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Renewables:
The Next Energy Super Cycle

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Renewable power has long been thought of as the energy source of the future, yet its history is riddled with many false starts. In the early 1970s many believed OPEC-induced oil supply constraints would be the catalyst for greater renewable adoption, yet fossil fuel usage continued to grow for the following forty plus years. Meanwhile, hydrogen has been viewed for decades as a just around the corner technology destined to help decarbonize everything from transportation to power generation; thus far it has not been adopted in any meaningful scale.

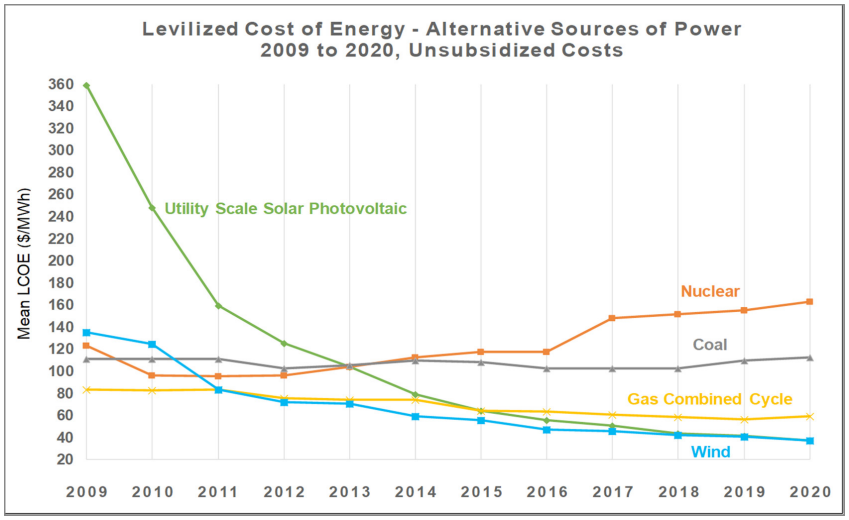
Irrespective of previous false starts, this time around is convincingly different. Never has there been such a global alignment of government policy and advantaged project economics coupled with public demand. The stage has been set for a renewable energy super cycle – one that will last decades and require trillions of dollars in capital for public demand and governments' emissions reduction targets to be met. In this paper we outline the drivers behind this burgeoning megatrend.

Drivers behind the renewable energy super cycle:

- Cost competitiveness of renewable power with traditional energy sources
- Global adoption of clean energy public policies
- Changing energy consumption patterns are increasing electricity demand

Competitive With Conventional Power

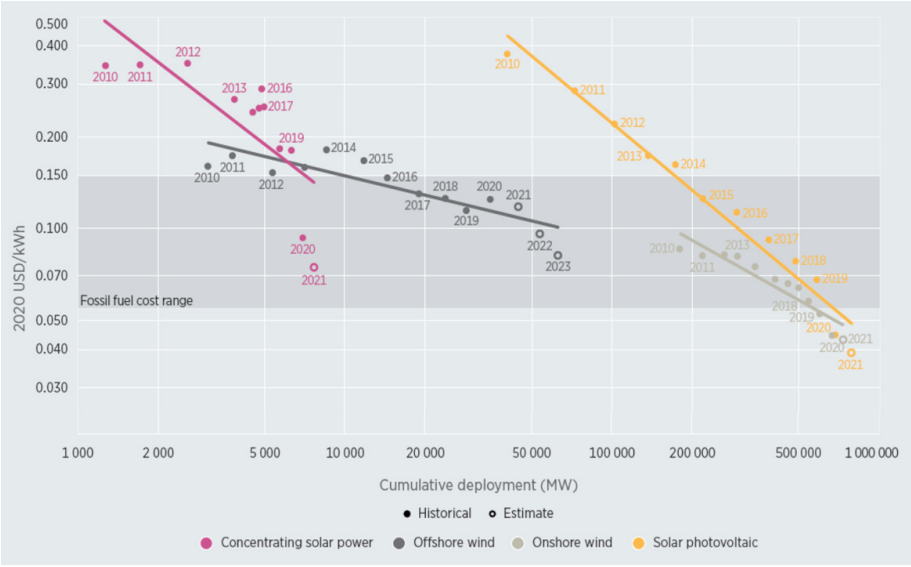
The first driver behind the renewable megatrend is cost competitiveness with conventional hydrocarbon power such as coal, oil and natural gas. Over the past several years, as illustrated below, the levelized cost of renewable power has fallen considerably. The price declines have been due to advances in technology, design enhancements, manufacturing improvements and declining installation costs. Onshore wind and photovoltaic (PV) levelized costs have declined the most at 70% and 90% respectively. Fossil fuels still make up the largest piece of the global power supply stack, but this is likely to change.



