Determining project viability with AI: a case study

For investors and developers, the million-dollar question is whether a prospective project will be financially viable. By using AI, that question is now easier and quicker to answer than ever before.

Investors and developers have long been hamstrung by the opacity surrounding energy data. There is no shortage of open-access data on grids and power-generation assets in the public domain, but developers need validated data to identify technical and financial risks for a prospective project to be profitable.

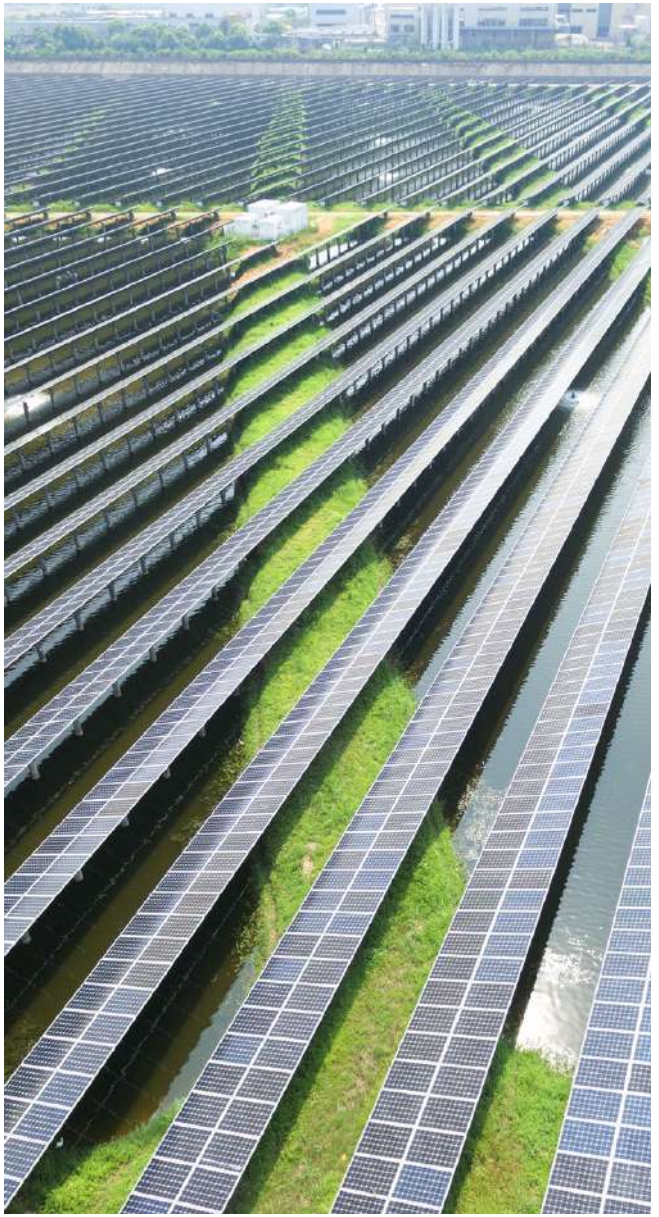
This is where image recognition — a rudimentary form of AI — can play a huge role in validating open-access data. ENIAN, a UK software firm, boasts one of the world's largest renewable energy project databases, having gathered publicly available data on power plants and grid assets, and their coordinates. The company uses a matching script to run across the data sets, and the AI is trained to recognize what a wind turbine looks like. The AI takes millions of sets of wind-turbine coordinates, and identifies which images and coordinates match up.

AI can then be used in cost prediction, with an enterprise platform simplifying project managers' workflow. With trustworthy data retrieved from image recognition, the platform provides datasets detailing assets' grid connections, distance to nearest substation, existing power-generation assets in the area, and indicators on the performance of assets.

Investors and developers have long been hamstrung by the opacity surrounding energy data. There is no shortage of open-access data on grids and power-generation assets in the public domain, but developers need the ground truths to identify technical and financial risks for a prospective project to be profitable.

