

Renewables Review

Market Report

June 2023

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Executive Summary – A Korkia View On Renewable Energy

Approximately 3 years ago, Korkia made a strategic decision to make renewable energy development investment its core focus. In that short period of time, we have invested in 6 countries, with 9 local development teams. Our portfolio includes nearly 8GW of active projects including onshore wind, utility scale solar, storage and small-scale hydrogen.

With a team of 40 in-house energy enthusiasts and +30 local developer team members we are leveraging our international experience to help maximize the value of our investments and predict the next best thing to do in a fast-developing market environment. Our intent is to actively participate in the global green transition while making solid investment decisions. As shepherds of the capital we invest, we have created a robust, systematic approach to analyzing investment destinations. With a constant beat on the macro level movement of the renewable energy industry, we also assess country risk, local industry risk, development risk, and asset value risk.

One consistent signal we are seeing in all markets is grid challenges. This is not new information to anyone in renewable energy development, but the scale of the challenge has become clearer. Experts suggest that the global grid footprint will need to double in size to fully transition to a net zero world. To put that into perspective, that would be grid lines roughly the distance between the Earth and the Sun, coming with a price tag of \$21 trillion.

The reactions on the grid challenge seem to be very similar across different markets. As the renewable market outpaces expectations, regulators start introducing entry and stay barriers by making the quality and financial requirements of energy asset development more demanding. The aim is to limit speculative activity on the market and focus the scarce service operator resources on serious investment intentions. While the shift is often challenging, the result is generally good news for established and well-funded entities such as Korkia.

What tends to happen next is that the electricity generators start looking for balanced asset portfolios with complementary generation profiles. For example, wind and solar assets typically are not producing at the same time and thus are not competing over same the grid capacity and do not cannibalize each other in terms of market prices. All of this is then followed up by both the grid owners and generators pushing for energy storage solutions to solve grid congestion challenges, including all forms of storage such as hydrogen, thermal and kinetic storages.

For Korkia this is all good news. Being a development focused professional renewable energy investor, our ability and agility to respond to the changing demands is good. And not only to respond but be among those who are on top of the game. Our investment already covers solar, wind and energy storage. Instead of developing and selling individual assets, we are producing balanced generation and storage portfolios with sizable volumes – just as the market demands.



Mikko Kantero
EVP, New Markets & Origination

“

Energy markets across the globe are facing the biggest system changes since decades. Staying on top of the developments is both interesting and necessary. Thanks to our presence on six markets today and a dedicated Markets and Business Intelligence Team covering even more markets, we are doing just that.

Finland could provide 10% of the EUs energy needs

Finland has had a spring of records. In the past few months, we have experienced; NATO membership, a hydrogen resolution adopted by the government, our nuclear reactor Olkiluoto 3 went live and energy prices broke subzero prices.

It is safe to say that renewable energy is booming in Finland. +86% of our energy production (including 19% biofuels and 32.7% nuclear) come from renewable sources, and we are outpacing most of our European counterparts in the race to hit our green transition targets. According to Fingrid wind and solar project submissions have surpassed forecasts by 10 and 5-fold respectively, translating to +250GW of wind and +45GW of solar projects in the queue. This compares to Fingrid's forecasted volumes, as of 2023, of 23GW Wind and 7GW Solar. Solar Power Europe's market analysis outlook has Finland's achievable solar potential topping 18GW by 2030.

Adding to the growing capacity of wind and solar, Finland went live in April with Europe's largest nuclear energy facility, adding 1,600MW of capacity. As hydrogen activities take hold in the market, our natural green resources will move Finland to a front runner in green energy. This spring we saw the real potential of our RES investments, when the recent nuclear capacity merged with windy days, and a boom of hydrogen power generated from annual snow melt floods which resulted in subzero prices. With all this green energy at hand, Finland is right on track to realizing its potential of delivering 10% of the EUs total energy needs.