Source: Lazard

Until recently fossil fuel power had been considerably less expensive than renewable power. However, due to steady declines in renewable levelized costs, renewable power is now competitive with conventional fossil fuel generated power in most countries of the world. Over the years, renewable power costs have tended to follow a learning curve, which is commonly used to describe the relationship between increasing product sales/installations and declining costs. For example, a cumulative doubling of solar PV sales has tended to occur with a 20% decline in costs.

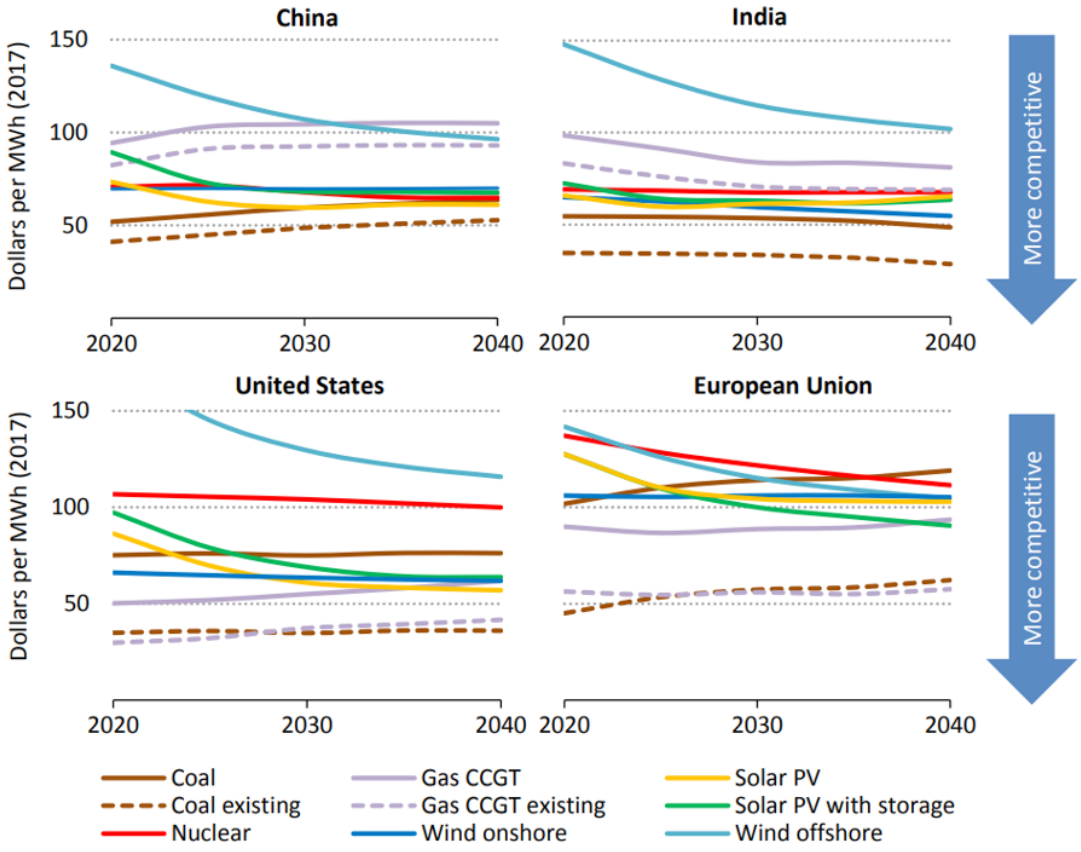
Renewable Power Learning Rates



Source: International Renewable Energy Agency (IRENA)

Renewable projects typically have a large upfront cost to build but then have little operating costs as the commodities that power the projects are essentially free (wind, solar, etc.). Hence, the more renewable power is installed, the cheaper it gets. Conventional power does not benefit from this quality as the cost of fossil fuel generation will fluctuate based on the underlying commodity price which is driven by supply and demand. These dynamics will lead to an increasing wedge between renewable and fossil fuel costs, creating a virtuous cycle and reinforcing the case for more renewable projects to meet marginal demand. The chart below illustrates cost forecasts for various types of power. The degree of change varies by region, due to quality of resource, labor costs and land acquisition costs. Nevertheless, there is a clear trend that renewable power costs will continue to decline while hydrocarbon power will either stabilize or drift higher.