Projects are augmented by AI and managers can examine qualitative details such as how many competitors are in the area and if other projects in the area have failed — and, if so, why. The data also reveals solar irradiance and wind speeds for potential sites, as well as an optimal route-selection estimate for connecting a power-generating asset to the grid, so project managers can make quick and accurate models of what a solar or wind farm can yield. An algorithm then produces a preliminary cash-flow model that indicates whether a project is worth pursuing further.

These tools could open up frontier markets — such as Central Asia, for instance, where there is tremendous potential for wind and solar farms — but development has lagged behind. "Very little is known about the grid networks of these countries, and the data you may find is outdated and fragmented. This tool allows us to run a scan and see what is there, and work backward after identifying the site," says Phillip Bruner, ENIAN CEO.



"There is so much opacity around where, actually, the nearest points of interconnection are, a project's available capacity, and who the owner is, so having this data without having to rely on third parties is very useful."

For developers, the name of the game is operational excellence, and automation through AI can allow firms to get a leg up on the competition by identifying profitable prospective projects quicker. The ability to rapidly scale data collection and analysis through automation also frees up time for project managers to focus on getting deals sealed faster, projects started earlier and timelines moved forward.

By augmenting project managers with verified data, projects become more predictable, efficient and cost-effective, and, ultimately, lead to better returns on investment.

While AI has been criticized for its impact on the labor market, focus should be shifted to its ability to free up skilled labor from linear tasks. As Bruner puts it: "AI is coming for the tasks you hate to do, such as spending lots of time processing data and validating data. The machine can step in and do those mundane tasks, so it augments everyone's capabilities."

Increasing research and development to bolster AI's capabilities

AI and its sidekicks of emerging technologies, including IoT, sensors, big data and distributed ledger technology, are game-changers for the renewable energy sector. Key accelerators such as prediction capability through demand forecasting and asset management, combined with increased automation providing operational excellence, are already leading to major cost-savings, better yields and improved returns on investment.

Just as R&D in the solar industry has driven down prices, further R&D in AI has the potential to lower costs drastically, while its capabilities should grow and solutions to its limitations could emerge. Governments are realizing this, too, with the US Department of Energy announcing in August 2020 US$37m of R&D funding for AI. The UK is also funding several new research hubs that will be created to develop robotic technology to improve safety in offshore wind.

"We are now at the point where the most sophisticated market participants are turning proofs of concept into real, scalable applications of the technology," says Howard, from Origami, adding that he expects these applications to de-risk the area for others.

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>
> **Alex Howard, Head of Strategy at Origami**

"If we are going to reach a net-zero future, the grid needs to be a lot smarter," says Bruner, from ENIAN. "It needs to be able to adapt to a lot of different power-generating and power-consuming devices that are interconnected, and that is where AI has the most potential to help renewable energy grow."

For a net-zero future, AI could be the missing piece of the flexibility jigsaw. Its ability to ensure an efficient and stable grid will be paramount as an increasing amount of renewable energy floods into the grid.

How Australia's vast resources could make it a green energy superpower

Developers and investors are tapping the country's sunshine, land and strong winds to drive a renewables revolution, despite policy issues.

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For Australia's renewable energy sector, there is a renewed sense of optimism. Last year, Australia was deploying new renewables 10 times faster per capita than the global average, and four times faster per capita than in Europe, China, Japan or the US. Another sign of Australia's ambition to lead the renewables revolution is the more than 10GW of roof-mounted solar photovoltaic (PV) deployed, by far the largest per capita rooftop-PV deployment in the world.

Recently, though, the pace has slowed. The COVID-19 pandemic has caused the biggest fall in global energy investment in history, and the Australian sector was not spared, falling off a cliff in the second quarter. Only AU$600m (US$429m) was invested in large-scale renewable projects, a drop of almost half from the first quarter, with uncertainty over federal policy and delays in grid connection also to blame.