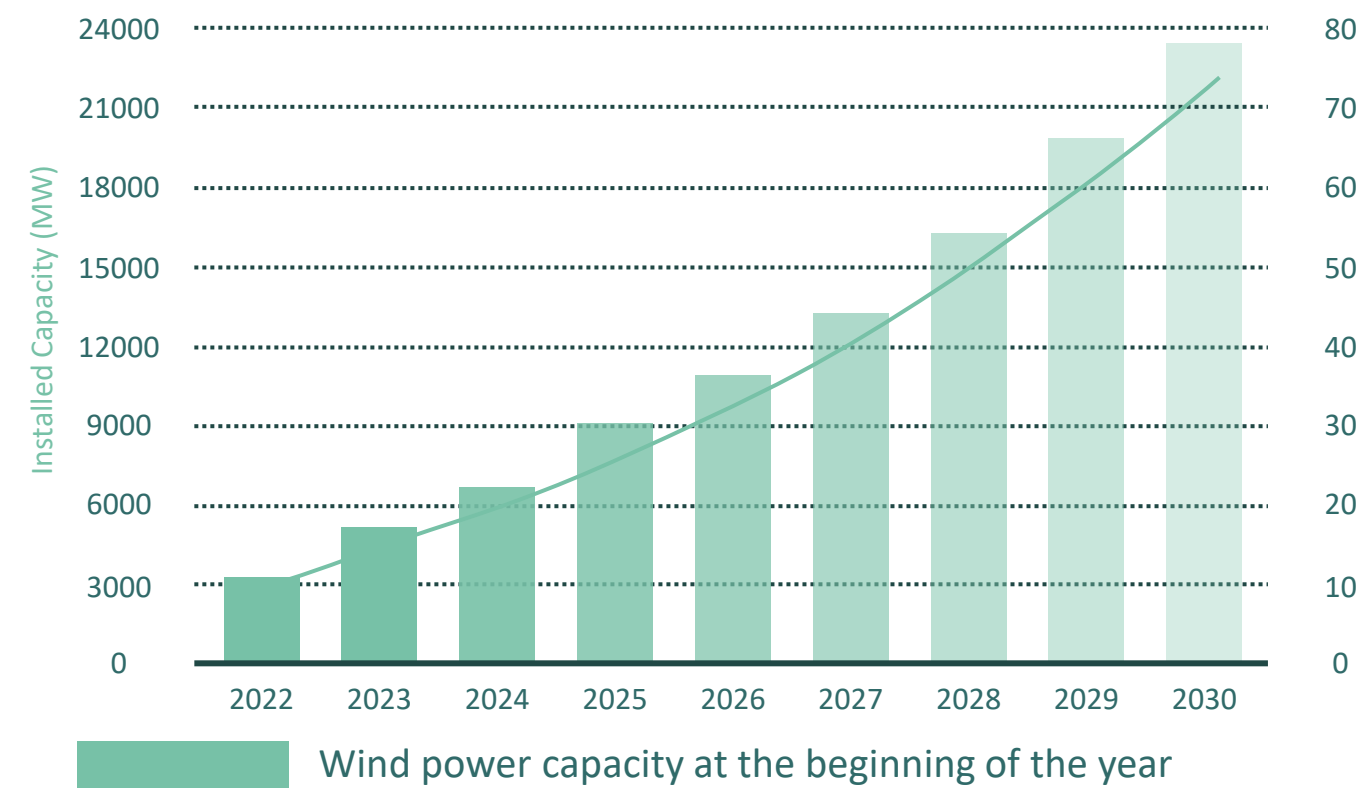
The war in Ukraine has led to rapid and substantial action to rid energy dependence from Russia. While the process has been painful for governments and consumers, societies have risen to the challenge, using a terrible situation to drive the transition to green energy both domestically and regionally. With Finland joining Nato, and the concept of collective defense, we are now a fundamental player in energy security. America is also taking notice of Finland's role in energy security recognizing our ability to play a major role in REE production. Jose W. Fernandez, the U.S. State Department's Assistant Secretary of State for Economic Growth, Environment and Energy joined Secretary Blinken in a recent trip to Finland, with one of the key topics being energy security. Finland's ability to contribute to diversifying the supply chain in renewable energy components is being noticed by the Americans, especially as it relates to the production of cobalt, nickel, lithium and graphite. The Confederation of Finnish Industries (EK) suggests that there is more than €90B of green transition investments pending.

And we are not the only ones to feel this way. In the month of May, Copenhagen Infrastructure Partners (CIP) and Myrsky Energia, a Finnish renewable energy developer, announced a deal to develop more than 1.8GW of onshore wind projects in Finland by 2035. Similarly, American Plug announced a €5.6B investment into Finland to build 3 hydrogen plants. The investment will create 1,000 jobs and 2.2GW of electrolyzer capacity by 2030.

