New Energy Sources

The Opportunities and Challenges of Transitioning to Renewables

IFS

Contents

Understanding and embracing a new energy landscape

As society increasingly demands decisive action on climate change, the global move towards decarbonization and sustainable energy is rewriting traditional business models.

Key trends

- Oil and gas companies are becoming utility providers, generating green electricity and producing alternative fuels such as hydrogen.
- Power and Utility companies are exploiting wind, solar and tidal generation, and must invest in adequate battery storage to reliably meet network demand.
- Domestic, commercial and industrial consumers are becoming increasingly self-sufficient, embracing wind and solar microgeneration and expecting to sell excess energy back to the grid.

The move to self-sufficient microgeneration

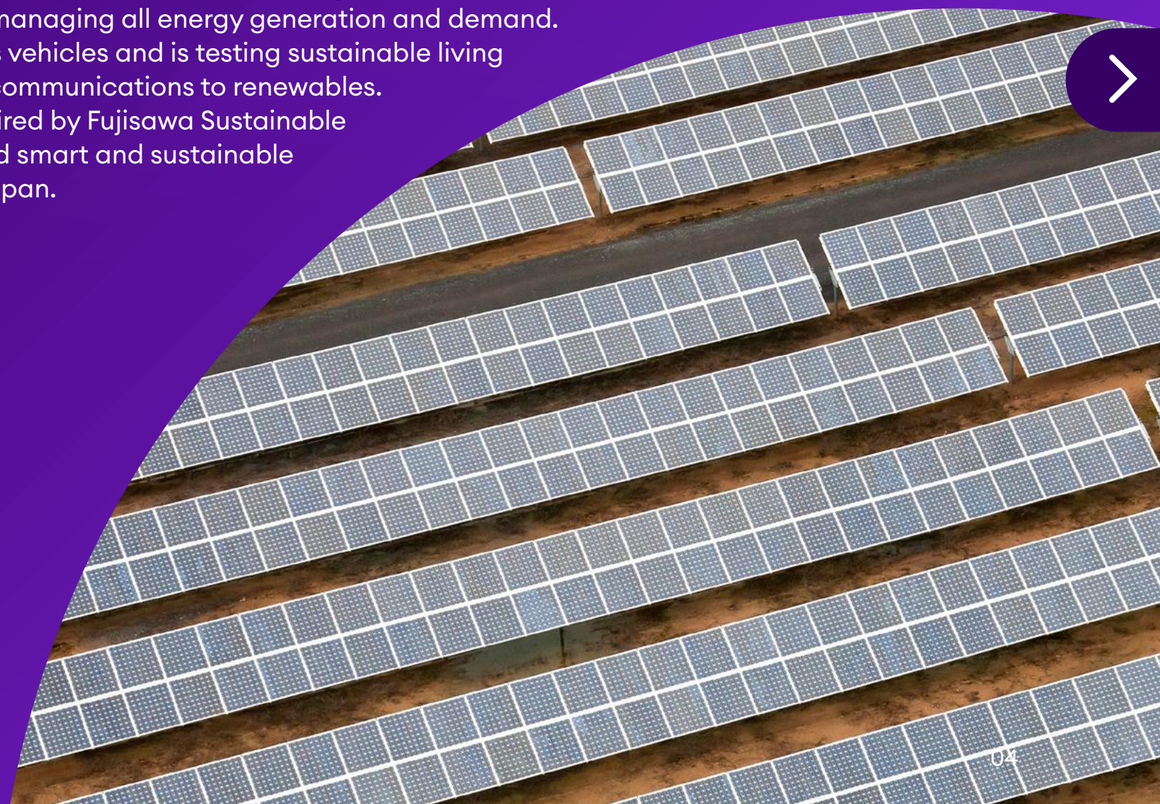
Increasingly, both industry and private households are turning to energy sources like solar panels, wind turbines and geothermal systems to supplement, or even replace, their primary energy supply, bypassing traditional energy companies.

This “Behind–the–Meter” self-generation is creating a growing network of prosumers: customers producing and storing energy and selling excess power back to the grid, whilst only occasionally consuming energy from the grid. To deal with such microgrids, utilities must consider adopting connection and operation fees to generate revenue to cover the cost of maintaining supply to those left behind in the race to renewables and occasional user customers. To optimize green energy consumption and reduce ‘dirty’ generation in peak periods, consumers can expect to be part of new demand response agreement models or pay varying rates to secure their energy from a preferred source.

The emergence of prosumer players and even entire communities focused on renewable operations is on the rise. New, purpose-designed residential communities are being built with self-sufficient sustainability at their core. They include water capture, storage and grey water recycling systems, solar arrays, solar walls, windows and roofs, and even battery walls and floors.

Renewables at work: Peña Station NEXT micro community

In the US, the Peña Station NEXT micro community just outside of Denver, Colorado is a joint venture with Panasonic, the local utility, the municipal government and other players. Spanning 220 acres and 1,500 residences, it combines a connected community, smart grid clean energy and enhanced mobility. The community has solar and wind generation and its own micro–Control Center managing all energy generation and demand. The facility has autonomous vehicles and is testing sustainable living technologies ranging from communications to renewables. Peña Station NEXT was inspired by Fujisawa Sustainable Smart Town, a Panasonic-led smart and sustainable development in Fujisawa, Japan.



Renewables at work: Fortis BC natural gas heat pumps

A report by the International Energy Agency (IEA) states that sales of new fossil fuel boilers should cease from 2025 if the world is to achieve net-zero emissions by the middle of this century[1]. Already in some markets, such as the UK, planned legislation will ban the use of gas boilers in new build properties from 2025. In other markets, regulators are turning to gas players to drive more sustainable technology solutions.

In British Columbia, Canada, Fortis BC is running a government-funded pilot to test high efficiency gas fueled heat pumps in 20 residential homes. In the face of heatwaves, the pumps use the outdoor ambient air as an additional energy source, transferring it indoors to heat or cool dwellings or heat water. The heat pumps use as little as half the natural gas traditional boilers require.