With Australia reaching its Renewable Energy Target of 33,000GWh by 2020, a year early, incentives are lessening, with new solar and wind farms no longer as reliant as they were on subsidy support. However, a rapidly maturing corporate power purchase agreement (PPA) market is leading a shift in direction and there are predictions aplenty that corporate PPAs will drive investment in renewables throughout Australia over the long term.

Meanwhile, in its Integrated System Plan, grid operator Australian Energy Market Operator (AEMO) forecasts that renewable energy may, at times, provide nearly 90% of electricity by 2035. Growth in utility-scale pumped hydro, large-scale battery energy storage systems, distributed batteries, and virtual power plants will all provide increased dispatchable resources.

With Australia reaching its Renewable Energy Target of 33,000GWh a year early, fewer incentives are required. However, a rapidly maturing corporate PPA market is leading a shift in direction and there are predictions aplenty that corporate PPAs will drive investment in renewables over the long term.

AEMO's optimal development path for the National Electricity Market (NEM) also suggests solar panels, backed by small batteries, could provide between 13% and 22% of electricity by 2040. In addition, electricity from new large solar and wind farms is expected to replace some 15GW of coal-fired generation that is scheduled to shut.

Clearly, there are high hopes for renewables in Australia, as their use continues to accelerate at a rapid pace. However, currently, renewables still represent a small portion of the nation's energy mix, with fossil fuels accounting for 79% of total energy generation last year.

At the policy level, the opportunity to build back better in the wake of the COVID-19 crisis could provide a watershed moment for the renewables sector. An EY assessment commissioned by the World Wide Fund for Nature suggests stimulus programs backing clean energy as a path out of recession would create nearly three times as many jobs for every dollar spent on fossil fuel developments.

However, the Australian Government continues to champion a recovery built on gas, offering AU$52.9m (US$37.2m) in funding to unlock more gas specifically for the domestic market. The Government announced it will continue to fund the Australian Renewable Energy Agency with AU$1.43b (US$1.18b) over the next decade, but it has overhauled its mandate, shifting investment in solar and wind to hydrogen, carbon capture and storage, microgrids and energy efficiency.

Betting big on battery storage

Grid problems have been causing delays to the Australian renewable energy development pipeline. Project sponsors, regulators and grid operators are starting to realize the importance of the role energy storage needs to play to allow the smooth penetration of intermittent clean electricity. Increased procurement of battery storage projects and the ancillary services they can provide, government funding, and regulatory signals to favor co-location of batteries with generation are some of the top drivers for the country's promising energy storage market.

This year, Australia is set to add 1.2GW of energy storage, more than double last year's total, according to Wood Mackenzie, as developers look to maximize returns from their wind and solar projects.

Power prices look set to drop with the country's trailblazing battery storage expansion. French developer Neoen's Tesla-built Hornsdale Power Reserve – a 150MW/194MWh grid-connected energy storage system, co-located with the Hornsdale Wind Farm – held the title of the largest lithium-ion battery in the world until earlier this year.

In September, the Government of the Australian Capital Territory announced that Neoen and Global Power Generation will supply 200MW of wind power to the national capital at record low prices, with the firms also building 50MW and 10MW/20MWh big batteries respectively. For Neoen, it is the first stage of the AU$3b (US$2.1b) Goyder project that proposes to combine 1.2GW of wind, 600MW of solar and 900MW/1,800MWh of battery storage. Each component will be the biggest of its kind in Australia and, together, the hub will be the largest of its kind in the world.

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Although surpassed this year by front-of-the-meter, behind-the-meter capacity is expected to grow by an impressive 581MWh. Policy support has been provided, with state Government schemes in South Australia and Victoria offering generous subsidies to help households install batteries to reduce their energy costs, in response to record-high retail prices last year. As a result, comparatively low feed-in rates for exported PV energy and market-competitive energy storage costs have pushed Australia's household storage capacity above 1GWh.

Amid these favorable conditions, the costs of energy storage systems are expected to decline by 27% over the next five years. By 2025, the levelized cost of electricity of solar-plus-storage and solar-and-wind-plus-storage are expected to be lower than that of gas plants, which should mark a tipping point for Australia's renewables sector.