Regional Cost of Electricity Bull and Bear Case

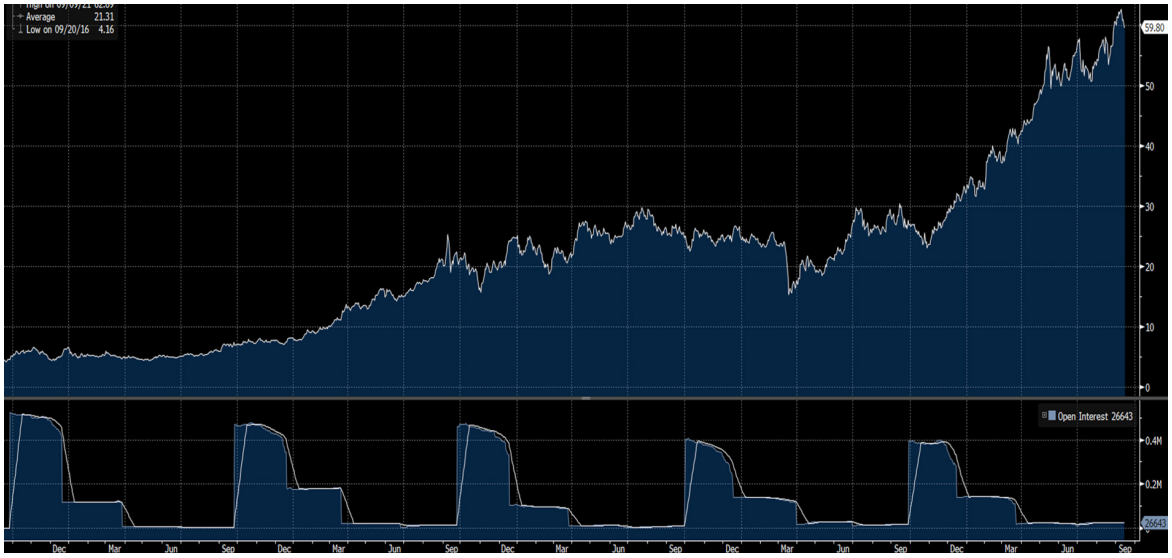


Source: IEA World Energy Outlook

Government Support Is Gaining Traction For Renewable Power

The second driver of the renewable megatrend is government policy. Europe has long been at the forefront of renewable energy adoption. The origins trace back to the oil shocks in the 1970s when the Commission for European Committee first called for new energy R&D to improve energy security and limit oil demand. In 2009 Europe adopted the Renewable Energy Directive that established a 20% share of E.U. energy consumption be derived from renewable energy sources by 2020. European renewable energy policy has evolved and has also become more aggressive over time. The European Green Deal now targets 55% (up from 40% previously) GHG reduction by 2030 compared to 1990 levels. Currently, Europe has one of the most aggressive green policies on the globe, broadly aiming for carbon neutrality by 2050. A key pillar of Europe's carbon neutrality target is the world's first emissions trading system which was launched in 2005. Initially criticized for weak carbon pricing (due to a glut of permits), which offered little incentive to reduce GHG emissions, with prices up almost 100% YTD the scheme provides an increasingly compelling incentive for emitters to decarbonize.

