Marketing/sales
- Origination
- Sustainability
- Supply chain
- New ventures
- Executive teams



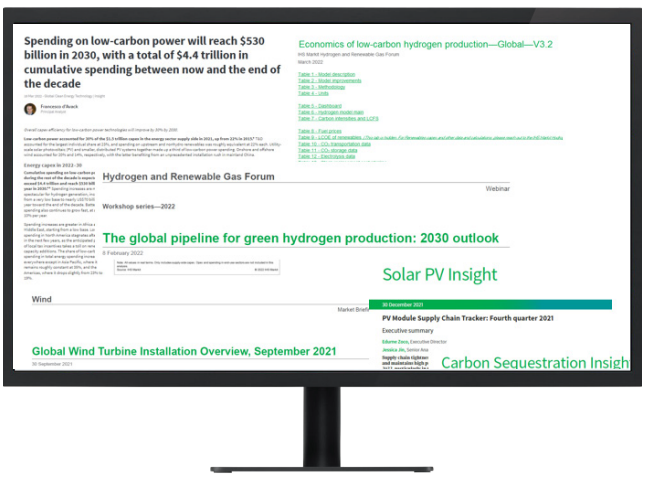
How is the service delivered?



All content delivered via Connect – a customized research portal



Flexible analytics tools to allow customers to deep-dive



Download data, insight & reports from anywhere

Relationships with experts to discuss details

Clean Energy Technology Analytics

Clean Energy Technology Analytics complements the Clean Energy Technology service by enabling users to save time on analysis, interpret data easier, and efficiently evaluate the clean energy technology landscape with a premium, all-in-one view.

The interactive console not only enhances existing technologies coverage, it also includes new coverage of other low carbon generation sources such as geothermal, concentrated solar power (CSP), and small modular reactors (SMR).

The next level offering in our cleantech solutions portfolio

The service facilitates analysis workflows and data management via its integrated, user-friendly dashboard, so users can quickly and easily compare market information across multiple technologies in a birds-eye view of the clean energy technology space.

Data Integration includes:

- Installations
- Projects
- Costs: CAPEX, LCOE, LCOH
- Policy Announcements
- Supply Chain

Solar PV

Key features:

- Global and country-level deployment figures and 5-year forecasts by system type.
- The largest dedicated solar project database globally with individual project level data for more than 100,000 projects.
- Detailed price, volume and supply vs demand forecasts for key components (modules, cells, wafers, polysilicon, inverters, trackers).
- Competitive environment analysis and supplier market shares throughout the value chain.
- Detailed analysis of key downstream stakeholders, including EPCs, developers, owners and O&M providers.
- System price forecasts and cost analysis.

Data (regularly updated data deliverables)	
PV Installations Tracker	Quarterly updates providing detailed tracking and forecasting of installations in over 90 PV markets, including annual and quarterly data, with segmentation by installation and system type (5-Year Forecast).
PV Systems Price Tracker	Biannual report contains the PV System Prices and Revenues by region, market, and segment. It includes full system price (or CAPEX) for the investor in the system as it is completed. The total system price includes margins of the suppliers to the system and development costs.
PV Inverter Market Tracker	Quarterly updates providing detailed tracking and five-year forecasting of PV inverter shipments, revenues and pricing, including annual and quarterly data, with segmentation by power rating, voltage, type, isolation and sales channels. Trackers also include over 60 detailed supplier market share tables by world, region and country.
PV Module Supply Chain Tracker	Combined analysis of the markets for polysilicon, solar wafers, PV cells and modules, with forecasts for PV installations, assessing the balance between supply and demand, and the impact on pricing and margins throughout the supply chain (5-Year Forecast).
PV Suppliers Tracker	Detailed data on the performance of leading companies in the PV module supply chain, plus detailed data of capacity, production, utilization and shipments for polysilicon, wafer, cell and module suppliers.
PV Manufacturing & Equipment Spending Tracker	Bi-annual report that tracks production, capacity and equipment spending on wafers, cells and modules, supply chain tool demand, technology roadmap adoption rates and more. Also provides quarterly data on market shares for cell types and production tools.
Solar EPC and O&M Provider Tracker	A detailed report revealing who the leading system integrators (EPCs) are worldwide and by region, showing market shares, rankings, over 500 company profiles and analysis. A comprehensive analysis of the O&M provider landscape by region is also provided.
Solar Deal Tracker	Comprehensive database coverage of planned and completed solar projects by installer, project developer, market segment, country, and other important criteria via an online dashboard.
PV Projects Pipeline Tracker	The PV project pipeline size and status by country for more than 1,000 individual PV developers.
Solar Market Tracker: North America	The Solar Market Tracker - North America provides forecasts and analysis for installed PV capacity in the United States and Canada at a country and state/province level.

Batteries & Energy Storage

Key features:

- Global deployment figures, long-term trends and 5-year forecasts (across a wide selection of end-market segments and applications).
- Regular updates on policy and regulatory changes, as well as updates on the supply chain.
- Analysis of business models and applications driving deployment.
- The largest dedicated energy storage database globally with individual project level data for more than 6,000 projects.
- Global database of battery manufacturing facilities, tracking the expansion announcements of leading manufacturers.
- Forecasts for component pricing and technology analysis.
- Profiles of next generation technology providers with overview of company's technology, commercial positioning, and insight into future direction.
- Analysis of alternative technologies and second-life batteries.