Targeting pole position in the export market

Australia has long been a net exporter of energy, with predominantly coal and gas equalling to around two-thirds of production. As the country's energy sector transitions to a low-carbon future, however, it seeks to also transform its exports and become a renewable energy export superpower.

At a policy level, a major statement of intent was made in July, when the Government announced it will fast-track an ambitious US$16b 10GW/30GWh solar/battery project that will send 24-hour renewable electricity to Singapore via a 4,500km cable. Granted "major project status" by the Government, developer Sun Cable's Australia-ASEAN Power Link is to be built by the end of 2027.

Although yet to win support from Singapore's Government, the project would consist of the world's largest solar array, biggest battery and longest power cable, providing 3GW of dispatchable electricity. About 3,700km of the high-voltage, direct-current cable would be under the sea and would connect Australia to the planned 16-nation ASEAN power grid, while also supplying power domestically to Darwin. Ambitious expansion plans could result in connections being established from India to New Zealand.

Meanwhile, another mega-project — the 15GW Asian Renewable Energy Hub, backed by Macquarie Bank and energy groups Vestas, CWP Energy and InterContinental Energy — is equally ambitious. With a US$20b price tag, it will be the world's largest wind-solar hybrid project, with the vast amounts of renewable energy generated used to produce green hydrogen and ammonia for export to Asian

markets. The hub also plans to sell about 3GW to iron-ore mines and liquefied natural gas facilities in Western Australia. Construction will not start until 2026, with the first exports expected one or two years later.

Policymakers have already pledged their support, with the Government agreeing to co-fund an AU$500m (US$352m) pilot project in Victoria to generate "blue" hydrogen from coal and store the emissions produced in an undersea basin. The Council of Australian Governments (COAG) Energy Council has estimated the potential value of the nation's hydrogen export industry could reach AU$26b (US$18b) by 2050, transforming the nation into a major force in renewable energy.

The two mega-projects would elevate Australia to a renewable energy export superpower, but it must still be proven to investors that the projects are profitable and there is the know-how to conquer the complex technical challenges posed.

Price volatility and grid stability cloud the picture

While developers and investors are driving renewed growth, and ambitious export plans lie in the pipeline, the sector is facing headwinds on grid stability and price volatility. Renewables projects have been held back by grid bottlenecks and have faced the risk of radical curtailment because of insufficient network capacity and system strength.

Policymakers have fast-tracked Project EnergyConnect, which will play a key role in improving grid stability and reducing energy price volatility. The 330kV above-ground transmission line, with approximately 800MW transfer capacity, will connect South Australia and New South Wales, with an added connection to north-west Victoria, and should be completed by 2023. In parallel, the New South Wales Government is creating three Renewable Energy Zones, involving the development of new grid infrastructure in energy-rich areas.

The construction of pumped hydro project Snowy 2.0 will provide an additional 2GW of dispatchable, on-demand generating capacity and approximately 350GWh of large-scale storage to the NEM, to alleviate some of the grid constraints in southern New South Wales.

Meanwhile, electricity retailers have tried out new tools to manage price volatility. AGL Energy has started a number of virtual power plant trials that will allow customers to harness the power of their solar battery systems in return for credits. Almost 25% of standalone homes – around 1.7 million in total – have solar systems installed, and AEMO estimates an additional 150,000 will be installed by 2025. Clearly, this signals a shift in mindset in consumers and approaches to managing price volatility.

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With a half dozen coal plants exiting the system over the next 15 years, and the only material replacement, other than Snowy 2.0, being significant volumes of non-synchronous generation, price volatility could be a major long-term issue. In response, the Government announced in mid-September that it is prepared to construct a new gas-fired power station if the Liddell coal-fired power station is not replaced.

The move is built on fears of a price spike akin to the rise in wholesale prices, by 85%, after the closure of the Hazelwood coal-fired power station. The Government will also set a dispatchable capacity investment target of 1GW in New South Wales, to come online by the end of 2023.

