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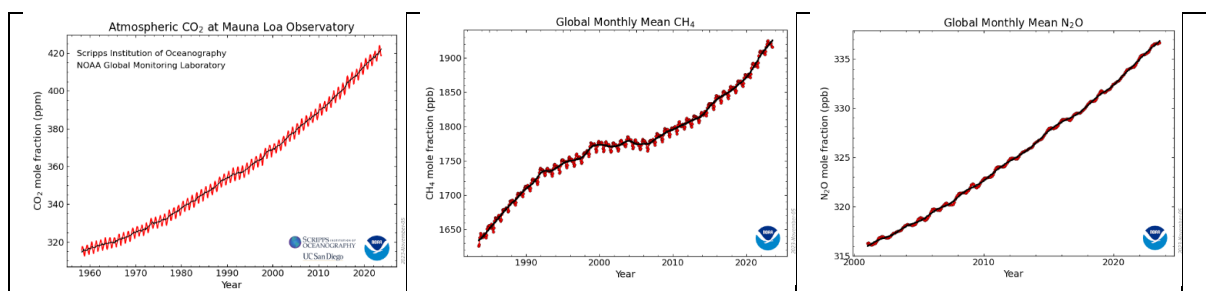
1. Some environmental statistics

Source: Articles in Reuters Sustainable Switch in November 2023

- The concentration of greenhouse gases in the atmosphere reached a record high in 2022. They were a full 50% above the pre-industrial level for the first time according to the World Meteorological Organisation (WMO).
- According to the UN Environment Programme the world is currently producing about 400 million tonnes of plastic waste every year, with less than 10% of it being recycled.
- More than one third of the food produced in the United States is wasted. Methane emissions from land-filled food waste are growing and totalled more than 55 million tonnes of CO₂ equivalent in 2020 according to the Environmental Protection Agency (EPA).

Global CO₂ (from 1959), CH₄ (from 1984) and N₂O (from 2001)

Source: NOAA website, 21 November 2023



2. Global warming rate

The abstract to a report by James E Hansen and others published on 2 November 2023 in Oxford Open Climate Change (Volume 3, Issue 1, 2023, kgad008) entitled ‘Global warming in the pipeline’ states that.....”decline of aerosol emissions since 2010 should increase the 1970-2010 global warming rate of 0.18°C per decade to a post-2010 rate of at least 0.27°C per decade. Thus, under the present geopolitical approach to GHG emissions, global warming will exceed 1.5°C in the 2020s and 2.0°C before 2050.”

3. China and India struggle to curb fossil fuels

From an article by John Kemp, Reuters, October 20 2023

China and India are burning record amounts of fossil fuels this year, even as they also install record renewable power generation capacity, highlighting the slow pace and enormous inertia to be overcome in the energy transition.

Both countries are experiencing rapid growth in energy use for services such as air conditioning, heating, cooking, lighting, power and transport as they try to raise living standards closer to those in the advanced economies.

Growing demand for energy services is so vast fossil fuels and renewable energy sources are acting as complements rather than substitutes, ensuring consumption from both is increasing simultaneously.

In effect, both countries are pursuing an “all of the above” approach to economic development and energy security, similar to the one advocated by then-U.S. President Barack Obama in his state-of-the-union address in 2014.

3.1 GROWING ENERGY DEMAND

In every historical case, the transition from a pre-modern agricultural economy to a modern urban and industrial one has been accompanied by a huge increase in the consumption of energy. Increased consumption provides more labour saving, higher wages, more comfort, more entertainment and more opportunity for travel to visit family and see the world.

If they follow the usual pattern, both China and India are likely to consume a lot more energy services in the next few decades as their populations aspire to reach the same living standards as North America and Europe.

In 2022, the populations of China (1.43 billion) and India (1.42 billion) were each similar to the total for countries in the Organisation for Economic Cooperation and Development (OECD) (1.38 billion). But total primary energy consumption in China (159 exajoules) and India (36 exajoules) was far lower than in the OECD (234 exajoules).

Each person in China consumed only 66% of the energy as their counterparts in the OECD and in India the figure was just 15%. Even that overstates the consumption of energy services locally since both countries and especially China export a high proportion of their energy-intensive manufactured output to the OECD.

Continued modernisation means both countries will use a lot more energy – making an “all of the above” strategy imperative for policymakers.

3.2 THE NEED FOR ALL SOURCES

In the OECD, total energy consumption has been essentially flat since 2007, so growing production from renewables and especially gas has displaced coal and to a lesser extent oil. Renewables (and gas) have been substitutes for fossil fuels such as coal and oil enabling a significant reduction in greenhouse emissions.