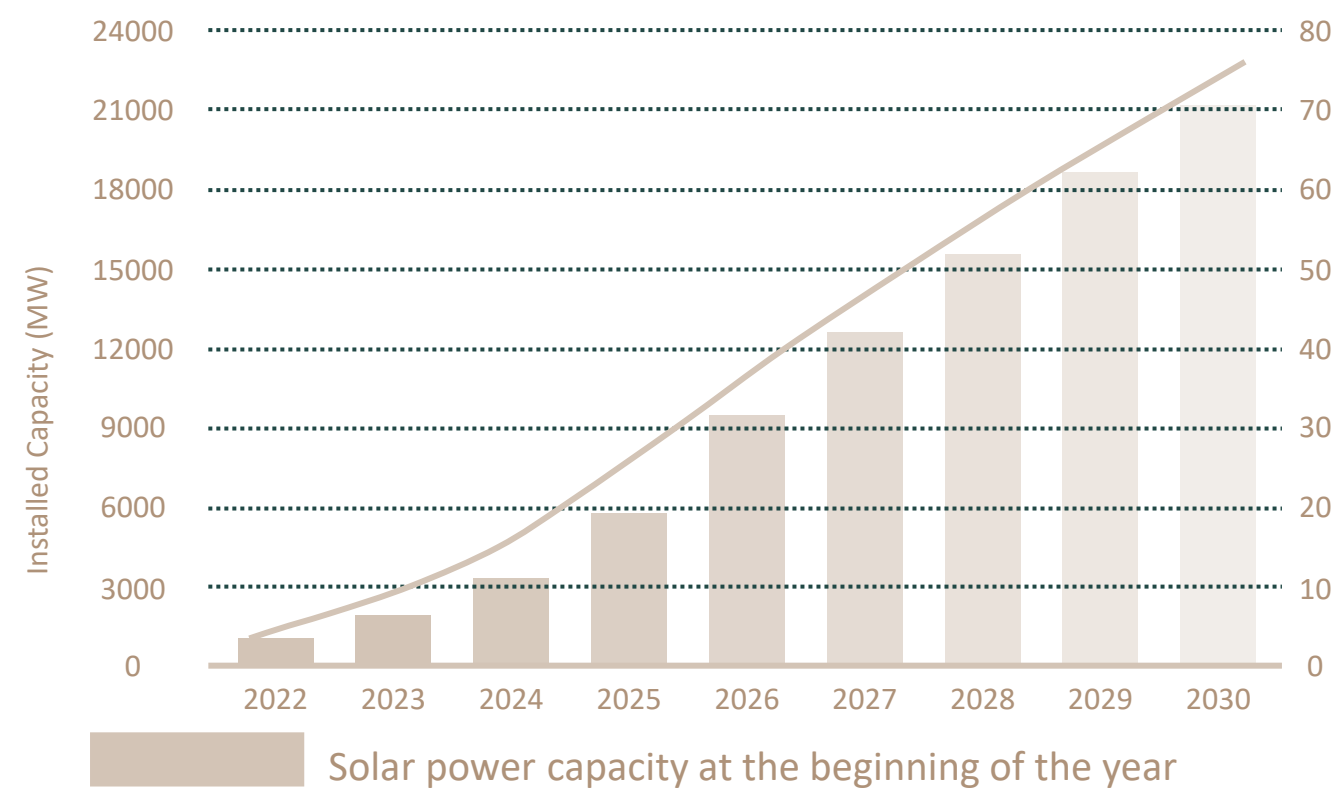
Local and international investments, government strategies and policies have aligned, pushing Finland into a strategic role in both the green transition and in electrifying Europe. Korkia, too, is driving this change. With over 1,000MW in Finland, our projects could power up to 10% of all Finnish family homes.

Fingrid Best Estimate Scenario 2023

Wind Power Growth Forecast



Solar Power Growth Forecast



Source: Fingrid best estimate scenarion H1/2023

Country Risk Profile Finland

Country Risk Index:
LOW

Korkia RE Industry Risk Index:
LOW-MEDIUM

The Finnish renewable market is maturing faster than anticipated. It is likely that additional mechanism will be introduced to increase the threshold to participate in the market. Global interest in Finland’s REE deposits likely to increase awareness and interest the Finnish market.

Information Being Tracked:

- The role of hydrogen
- Energy prices
- Impact on high level of wind and solar projects on the market

Sweden, A pioneer of Renewable energy Technology

Sweden has accelerated their renewable energy targets, with plans to reach 100% green generation by 2040 and net zero carbon emissions by 2045. Over 90% of the energy generated today comes from renewable sources, the majority derived from hydrogen and nuclear, and 24% coming from wind and solar. Sweden is one of the world's leaders in wind. As of 14th March 2023, 3GW of installed capacity is generating ~38% of the EU's total wind generation. The country also boasts a growing solar market. As of 2022, there was 3GW of installed solar, with Solar Power EU forecasts showing a remarkable solar potential of 30GW by 2030.