European Carbon Prices



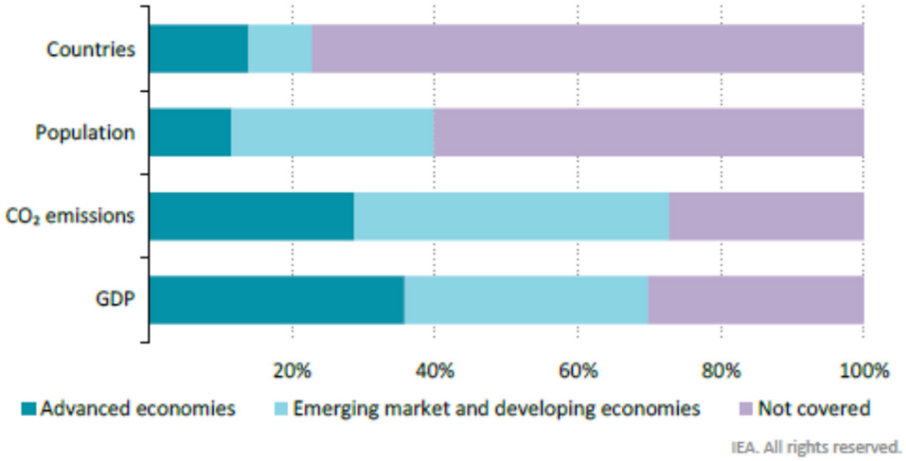
Source: Bloomberg

There has also been progress outside of Europe. While the U.S. currently lacks a comprehensive federal policy, many states have instituted policies of their own. California has been a leader in the adoption of polices to reduce carbon emissions. Similar to Germany, it targets carbon neutrality by 2045 including zero carbon retail electricity sales. Colorado, Arizona, Connecticut, Hawaii, New Jersey, Maine, New Mexico and Oregon are just some of the states that have also passed or proposed legislation with zero carbon emissions targets. Although more comprehensive federal policies have been proposed, bipartisan support has proved evasive. Instead, tax credits for wind and solar coupled with consumer subsidies have been the primary mechanism for encouraging renewable energy adoption in the U.S. The Biden administration, through executive order, has also indirectly supported renewable energy by ceasing to issue new leases for fossil fuel production on federal lands.

China currently produces approximately one quarter of world's greenhouse gas emissions. Rapid industrialization coupled with its Belt & Road Initiative, which still finances coal fired power plants outside of China, runs counter to many of the green policies being adopted elsewhere. However, China has adopted the Paris agreement (2015) and has also pledged carbon neutrality by 2060. Other pledges include having renewable energy sources account for one quarter of total energy consumption by 2030 (15% in 2019 vs. 7% in 2009), reach peak CO_2 emissions by 2030 and reduce carbon intensity by 65% by 2030. China has also launched its first national emissions trading scheme.

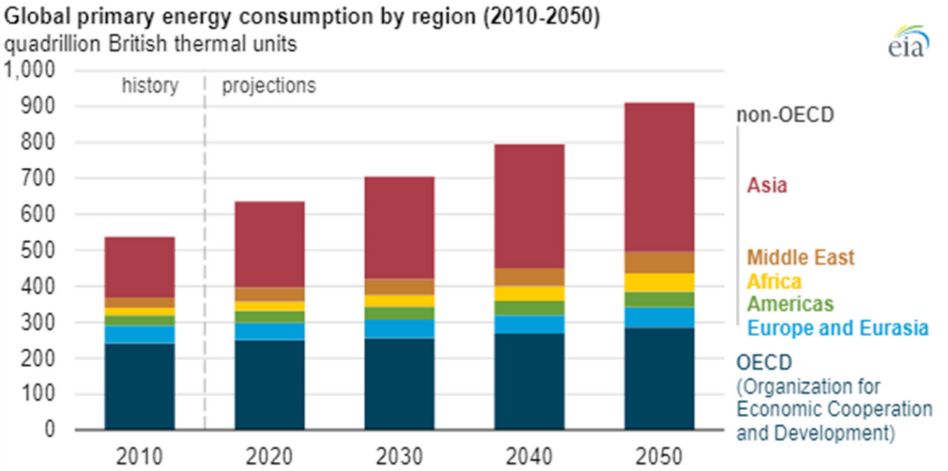
India targets a fivefold expansion in renewable capacity to 450GW by 2030 to meet its decarbonization targets. New regulations have also made it easier for companies to switch entirely to renewable power. Companies will now be able to purchase renewable electricity directly from state distributors at "green tariffs" which is viewed as a key step towards decarbonization. While the U.S., China and India represent the largest opportunity for global decarbonization (these three countries represent 45% of total HGH emissions), lots of smaller countries have also come out with very aggressive green policies. Norway (not an E.U. member) aims for all new cars to have zero emissions by 2025. Meanwhile, Chile, New Zealand and South Korea are also just a few countries which have launched a carbon tax scheme.