In a reflection of the broad uncertainty surrounding policy in Australia's renewables sector, the COAG Energy Council has tasked the Energy Security Board (ESB) with developing advice on a long-term, fit-for-purpose market framework that could apply from the mid-2020s. In the near term, more change could be on the horizon, with the ESB required to recommend any changes to the existing market design, or an alternative market design, by the end of the year.

Despite this policy uncertainty, the future should shine bright for Australia's renewables sector. Developers have launched a renewables revolution, leading the global shift to a low-carbon transition. The closure of thermal plant, combined with the falling cost of renewables and batteries, provides a tremendous opportunity for continued impressive growth. If the industry can weather the storm caused by policy uncertainty, it will be supercharged for success.

How Ireland is securing a sustainable energy future

Clear targets and governance are helping the country's coalition Government lay the foundations for the long-term growth of renewables.

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New policy has underlined the growing importance of renewable energy development in Ireland, boosting confidence in its sustainability and enabling investment across a more diverse range of technologies.

The publication, in early October, of the Climate Action and Low Carbon Development (Amendment) Bill 2020 set out a new path to meet Ireland's 2050 net-zero emissions targets via a set of five-year economy-wide carbon budgets. The bill is indicative of Ireland's recent efforts to create a clear and reliable framework for decarbonization that provides strong signals for investment in renewables.

The 2019 Climate Action Plan kicked off this new era. It specifically addressed the need for public- and private-sector support to develop Ireland's renewable electricity market. Restating Ireland's pledge that 70% of its electricity will come from renewable sources by 2030, the plan aligned a state-led auction scheme — the Renewable Electricity Support Scheme (RESS) — with a target for 15% of Ireland's renewable electricity demand to come from corporate power purchase agreements (PPAs) by 2030. It also highlighted the need to address planning, consenting and grid-connection issues for offshore wind development.

The Coalition's Programme for Government (PfG), ratified by the Fianna Fáil, Fine Gael and The Green Party Coalition in June 2020, supports the 2019 plan. It stated the intent to reach net-zero emissions by 2050 and upped the offshore wind development target from 3.5 gigawatts to 5GW by the end of the decade.

For RESS specifically, the Coalition promised annual RESS auctions in its PfG, and it held the first in July 2020. Further, it awarded €3m (US$3.5m) in capital funding to support the creation of community projects under RESS in its most recent budget. The introduction of this scheme has provided the detail and stability needed to generate interest and create confidence in a more diverse renewables sector in Ireland.

Such policies will be vital to transforming Ireland's poor performance in reducing its carbon emissions to date. In 2018 — the latest year for which figures are available — Ireland's renewable energy share was 11%, versus the 16% target set for the country's gross final consumption of energy under the EU's Renewable Energy Directive. Ireland's Environmental Protection Agency has also forecast that the country will achieve only a 2%-4% reduction on 2005 (base year) emission levels in 2020, considerably lower than its 20% target.

In addition, while the new RESS should boost diversity in terms of technology, Ireland's renewables sector has traditionally been dominated by onshore wind. Total wind capacity installed increased by 69% between 2015 and 2019, showing growing interest in the sector, but RESS should now encourage much more diversification in terms of technologies.

The first RESS auction in July 2020 has generally been seen as a success, particularly in terms of diversification. However, key sectoral issues must be addressed to ensure that the confidence in RESS continues to build.

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Auction results

The first RESS auction contracted 1,275.5 megawatts of capacity from 19 wind farms and 63 solar projects. The latter was particularly welcome news for solar after more than a decade in which onshore wind has dominated. More generally, this strengthens the investment environment for renewables by supporting diversity in terms of the technologies available in the market.

However, the prevalence of smaller projects, particularly within solar — which range in size from 0.5MW to 119MW, with around half at 4MW — could lead to funding issues for this first set of RESS auction winners.