Data (regularly updated data deliverables)	
Battery Market Tracker	Historical data and forecasts for battery demand by sector and technology, capacity and production for battery cells, price and cost analysis
Battery Cell Manufacturer Database	Detailed analysis and forecasts for the buildout of battery cell manufacturing capacity, including a global database of battery cell factories.
Grid-Connected Energy Storage Forecast Database	Forecasts presented as an Excel database with PDF summary, and an interactive data visualization tool. Each edition examines and explains the latest changes to the market outlook and summarizes the current situation in each major market.
Energy Storage Company and Project Database	A detailed database with over 3,500 planned and completed energy storage projects with details of the timings and key companies involved.
Residential Energy Storage Index (RESI)	This quarterly deliverable provides up-to-date information on the development of the global residential energy storage market, including market shares and quarterly data.

Onshore and Offshore Wind

Key features:

- Installation forecasts – global and key regions.
- Profiles of leading OEMs.
- Announced wind turbine order tracker, updated bi-annually.
- Global wind ownership rankings.
- Market briefs for both offshore and onshore wind.
- LCOE outlook for both onshore and offshore wind technologies.
- Offshore Wind Substation Topsides, Foundations, and Substructures market fundamentals and costs.

Data (regularly updated data deliverables)	
Global wind power market outlooks	Drivers, inhibitors, siting, development, and main players for key countries in Asia, CIS, Europe, the Americas, Africa and the Middle East.
Global Wind Turbine Installation Overview and Top OEMs profiles	Includes global and regional overviews as well as profiles of the top 5 wind turbine vendors. Tracked data include newly installed capacity at both greenfield projects and fully repowered projects where the original utility-scale wind turbines (including towers and foundations) have been fully decommissioned, removed, and replaced with new utility-scale wind turbines.
Global Announced Wind Turbine Order Tracker (biannual)	Publicly announced supply agreement for a quantity of wind turbines between a wind project developer/owner and a turbine manufacturer. Such orders can range from concrete, project-based contracts to those based on framework agreements, or loosely defined letters of intent (LOIs)/ memorandums of understanding (MOUs).
Global wind ownership rankings	Overview of top RES owners' portfolios (by country, technology) based on net MW ownership at year-end.
Global offshore wind projects database	

Hydrogen & Renewable Gas

Key features:

- Analysis of policy, technology, market issues, and drivers.
- Forecasts for capex, opex, and input energy prices for hydrogen production for key technologies, as well as transportation and storage options by benchmark volume and distance.
- Full energy balance for benchmark years 2020, 2025, 2030, 2040, and 2050.
- Global database of power to X projects and hydrogen production from fossil fuels with carbon capture.
- Review of corporate strategies and business models for deployment.
- Analysis of emerging trends: drivers and implications.
- Interactive models for levelized cost of hydrogen and renewable gas production hydrogen transportation and automotive fuel cell outlooks.

Data, strategic reports and insights	
Modelling of production costs for each supply source	Analysis provided for benchmark years 2020, 2025, 2030, 2040, 2050, including capex, opex and input for energy prices as well as levelized costs. Analysis includes reforming and gasification with and without carbon capture and storage (CCS), methane pyrolysis, electrolysis (AEC, PEM, SOEC).
Transportation and storage of low carbon gases	Analysis provided for benchmark volumes and distances as well as capex and opex Transportation includes tube trailer, liquid trailer, pipeline, and liquid ship. Storage includes compressed tanks, liquid tanks, salt cavern, and depleted oil and gas field.
Levelized cost comparison for low carbon gases and alternative fuels	Analysis provided for benchmark years 2020, 2025, 2030, 2040, 2050, including capex and opex. End use transport includes light/medium/heavy duty, buses, shipping, and aviation. End use industry includes iron and steel, and end use residential and commercial includes space and water heating.
Use of low carbon hydrogen in the power sector	Analysis provided for benchmark years 2020, 2025, 2030, 2040, 2050.
Demand by sector by fuel in the reference case and the plausible case.	Data covers biomass, coal, electricity and heat, hydrogen, natural gas, oil.
Supply of hydrogen by fuel	– Installed capacity of electrolysers needed to supply hydrogen – Capacity of SMR and Gasification – Fuel needs for hydrogen supply – Renewable power generation capacity for hydrogen supply

Carbon Sequestration

Key features:

- Analysis of carbon sequestration technology and nature-based solutions.
- Costs for technology-based solutions.
- Tracking of over 350 CCUS projects associated with CCUS, Bioenergy with CCUS, and Direct Air Capture.
- Detailed information on individual and total project capacity.
- Country level carbon sequestration policy and support frameworks.
- Analysis of levelized cost of CO2 avoided

Data, strategic reports and insights	
Global CCUS project tracker	Tracking of carbon capture projects associated with three types of technologies: carbon capture, utilization & storage (CCUS), bioenergy with CCS (BECCS), and Direct Air Capture (DAC).

About S&P Global Commodity Insights

At S&P Global Commodity Insights, our complete view of global energy and commodities markets enables our customers to make decisions with conviction and create long-term, sustainable value.

We're a trusted connector that brings together thought leaders, market participants, governments, and regulators to co-create solutions that lead to progress. Vital to navigating Energy Transition, S&P Global Commodity Insights' coverage includes oil and gas, power, chemicals, metals, agriculture and shipping.

S&P Global Commodity Insights is a division of S&P Global (NYSE: SPGI). S&P Global is the world's foremost provider of credit ratings, benchmarks, analytics and workflow solutions in the global capital, commodity and automotive markets. With every one of our offerings, we help many of the world's leading organizations navigate the economic landscape so they can plan for tomorrow, today. For more information, visit www.spglobal.com/commodityinsights.

FOR MORE INFO:

Sandra Ortega, Product Management Executive Director

E Sandra.Ortega@spglobal.com

CONTACT US

The Americas	EMEA	Asia-Pacific
+1-877-863-1306	+44-20-7176-1234	+852-2533-3565

spglobal.com/commodityinsights

562155591_0922_ZT