[1] IEA: Net Zero by 2050

Balancing reliability and sustainability

While electrification from renewables provides a sustainable energy solution, it also poses challenges around resilience. Currently, around 70% of infrastructure in the US is over 50 years old. While renewables provide an opportunity to update and build the grid back better, the short-term reality will see the lifetime of existing ageing assets needing to extend further, demanding robust maintenance and monitoring to remain reliable and safe.

The unpredictability of wind and solar generation also requires careful planning. When a consumer flicks a switch, they expect the lights to come on. Provisioning a spinning reserve – unused capacity which can compensate for power shortages or frequency drops– becomes far more challenging with renewables. In addition to battery storage, certain liquid fuels, such as propane, can provide a low or even zero carbon complementary energy source. Solar and wind powered microgrids can be supported by renewable propane to ensure on demand power and heating with minimal energy transfer loss.

Natural gas is also a practical solution to support a sustainable transition to renewable energy. Whilst a fossil fuel, it is significantly less environmentally damaging than coal to generate reserve energy capacity. By using biogas methods, natural gas can also be collected in a renewable way from landfill, animal manure and wastewater. Natural gas comprises mainly methane, which emits the least amount of carbon dioxide (CO_2) and other harmful substances compared to oil and coal. Liquefied Natural Gas produces 40% less carbon dioxide (CO_2) than coal and 30% less than oil. Combustion does not create soot, dust or particulates, and the production of compounds harmful to the atmosphere such as sulfur dioxide and mercury is insignificant.

Factoring for climate change

Global warming is dramatically increasing the risk of extreme so called ‘billion dollar’ economic impact weather events. Wildfires from heatwaves are regularly destroying infrastructure, whilst extreme sub-zero temperatures, flooding, high winds and tornados are causing serious failures and outages. All players in the energy space must test for and ensure adequate network resilience in the event of a major climate event.

Meeting customer expectations

Both new entrants and existing Utility companies must be prepared to meet rising customer service expectations. 24/7 digital communication and personalized, self-service options via portals and messaging sites are now expected and, in the case of younger consumers, often preferred to more traditional channels. If they don’t get an immediate response, customers will often engage using multiple channels, increasing complexity and costs for customer service teams. In an increasingly crowded market, the performance of the field service workforce can make or break a brand. Real time information and updates from suppliers is becoming the industry norm for service providers, not the exception.

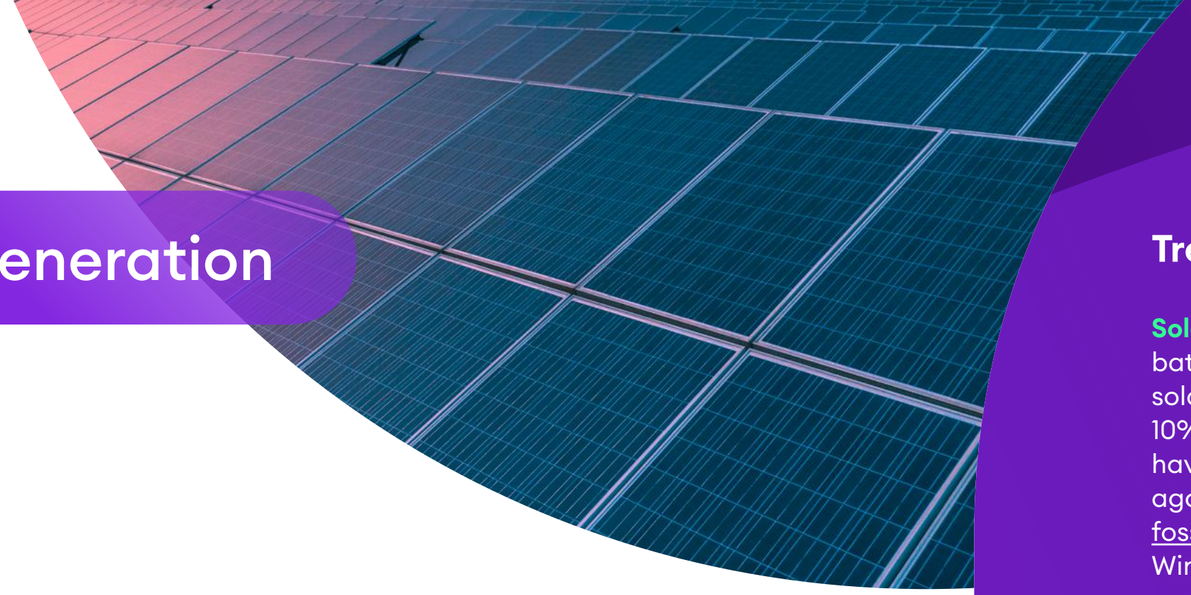
Emerging new participants

Several companies are pivoting their businesses to capitalize on the opportunities presented by renewable energy. Whilst some Big Oil corporate advertising campaigns may claim otherwise, the oil and gas industry has to date been criticized for failing to invest proportionate sums into renewable energy projects compared to continued fossil fuel ventures. Other participants, meanwhile, are seizing the chance to build and diversify.

Tesla, principally known for battery electric vehicle development, is one example of a non-traditional player using its knowledge to evolve into the energy sector. In Angleton, Texas, the company is building a 100 megawatt pilot energy storage project capable of powering up to 20,000 homes on a sunny day. Tesla’s Megapack product is specifically designed for utility companies. The company has now applied to become a distributor and a generator for the state. Elon Musk has already predicted Tesla Energy will become the same size as Tesla Automotive.

Technologies and opportunities

While each energy source has certain merits and limitations, renewable energy opportunities should not be considered in isolation. Increasingly, these new technology solutions are being used together, offering complementary capabilities and building network capacity and resilience.



Solar generation

Solar energy – power derived from the sun – offers an inexhaustible supply that, if efficiently captured and stored, is more than sufficient to meet global energy needs. New research suggests only 50% of the world's rooftops would need to be fitted with solar panels to meet annual global electricity demands, with Asia, North America and Europe the potential hotspots for rooftop solar energy generation.

Most current global solar energy capture relies on photovoltaic (PV) cells. Clear plastic or glass surfaces sandwich silicon which captures light energy from photons. The individual cells are mounted together to form large solar modules, which in turn are sited to form banks of solar arrays. Arrays can range in size from a residential or factory rooftop to vast generation footprints across rural fields, deserts and plains.