After the formal notice of award for RESS on 25 September 2020, projects had 30 working days to enter an Implementation Agreement, post a €25,000

(US$29,310) per MW performance bond, and commit to achieving commercial operations by the end of 2023 at the latest.

Smaller developers and projects can find such requirements onerous in the short term, as bank financing requires a detailed due diligence process that could take six to nine months. If banks concentrate financing on larger projects that generate higher fees, smaller developers may need to sell the asset or take on a partner, diluting their share of the project.

Corporate buy-in

Alongside the RESS auctions, the Government also hopes to drive the uptake of corporate PPAs to cover 15% of renewables demand by 2030. This will fill in the gaps around government auctions by providing an alternative demand source and revenue stability for developers, as well as portfolio diversification.

A lack of large corporates in Ireland makes the 15% target quite ambitious. This equates to about six terawatt-hours (TWh) of EirGrid's Tomorrow's Energy Scenarios forecast. The state-owned electric power transmission company predicts an overall electricity requirement for Ireland of approximately 41TWh by 2030. However, the expected proliferation of data centers around the country will help to meet this goal. Amazon has already signed three PPAs to power its Irish data centers, which should add 229MW of renewable energy to the grid. In August, Facebook signed its second long-term renewables contract in Ireland, for 28.8MW of wind power from a new project in County Tipperary, to support its business in the country.

Sectoral challenges

While successful RESS project developers will now be working towards finding finance, the Government must look much further ahead. Addressing key sectoral challenges, including grid capacity, planning and setting appropriate commercial rates, will be crucial now that it has a successful first auction under its belt.

Delays or issues around planning and rates can usually be factored into the development process, but insufficient grid capacity would stop this power from reaching the market and cause Ireland to miss its 2030 targets.

"Dispatch down" curtailment and constraint figures for wind averaged 11.5% during the first half of this year, according to EirGrid. The **Irish Wind Energy Association (IWEA)** has pointed out that this is enough to power Galway city for a year.

This issue could also jeopardize the Government's aim to develop offshore floating wind potential on the Atlantic Coast. While the Government believes there is potential to develop at least 30GW in this area, some of this would probably be for export and, therefore, potentially would not need to be factored into Ireland's future grid capacity. The PfG pledges to add offshore wind to the annual RESS auctions schedule from next year, aiming to develop 5GW by the end of the decade. However, it also addresses the need for investment in new technology and interconnectors.

A new marine planning framework and licensing regime, due to be adopted in late 2020 under the Marine Planning and Development Management Bill, aims to tackle planning and consent issues for offshore wind.

Change ahead

As the coalition attempts to create the necessary tailwinds to fully develop Ireland's renewables sector, the industry is now looking ahead to the second RESS auction next year. The first was undoubtedly a success, but the Government will still be expected to consider some changes, particularly with regards to indexation of bid prices.

Auction bids were made without indexation to any inflationary measure in the first RESS auction, pushing prices €10–€12 (US$12–$US14) higher, according to IWEA. It has called for a review to address this.

Although there is more to do, the coalition has signaled its intent to address sectoral issues in the renewables space by delivering bills to tackle offshore-wind planning and provide greater detail on pursuing net-zero targets well within its first year in government.

More generally, creating a detailed legislative framework to tackle climate change and a solid mechanism for renewables development with RESS has given a welcome boost to Irish renewable energy development. These elements will provide a solid foundation for Ireland to build a leading position in renewables.

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The energy industry is in transition, experiencing rapid, fundamental change due to a complex mix of forces, including decarbonization, digitization and geopolitical uncertainty.

Mining and metals, oil and gas, and power and utilities companies must accelerate their own transition to unlock the opportunities this presents, while still addressing short-term operational and commercial pressures. EY's Global Energy & Resources team brings a breadth of experience and talent to help companies adapt for now and be ready for whatever comes next. By considering four key pillars of change — structure and culture, customers, technology, and skills and capabilities — we can help you adapt for today and reap the opportunities of tomorrow. And together we can build a better working world.

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