But total energy consumption has continued to grow rapidly in China (by an average of 3.1% per year in the last decade) and India (3.8% per year). Renewables (and gas) have served as complements to other fossil fuels – ensuring energy remains affordable and reliable even as consumption increases significantly.

China and India’s current trajectory for energy consumption looks a lot like the United States or Western Europe between the 1950s and 1970s, a period of rapid growth in economic output, living standards and energy use.

3.3 EMISSIONS PEAK BUT NOT SOON

Eventually, China and India’s energy consumption will start to grow more slowly, at which point renewables will substitute for fossil fuels rather than just complement them. But given their current position in the historical development process, that point is likely to be some years in the future for China and possibly decades in India.

Since 2018, China’s solar generation capacity has increased at 26% per year, wind generation capacity by 18% per year, while thermal capacity has grown by just 4% per year. India’s solar generation capacity has grown by 25% per year, wind has grown by 5% per year, while coal has risen by just 1% a year. Even so, in 2022, fossil fuels accounted for 82% of primary energy consumption in China and 88% in India, including 70% of total electricity generation in China and 77% in India.

Behind both China and India in the development process, sub-Saharan Africa’s population had increased to 1.20 billion in 2022 and is forecast to rise to 2.17 billion by 2050 and 3.57 billion by 2100. The region’s urbanisation, industrialisation and energy consumption per person is even lower than China and India with commensurately greater potential to increase in future.

Policymakers from OECD countries use the U.N. conference process and other diplomatic forums to press China and India to speed up their transition from fossil fuels to zero-emission alternatives. But such advice can sound at best impractical and at worst an effort to force them to accept structurally lower living standards.

In practice, governments in China and India have prioritised increasing access to energy services and ensuring energy remains affordable and reliable. In that, too, they are following the historical and current example of the OECD nations.

4. Renewable hydrogen takes flight with octocopter

From an article in Energy Source & Distribution, November 8, 2023



Australian aerospace startup AMSL Aero (AMSL) is looking to take hydrogen flight to the skies with the support of the Australian Renewable Energy Agency (ARENA). ARENA has awarded \$5.43 million for AMSL, as part of the Advancing Renewables Program, to develop a hydrogen powered electric Vertical Take-Off and Landing aircraft (eVTOL) named the Vertiiia.

Similar in operation to a helicopter and fitted with eight rotors, the Vertiiia will be capable of carrying up to five passengers over distances up to 1000km. The \$10.86 million project follows AMSL's successful development of a prototype battery electric version of the Vertiiia aircraft.

The \$5.43 million ARENA grant will support AMSL to undertake development and certification activities for the aircraft, culminating in successful demonstration with a test flight of the prototype. If successful, the aircraft will be one of the lowest cost and cleanest forms of air transport for ranges up to 1,000km.

Based at Sydney's Bankstown Airport, AMSL Aero was founded in 2017 to develop and manufacture zero emissions aircraft. AMSL intends for Vertiiia to be available for markets such as air ambulance, emergency services, and passenger and cargo transport. Due to its configuration, the aircraft offers new and innovative ways for emergency services to deal with specialised situations, including fighting bushfires.

The aviation sector is responsible for roughly 2.5% of global greenhouse gas emissions, with nearly a fifth coming from short haul flights under 1,000km.

5. Space-based solar power

From an article by Steve Way, Fraser Nash Consultancy, Energy Source & Distribution magazine, Sep/Oct 2023

Space-based solar captures solar energy in space using large satellites and beams it to the ground. It provides low carbon renewable energy that supports the baseload needs of the grid and can be 'dispatched' as needed.

A simple conceptual model consists of a fully autonomous satellite operating in a geostationary orbit constantly directed at a point on the ground. Solar energy captured by the satellite provides constant power almost continuously.

The satellite's solar panels provide power to electronics that turn electrical energy into a microwave beam that can penetrate clouds, fog and the atmosphere. The microwaves are captured at a ground station called a 'rectenna' and converted to electricity for export to the grid.

Very large equipment is needed to provide grid level power output of gigawatts. The satellites need to be kilometres in scale. To spread the beam to a safe intensity, the ground-based rectenna must be around 5km in diameter.

While requiring significant initial capital costs, the high power output and constant energy availability means it competes favourably for energy cost against fossil-fuelled generation in international estimations, using a metric called value adjusted levelized cost of energy (VALCOE). This metric of competitiveness was introduced by the International Energy Agency (IEA) in 2018 as it captures the cost per unit of energy as well as its availability.

A lot of challenging technology developments are still needed. To test, prove and refine the concept to first power production could take 20 years.