Commercial solar arrays have systems that allow the panels to track the sun's path to maximize sunlight throughout the day. Inverters convert the direct current (DV) generated by the panels into alternating current (AC) that can be fed back to the grid.

An alternate form of solar generation relies on using the sun's heat to create thermal energy that can be stored or used to power steam turbine electricity generators. This concentrating solar thermal power (CSP) technology uses multiple mirrors to direct the sun's heat to receivers containing liquid.

Trends and predictions

Solar PV costs continue to fall: the cost of solar PV, wind and batteries has steadily fallen dramatically. Research[2] shows solarvoltaics and battery costs have fallen exponentially around 10% each year. Since first commercially used in 1958, solar PV costs have decreased by over three orders of magnitude. Only 10 years ago, it was much cheaper to build a new power plant that burns fossil fuels than to build a new solar photovoltaic (PV) or wind plant. Wind was 22%, and solar 223% more expensive than coal.

[2] Source: Empirically Grounded Technology Forecasts and the Energy Transition, Way, R., Ives, M., Mealy, P. & Farmer, J.D. (2021)

Floating solar farms appear: So-called floatovoltaics use reservoirs and dams instead of real estate for arrays. Floating solar arrays are cheaper to install, reduce water evaporation and produce up to 10% more power due to water cooling effects.

Buildings have generation built-in: Building-integrated photovoltaics (BIPV) integrate solar generation into the very fabric of the structure such as canopies, walls, floors and roofs. They have the potential to reduce the cost of building materials and remove the need for mounted solar panels.

Solar panels appear on highways: solar panels can be employed as noise barriers on motorways and highways, generating power. In the US alone, 3,000 miles of currently inert traffic noise barriers across 48 states could be replaced with solar PV generation capacity.

Wind generation

Research suggests that in the future wind energy will be the most cost-effective source of electrical power. According to the Global Wind Energy Council's latest Global Wind Report, total global wind power capacity is now up to 837 GW, reducing annual CO_2 emissions by 1.2 billion tonnes – equivalent to the annual carbon emissions of South America. With projects now cost competitive with new coal and gas plants, the council also suggests the number of wind energy projects needs to increase by four-fold over the next ten years if the world is to meet net zero by 2050.

Wind generation captures the kinetic energy of wind using a turbine. A rotor spins a generator, generating electric current which can be used immediately or stored in batteries. Horizontal axis turbines pivot into the wind, whilst vertical axis designs allow generation from omni directional wind flows.

Commercial generation turbines are carefully located in areas with favorable wind and weather conditions, either on land, on lakes, or offshore in the sea, creating wind farms. Land-based turbines offer generation ranging from 100 kilowatts to several megawatts. Featuring large, efficient rotors, they provide power to the grid. Offshore wind turbines are even larger and are moved and sited into position using ships. Wind flows across oceans and lakes are often very powerful, generating significant electricity for the grid.

Increasingly, smaller turbines (below 100 kilowatts) are being installed by industrial and residential customers on their own property to provide self-sufficient microgeneration. These 'behind-the-meter' schemes are known as distributed wind generation. Distributed wind turbines are often used alongside other distributed energy resources, such as batteries, photovoltaics and generators, to create hybrid microgrids with greater resiliency.

Trends and predictions

Source: Global Wind Report 2022

Capacity rises: almost 94 GW of capacity was added globally in 2021. Europe, Latin America and Africa & Middle East had record years for new onshore installations, but total onshore wind installations in 2021 was still 18% lower than the previous year. The decline was driven primarily by the slow-down of onshore wind growth in the world's two largest wind power markets, China and the US.

More investment offshore: 21.1 GW of offshore wind capacity was commissioned last year, three times more than in 2020, making 2021 the best year in offshore wind history, with 22.5% global market share. China made up 80% of offshore wind capacity added worldwide in 2021, bringing its cumulative offshore wind installations to 27.7 GW. This is an astounding level of growth, as it took three decades for Europe to bring its total offshore wind capacity to a similar level.

Increased CO_2 savings: total global wind power capacity is now up to 837 GW, helping the world avoid over 1.2 billion tonnes of CO_2 annually – equivalent to the annual carbon emissions of South America.

More contracts awarded: Wind auction activities bounced back in 2021 with more than 88 GW of wind capacity awarded globally, 153% higher than in 2020.

Future investment continues: 557 GW of new capacity is expected to be added in the next five years under current policies - more than 110 GW of new installations each year until 2026.

Hydrogen generation

One of the major challenges for energy companies developing renewable energy generation is energy storage. Weather is unpredictable. When sunlight or wind power is available, the electricity generated can be distributed instantly, in real time, to meet current demand on the grid. But often renewable supply exceeds demand in peak generation periods and electricity must be stored if it is not to go to waste.

Game-changing properties

Hydrogen offers a compelling, green, stored energy source alternative to costly, large-scale battery arrays. Hydrogen is a game-changing energy source because of its sustainable properties. Firstly, it is ubiquitous. As the third most abundant element on the Earth's surface after oxygen and silicon, hydrogen constitutes 75% of the elemental mass in the universe.

Secondly, hydrogen energy is renewable and clean in use. Whether combusted to generate thermal energy or used in a fuel cell reaction with air to liberate electric current, the only emissions are water vapor and warm air.

Currently, for cost reasons, most hydrogen gas is produced using fossil-fuel reforming, a process that uses steam to convert methane or natural gas into hydrogen and CO_2 molecules. This mechanism is highly energy-intensive, and clearly has environmental consequences, creating almost 900Mt of CO_2 emissions per year. KPMG research finds that of the 115 million tonnes of hydrogen by volume produced, currently only 2% comes from renewables.

However, hydrogen can readily be produced from renewable sources, such as biogas, a gaseous form of methane obtained from biomass, or, even better,

Green	Produced via a zero/low-carbon energy source (wind, solar, hydro power, nuclear etc.)
Blue	Produced from a fossil source combined with carbon capture and storage (CCS).
Grey	Produced from fossil fuels without CCS (and thus CO^2 emitting).