Coverage Of Announced National Net Zero Pledges



Changing Consumption Patterns To Drive Electricity Demand Growth

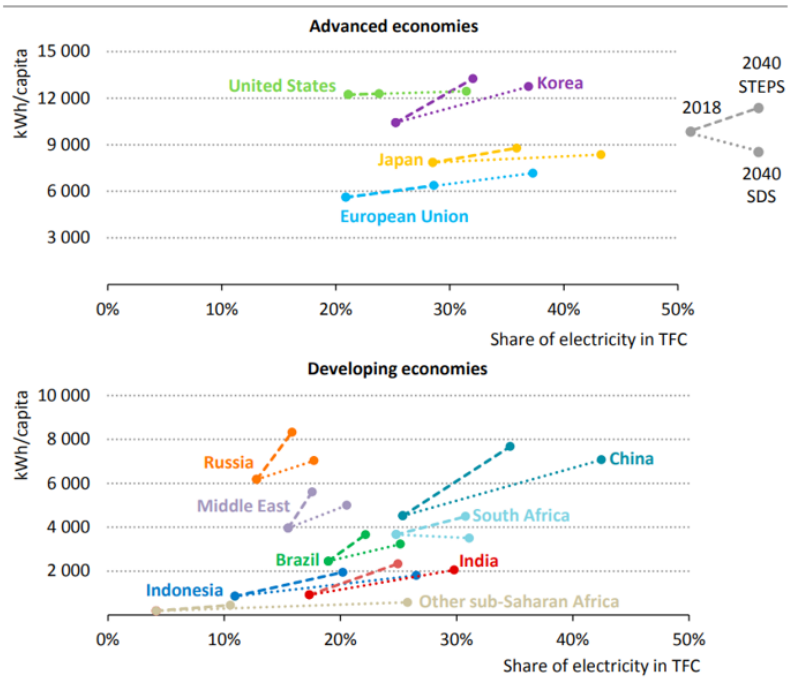
Lastly, changing power consumption trends will drive electricity demand growth – which will be met by renewable energy. According to the Energy Information Agency (EIA), global energy consumption is expected to increase roughly 50% by 2050 (2018 base year). This will primarily be supported by non-OECD demand (see chart above), driven by a combination of population growth and rising standards of living. For example, India accounts for 18% of the world's population but only uses 6% of the world's primary energy. To put that in perspective, India's per capital energy consumption is one third of the global average. China has 400 million middle income generators (NBS categorizes as $15.2k) as of 2020 and, according to a McKinsey study, could reach 550 million within the next few years.



Source: Energy Information Administration

Today, electricity only accounts for 20% of final energy consumption compared to oil and natural gas which combined represent close to 60%. But electricity represents the greatest growth dynamic within the global energy consumption stack. Similar to total energy consumption, developing economies will be the primary drivers of electricity consumption growth. As the chart below illustrates, under different scenarios, China, Russia and the Middle East are expected to experience the largest positive change in per capita electricity consumption through 2040. This compares to relatively flat consumption growth in the U.S., E.U. and Japan.

Per Capita Electricity Demand And Share Of Electricity In Total Final Consumption
In Advanced And Developing Economies



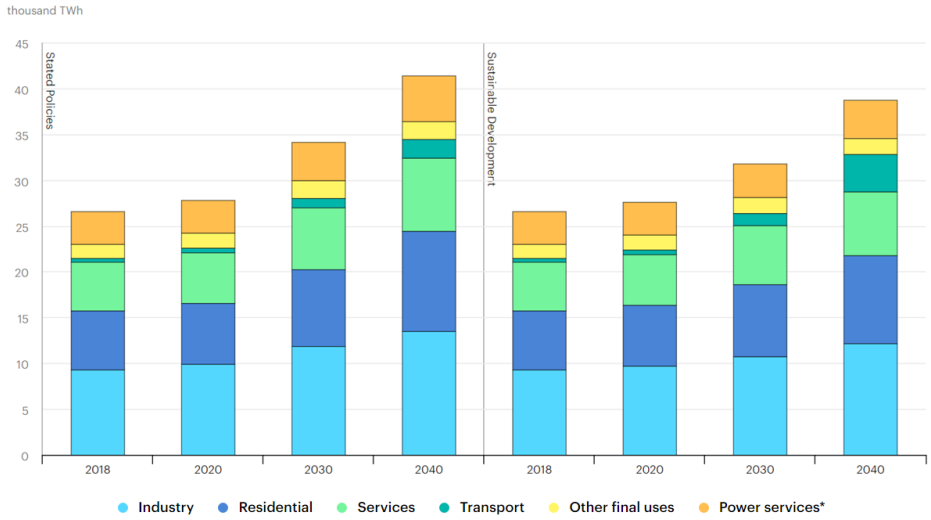
All regions see higher electrification in the Sustainable Development Scenario, while levels of demand relative to the Stated Policies Scenario vary according to regional contexts