6. New Scottish blade a 'step change' for tidal energy

From Energy Source & Distribution news, October 26, 2023

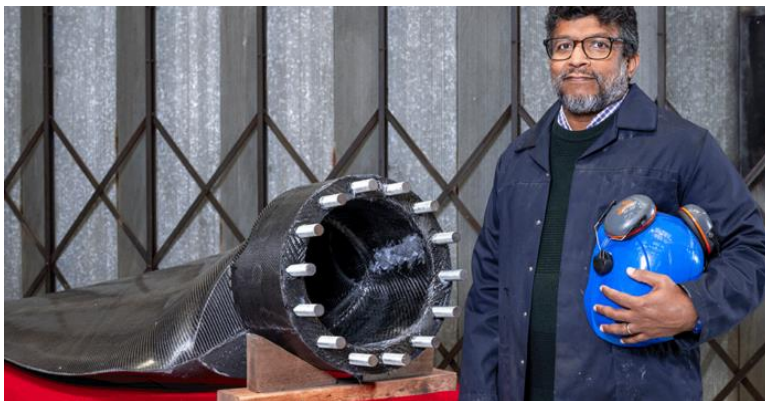


Image: Fastblade

A state-of-the-art tidal turbine blade has been manufactured in Scotland for the first time and more cheaply than before, which, engineers say, could reduce the levelised cost of tidal energy. The design engineers, from the University of Edinburgh, say the new structure reduces the amount of materials necessary—bringing down the weight, volume and, crucially, the cost of manufacturing the blade.

The team is based at FastBlade—the world's first rapid testing facility for tidal turbine blades—at Rosyth in Fife, Scotland. FastBlade leader Dr Eddie McCarthy, from the University of Edinburgh's School of Engineering, said, "This project represents a major step change in our group's capacity to manufacture tidal blades at reasonable size scale (around three metres long) at a reasonable speed.

“We have found a faster, cheaper route to manufacture than the usual tidal blade fabrication process, based on an altered design. We hope the combination of improved design and optimised manufacturing process will contribute to reducing the levelised cost of energy (LCOE) of tidal stream energy, with the long-term goal of matching LCOE of offshore wind.”

Currently the UK contract price for tidal stream energy is around £178/MWh, compared to £65 for offshore wind, and the high generation cost is a barrier to the development of tidal energy—potentially the missing piece of a year-round, renewable energy grid.

Lead design engineer Professor Dilum Fernando said, “This is the first time this type of structure has been used in blade manufacturing. Its monolithic structure eliminates the weaker adhesive joints found in conventional rotor blades, which will make it more resilient to tidal stream conditions.”

7. Power grids investment needed

Source: Reuters Power Up

The International Energy Agency recently released a report warning that a lack of investment in the world’s electric power grids is emerging as a key bottleneck in the race for net zero. New solar and wind farms are coming on stream at a faster pace than can be channelled by existing infrastructure, leading to lengthening queues to connect new energy projects to national power networks.

The Biden administration has announced \$3.5 billion in grants for upgrading the aging U.S. power grid to handle the demands of a green energy transition. It is the first round of selections under the Department of Energy’s \$10.5 billion grid resilience and innovation partnerships program.

8. World’s tallest wooden tower to be built in Australia

From an article by Tara Subramaniam, CNN, Wed October 4, 2023

Western Australia may soon be home to the world’s tallest wooden building, after authorities in Perth green-lit plans for a 191.2-meter-tall (627-foot) “hybrid” tower constructed using mass timber.

On Thursday, Perth’s Metro Inner-South Joint Development Assessment Panel (JDAP) approved Grange Development’s proposal for the skyscraper, currently dubbed the C6 building, which would stand nearly twice as high as the current record holder.

The developers say 42% of the proposed tower will be constructed from timber, with the columns and core made of reinforced concrete.

If completed, the high-rise will surpass the world’s tallest timber-concrete hybrid building, the Ascent tower in Milwaukee, Wisconsin, which stands at 25

stories or 86 meters (284 feet), according to the Council on Tall Buildings and Urban Habitat. The proposed structure, located on Charles Street in South Perth, will also be taller than the forthcoming hybrid timber Atlassian Headquarters in Sydney, which is poised to claim the record from Ascent but is yet to be completed.

Like Atlassian, the proposed C6 tower will combine laminated timber beams with a steel exoskeleton to support the structure. The tower will use 7,400 cubic meters of timber harvested from 600 trees, according to Grange.

Grange's plan also includes green features such as a rooftop garden, an urban farm and resident access to 80 new fully-electric Tesla Model 3s.

Ross Rutherford

ESR Editor

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