Diagram Source: https://home.kpmg/xx/en/home/insights/2020/11/the-hydrogen-trajectory.html

directly through electrolysis using electricity generated by clean wind, solar and hydro power. Electrolysis from renewables effectively creates hydrogen without an onerous carbon footprint, delivering 'green hydrogen' energy that can help to decarbonize other industrial processes, and provide hydrogen fuel for road vehicles and even ships.

Using electricity for hydrolysis to liberate hydrogen gas from water, forward-thinking energy companies are already looking to commercialize green hydrogen production. The potential for a global Hydrogen Society is tangible and is actively being developed by global coalitions such as the Hydrogen Council. Hydrogen gas offers a clean, entirely renewable source of fuel that can be compressed and stored in tanks or liquefied as an organic oil. It also, thanks to hydrogen fuel cell vehicles, provides completely emissions-free mobility.

Renewables at work: Toyota Hydrogen powered community

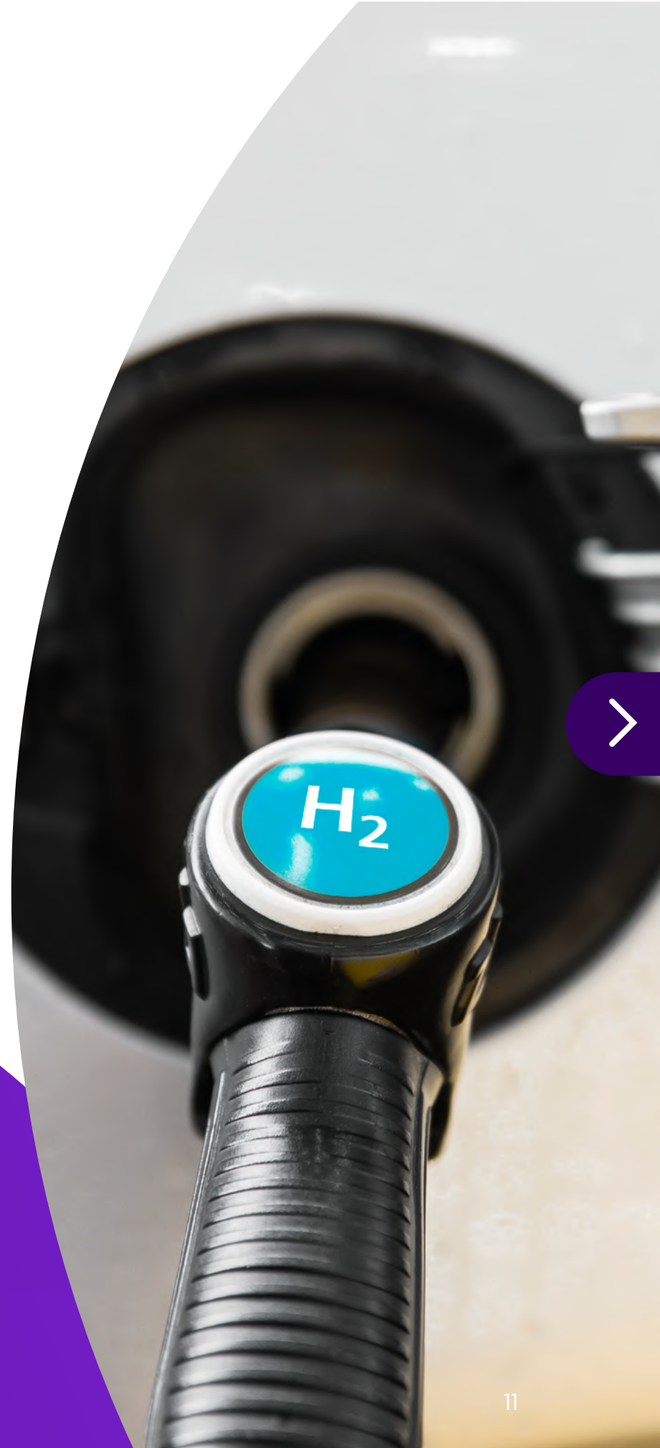
In Japan, a prototype city of the future is being created by Toyota. Situated at the base of Mount Fuji, Woven City is a 175-acre urban development project to create a fully connected ecosystem powered by clean energy produced through hydrogen fuel cells and rooftop solar arrays. Residents and researchers will be able to test and develop technologies such as autonomy, robotics, personal mobility, smart homes and artificial intelligence in a real-world environment.

Renewables at work: Green hydrogen, EDF Renewables UK

EDF Energy, an IFS customer, is developing low carbon hydrogen production which will be vital in supporting the UK to transition to net zero by 2050. Tees Green Hydrogen will use green electricity from nearby Teesside Offshore Wind Farm along with a new solar farm to power a hydrogen electrolyzer. The project will supply local business customers with hydrogen to support decarbonization efforts and a significant reduction in industrial pollution.

Renewables at work: Green steel

Europe's largest iron ore producer, mining company LKAB, relies on an IFS EAM solution to support its data-driven mining. LKAB is part of a consortium that, alongside an energy company and steelmaker, is trying to produce steel in the greenest possible way. The pilot project has successfully produced the world's first hydrogen-reduced sponge iron. The ground-breaking process reduces production emissions by 90%, paving the way for future fossil-free iron and steelmaking. The hydrogen used in the direct reduction process is generated by electrolysis of water with fossil-free electricity and can be used immediately or stored for later use.



Trends and predictions

Slow shift from grey to green hydrogen: projections suggest that the rearrangement of the value chain from grey to green hydrogen is unlikely to occur at scale before the 2030s.

Bigger electrifiers will reduce green hydrogen electrolysis costs - as investments in wind and solar increase, so does the chance for offtake of low-cost electricity for green hydrogen production.

National hydrogen policies are increasing - strategies are being adopted by both public and business entities around the world, with new developments emerging in Europe, the Asia Pacific (ASPAC) region, the Americas, and the Gulf Cooperation Council (GCC) countries.