Notes: TFC = total final consumption; kWh = kilowatt-hour; STEPS = Stated Policies Scenario; SDS = Sustainable Development Scenario. Other sub-Saharan Africa excludes South Africa.

Source: International Energy Agency (IEA)

Mass adoption of digital devices (such as smart phones and computers) is already helping to drive electricity usage growth. This trend is unlikely to slow anytime soon as cars, homes and offices, with increasing frequency, bypass hydrocarbon-based fuels – which further propels electricity use. A Princeton University study suggests that electrifying all transport and buildings could double the amount of electricity used by 2050. According to another study by McKinsey, this will drive electricity's share of energy consumption from 19% today to 30% by 2050. Under a two-scenario forecast by IEA, global electricity usage is expected to grow by approximately 50% (bull case) and 40% (bear case) by 2040 as illustrated by the chart below.

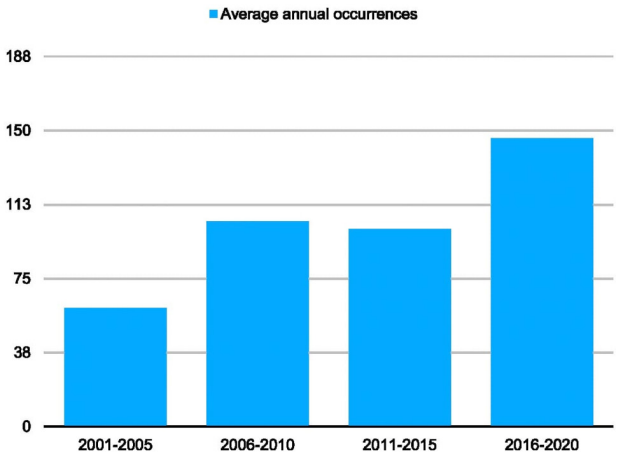
Global Electicity End-Use Forecast Bull And Bear Case



Source: International Energy Agency (IEA)

It is important to note that the higher electricity demand will not come without costs. As the digital economy continues to grow, it will require increasingly reliable electricity. In the U.S., most of the electricity grid was built during the 1950-1960s with a 50-year life expectancy. However, we are now beginning to reach capacity limits. The number of electricity outages in the U.S. alone have doubled over the last 10 years due to increasing electrification based on EIA data (2018) (Chart below). In order to handle growth in electricity demand through the electrification of everything, grid capacity will need to be increased and grid resiliency improved. Moreover, if the growth in electricity demand is met by renewable power, in order to combat intermittency issues additional investments in storage will be required – most likely enough to handle 24 hours of demand.

Major Disturbences And Unusual Occurrences On USA Electric Grids



Source: Energy Information Administration (EIA)

However, the transition to renewables will prove to be a game changer in not only how we think about and use energy, but also from a capital allocation standpoint. According to the IEA, in order to achieve global carbon neutrality by 2050, annual energy investments will need to more than double to $5 trillion by 2030. The largest component of this spending will be in energy infrastructure. This includes the assets that generate large scale renewable electricity and the power lines and equipment that facilitate electricity transportation to end users. Electricity generation will require the largest investment, more than tripling to $1.6 billion annually. Meanwhile, electricity transmission and distribution grid expansion and modernization will also require a large increase in investment to over $800 billion (from $260 billion) annually by 2030.

The Stage Is Set For A Renewable Energy Super Cycle

Power producers are responding to environmentally mindful customers and business which are increasingly demanding their power come from renewable sources. Thanks to the technological progress achieved over the past decade, renewable power is often the cheapest source. Meanwhile, governments are facilitating this transition to renewables through combinations of subsidies, favorable tax treatment and policy. Combined with a favorable long-term electricity demand outlook, renewable power appears to be at the dawn of a super-cycle – one that will last decades.