Sources: KPMG: The Hydrogen Trajectory 2020; KPMG National hydrogen Strategies

Tidal generation

The cyclic rise and fall of tides offers an exciting source of renewable energy. Whilst still an emerging technology, a few commercial plants are successfully in operation, including the 250MW La Rance, in France, since 1966. Currently the largest, completed in 2011, is the Sihwa Lake Tidal Power Station in South Korea, with a capacity of 254MW. Locations offering the most potential for affordable tidal energy production include China, France, England, Canada, and Russia.

Four principal methods are available for tidal electricity generation:

Tidal streams or currents (tidal turbines)

Tides can create fast flowing water called tidal streams. By placing turbines in the streams, tidal generators produce a cyclic and predictable supply of electricity. Tidal turbines are large, and work best in shallow waters. They must be sited carefully to limit impact both to the tide and the environment. Tidal stream generation requires significant initial investment and maintenance but offers lower generation cost with less environmental disruption.

Tidal barrages

Tidal barrages are dams constructed across rivers, bays or estuaries to retain water. As the tide rises, gates open to allow water to accumulate behind the dam. Once full, the gates close. When the tide is low, the gates open to release water through turbines to generate electricity. Tidal barrages can have a major impact on the ecosystem and landscape, and the energy produced is more expensive than tidal turbines.

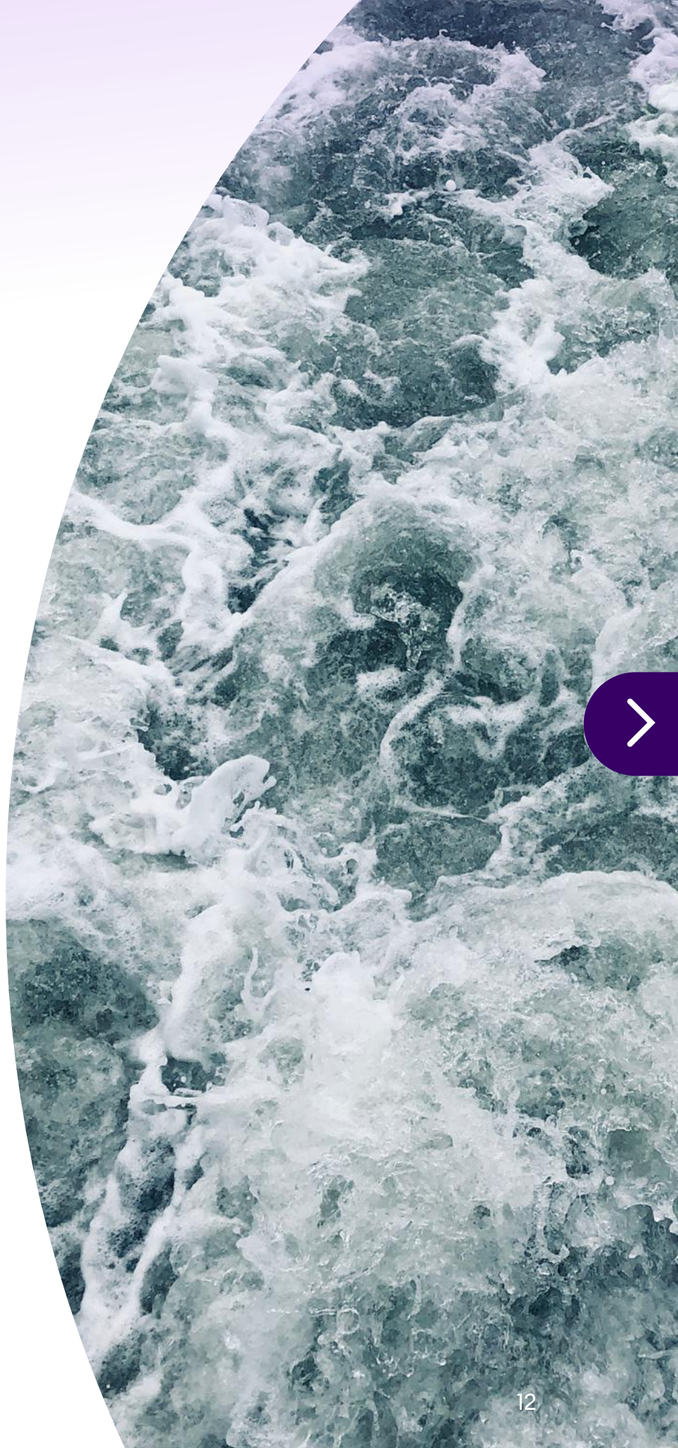
Tidal lagoons

Tidal lagoons use the same generation principles as tidal barrages, but make use of naturally occurring lagoons, bays and estuaries, reducing cost and local impact. Tidal lagoon generation is in its infancy: one major project at the Yalu River in China is under construction, and a private venture constructing a plant in Swansea Bay, Wales.

Renewables at work: Tidal Lagoon Power, Swansea Bay, Wales

The UK has the second highest tidal range in the world. At Swansea Bay, in Wales, and the difference between low and high tide is 7-9 meters. Here, Swansea Bay Tidal Lagoon will become the world's first tidal lagoon power plant.

A man-made lagoon will fill and empty four times a day, generating electricity on each cycle. The project, due for completion in 2024, will comprise 16 hydro turbines and a 9.5km breakwater wall, generating electricity for 155,000 homes for the next 120 years.



Dynamic Tidal Power

Currently still in development, Dynamic Tidal Power seeks to capture energy from tidal flows running parallel to the shoreline. A long dam stretches out to sea, with a parallel barrier forming a T shape at the end. Bi-directional turbines within the dam generate electricity as the tides flow through the barrier in each direction.

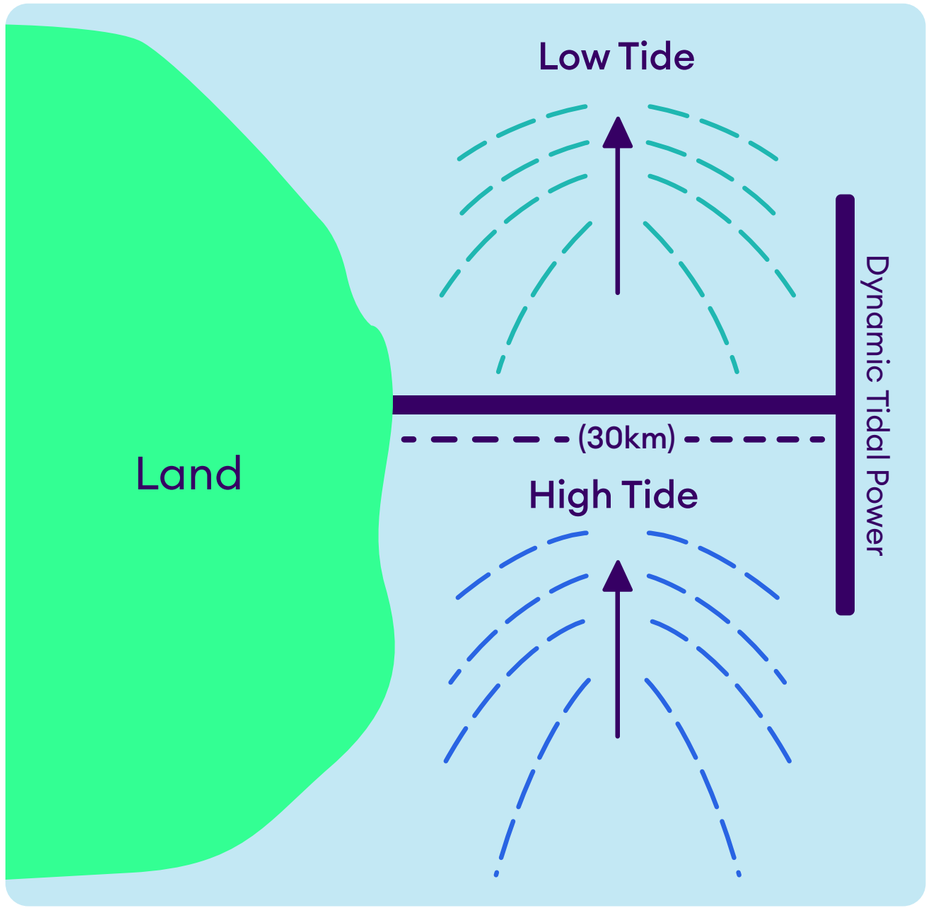


Image source: https://energyeducation.ca/encyclopedia/Dynamic_tidal_power

Trends and predictions

Sources: Zion market Research, the Wave and Tidal Energy Market 2022

A market in growth: The Wave and Tidal Energy Market is expected to grow annually at a CAGR of around 32.1 % (2022-2028).

Clear opportunity for new entrants: there is significant opportunity for new players to enter the market by introducing new technologies.

Encouraging shifts in market frameworks: The Canadian province of Nova Scotia has implemented Feed-In Tariff (FIT) programs for various tidal power demonstration farms, building the market for tidal technology.

Biofuels

According to the International Energy Agency, bioenergy currently accounts for roughly one-tenth of world's total primary energy supply. Even excluding traditional use of biomass, its contribution is five times higher than wind and solar PV combined.

Biofuel is liquid or gaseous fuel that is produced from organic sources such as plants, or from agricultural, domestic or industrial biowaste. Biofuel is often used for transportation, in the form of bioethanol (made by fermenting starch or sugar) and biodiesel (made from oil-rich plants like soybean or oil palm or from waste commercial cooking fat). The largest producer of bioethanol is the USA, while the EU is the largest producer of biodiesel.

Other gaseous biofuels include methane gas and biogas (from the anerobic digestion of biomass)–and methanol, butanol, and dimethyl ether.

Whilst considered a carbon neutral fuel source, some biofuel production methods can conflict with environmental benefits. Industrial processes for agricultural biofuels create emissions, whilst use of land to grow crops for biofuels may compromise availability of food and impact market prices.

Trends and predictions

Sources: International Energy Agency, Renewables 2021 Analysis and forecast to 2026

Demand increasing 28% over next 5 years: global demand for biofuel is forecast to increase by 2026, reaching 186 billion liters.

Asia will surpass European biofuel production before 2026: Asia accounts for almost 30% of new production over the period, overtaking European biofuel production by 2026. Indian ethanol policies and targets for biodiesel in Indonesia and Malaysia drive the growth in Asia.

Ethanol and renewable diesel will lead biofuels growth: in the United States and Europe, renewable diesel demand will nearly triple between 2020 and 2026, whilst ethanol demand growth surpasses that of renewable diesel.

Policy discussions will help double biofuel growth rates: policy discussions in the United States, Europe, India and China will have a profound impact on biofuel prospects over the next five years, potentially seeing biofuel demand growth more than double to near 9% a year.

Battery storage

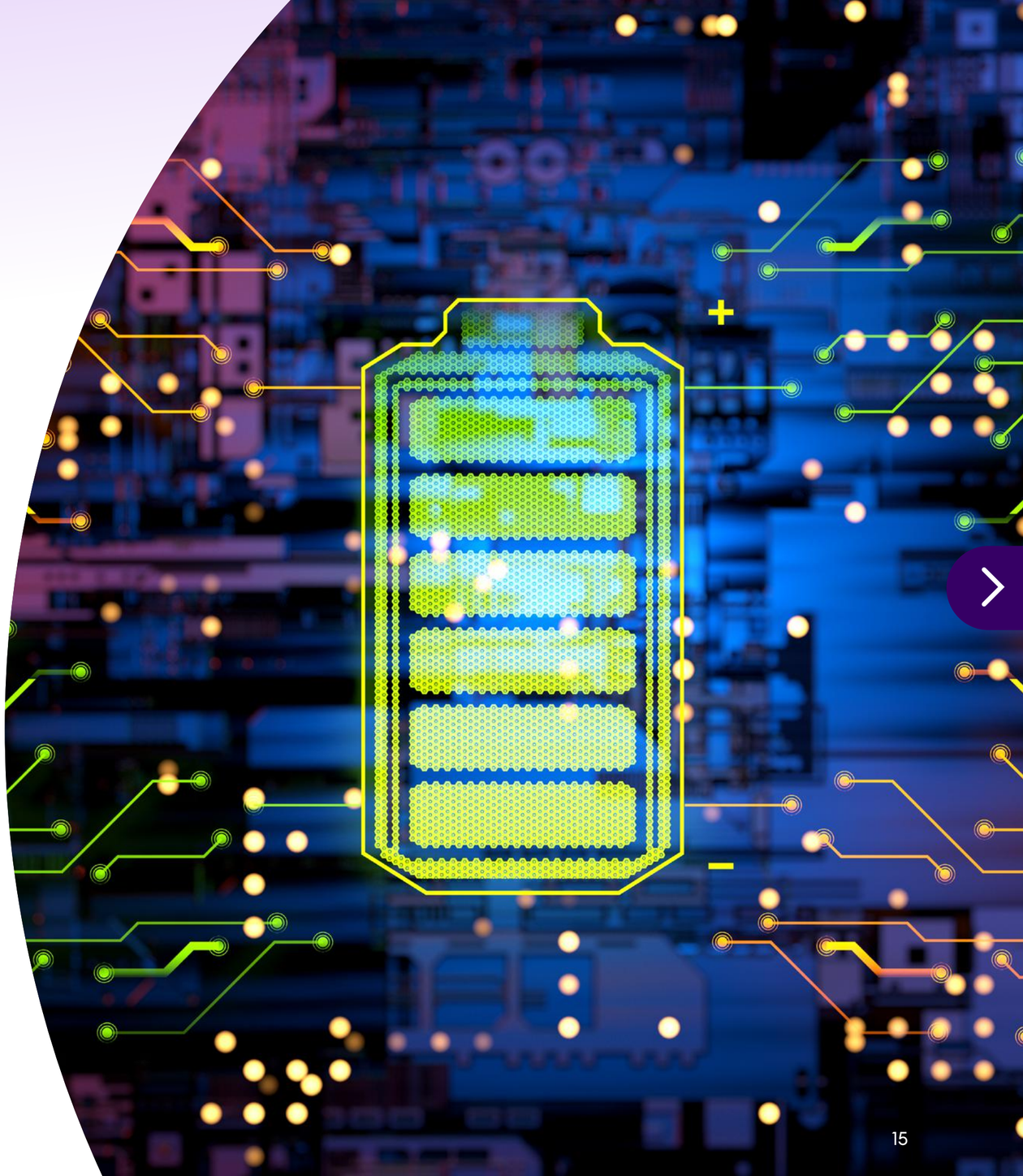
Battery storage technology is critical to renewable energy generation like solar and wind. Battery energy storage Systems (BESS) allow surplus green energy, whether from commercial network generation or distributed microgrids, to be captured and stored to meet demand. The UK government estimates technologies like battery storage systems could save the UK energy system up to £40 billion ($48 billion) by 2050. Both established and emerging battery technologies are all reliant on the availability of sometimes rare minerals including graphite, cobalt, lithium, manganese, and nickel. Developers are therefore actively exploring chemistries that use more abundant, accessible elements.

Lithium-ion storage

The global shift initially to hybrid and now to battery electric vehicles, coupled with renewable generation storage applications, has created a major global demand for battery manufacture, currently based around Lithium-ion technology. Proven Li-ion batteries deliver the highest level of energy density. Li-ion cells are low maintenance, with no battery memory issues, have low self-discharge, and offer a lifetime spanning thousands of charging and discharge cycles. To operate safely, cells need a protection circuit to maintain voltage and current, and large batteries are heavy to transport. Next generation Li-ion batteries are being developed for commercial energy storage systems and transport applications.

Lithium sulfur storage

Li-S batteries use lighter active materials in the electrodes, sulfur and metallic lithium. The result is a lighter cell with an energy density four times greater than that of lithium-ion. Research is currently underway to increase the number of charging cycles before failure.

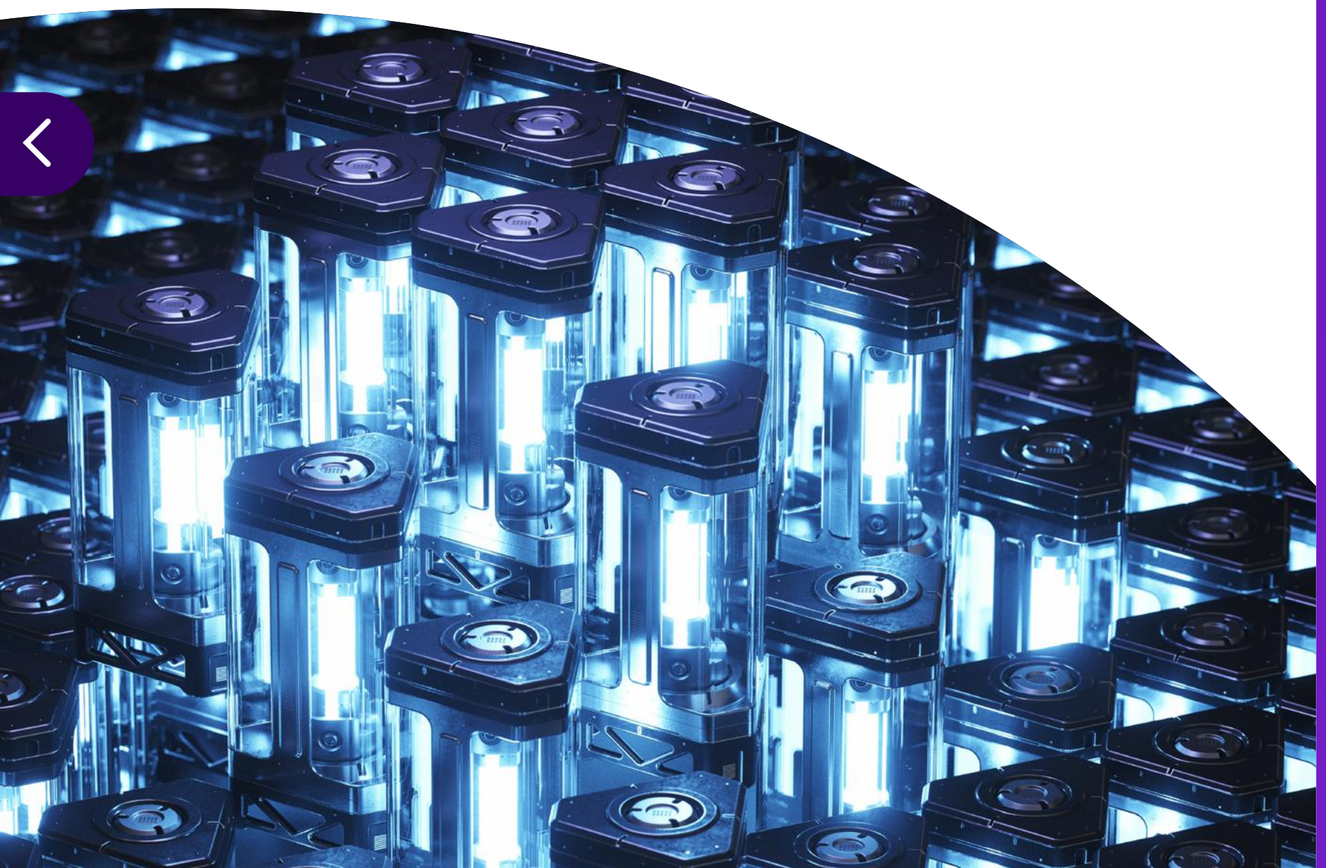


Solid state Li-ion storage

Here, solid state battery technology replaces the liquid electrolyte with a solid compound. Solid electrolytes are non-flammable, making batteries safer, and can be denser and lighter – ideal for electric vehicles.

Renewables at work: Tesla Energy Plan

In the UK, the Tesla Energy Plan from Octopus Energy allows consumers with solar panels and a Tesla Powerwall to reduce reliance on fossil fuels. Creating Tesla's 'UK virtual power plant', the system automatically optimizes and shares stored energy with the grid when demand is high – supporting the local community with renewable energy and enhancing the stability and resilience of the grid.



Trends and predictions

Source: Researchandmarkets.com: Global Battery Energy Storage Systems Market 2022

Growth in global battery energy storage systems: The global battery energy storage systems market is expected to grow from USD 4.4 billion in 2022 to USD 15.1 billion by 2027, at a CAGR of 27.9%. drivers include grid modernization, growing penetration of lithium-ion batteries in the renewable energy sector, and the shift to renewable energy.

Lithium-ion batteries will dominate the battery energy storage system market: High energy, power density and 5-15 years with 98% efficiency will keep Li-ion on top. Lithium-ion-sulfur battery energy storage systems also support on-grid connections.

On-grid connections will be the biggest battery energy storage system market: upfront on-grid connections cost less than off-grid systems, and support export to the grid for use on a metered basis later.

The Utility application dominates ensuring continuity of supply: The utility BESS ensures power quality, frequency, and voltage control services in case of sudden fluctuation in the energy supply.

IFS Cloud: Solution for transition

In a regulated sector, environmental issues and a focus on resilience make it more important than ever to extract the most value from your available resources. This means efficiently managing new projects, optimizing usage of field engineers, and ensuring the supply network can meet demand.

IFS Cloud is the leading single platform for organizations whose business revolves around any combination of service, projects and assets. By eliminating silos, IFS Cloud provides holistic visibility and control across this complete lifecycle delivering lower operational costs, improved customer satisfaction and supporting growth through different business models. IFS Cloud can integrate seamlessly with any existing ERP solution or provide an enterprise-wide ERP upgrade as part of a digital transformation strategy.

Manage Service, Projects and Assets

The need to manage new investment projects, complex and linear assets, a distributed field workforce and increasing customer expectations poses many challenges for the energy and utilities ecosystem.

By applying holistic, composable, seamless software capabilities across Assets, Projects and Field Service, IFS removes business silos to create united, smart and agile organizations.

Manage and maintain complex transmission network assets from cradle to grave

Planning new investment and managing the operation of power network and equipment is key to keeping customers connected, ensuring the safety of your workforce and of local communities, and improving your operating margin. IFS Enterprise Asset Management offers seamless linear asset management including mapping and GIS integration, Asset design management and Mobile optimization. Capabilities include:

- Asset planning and implementation
- Asset operations and maintenance
- Asset performance management

Control and complete projects faster

Projects in the utilities industry are complex, involving multiple stakeholder divisions such as sub-contractor workforces, regulators, government agencies, and more. Typically, this meant using separate software products across different stages of the project such as tendering, commercial, estimating, engineering, procurement, manufacturing & fabrication, planning, cost control, construction, installation, service and de-commissioning. In contrast, IFS supports the management of complex project lifecycles, and joint ventures with seamless, fully integrated project management software. Capabilities include:

- Project Gantt functionality – multiple operations
- Definitive view of entire project lifecycle
- Bid to Contract Management
- BIM, CAD and Product Lifecycle Management

Deliver market leading service with an optimized field workforce

Optimizing the productivity of your field workforce while delivering a great experience for your customers is ever more challenging in today's on-demand economy. IFS's world-class real-time scheduling and optimization tool uses AI and advanced algorithms to deliver the optimum workforce schedule, increasing satisfaction, building loyalty, and growing revenue. Capabilities include:

- Dynamic scheduling optimization - multiple dependencies
- Dispatch and mobility applications
- Integrated GIS
- Remote assistance - augmented reality
- 'What-if' planning
- Real-time visibility using any device

About IFS

IFS develops and delivers enterprise software for companies around the world who manufacture and distribute goods, build and maintain assets, and manage service-focused operations.

Within our single platform, our industry specific products are innately connected to a single data model and use embedded digital innovation so that our customers can be their best when it really matters to their customers–at the Moment of Service™.

The industry expertise of our people and of our growing ecosystem, together with a commitment to deliver value at every single step, has made IFS a recognized leader and the most recommended supplier in our sector.

Our team of 4,500 employees every day live our values of agility, trustworthiness and collaboration in how we support our 10,000+ customers. Learn more about how our enterprise software solutions can help your business today at **ifs.com**.

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Production: IFS, August 2022.