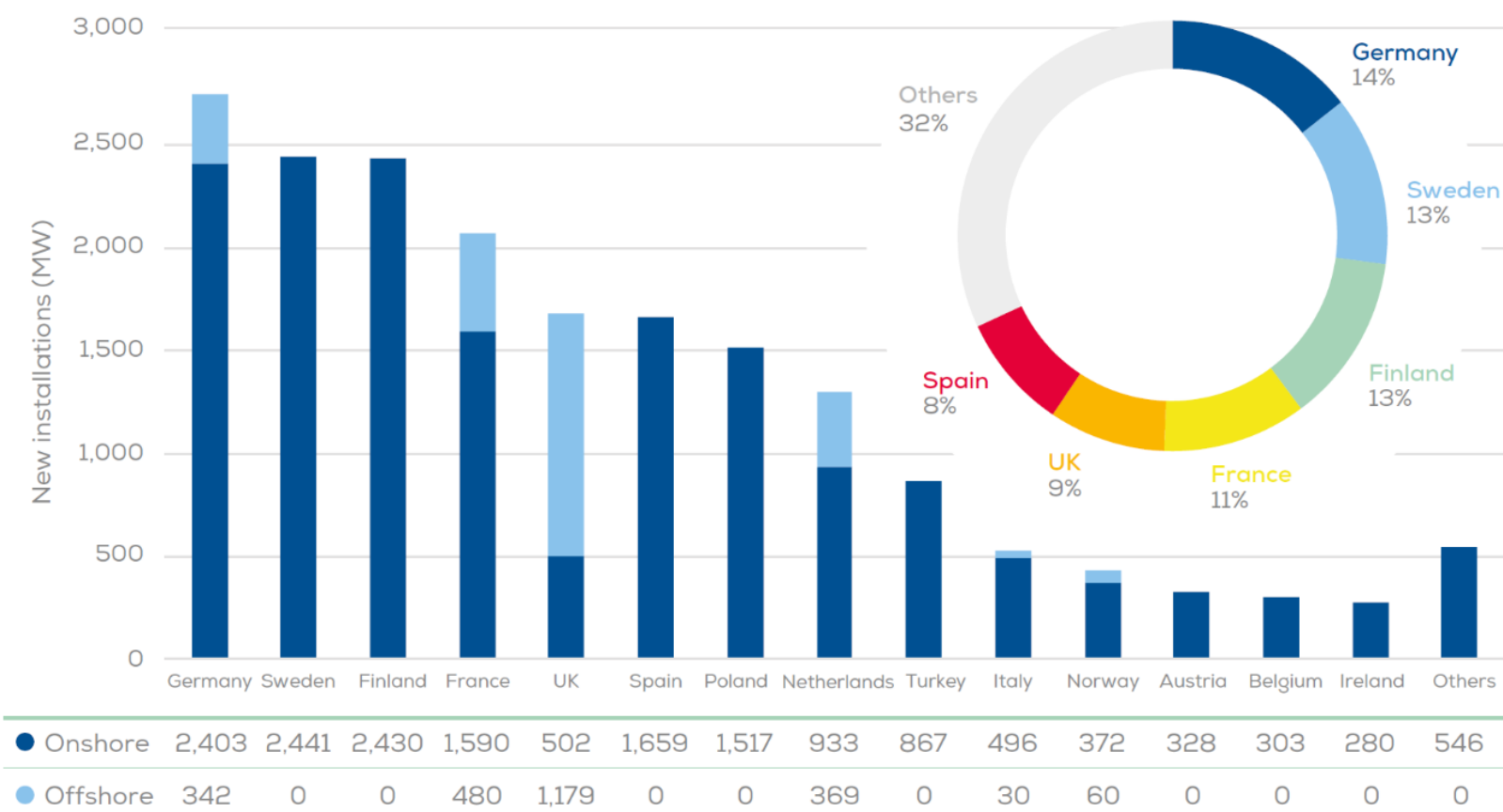
Not only is the country a leader in terms of renewable energy generation, but also in terms of green innovation and R&D. Sweden currently boasts 7 municipalities that are 98% powered by fossil-free energy. The cities have green energy initiatives to electrify transport, heating and construction needs. They have delivered vehicle fleets running on battery and biogas for their commuters, have deployed waste trucks that can produce biofuel. Sweden has also successfully piloted a hyper local energy development concept in residential communities. 48 family apartments spread across 3 buildings have been given photovoltaic solar panels, thermal energy storage and heat pump systems. A micro energy grid connects it all and helps charge electric cars overnight. The result is a cluster of 'prosumer' buildings, producing rather than consuming enough power for 77% of residents' needs.

Sweden is also home to technical innovations in harnessing energy. One recent advancement is the development of a wind turbine made from wood. Developed by the Swedish company Modvion, this turbine is the world's first fully wooden wind turbine. It is designed to be more efficient than traditional wind turbines, and it is expected to generate more power. It has the added benefit of being more appealing for communities, creating new avenues to provide renewable energies to communities. Other recent advancement include the development of the world's first permanent electrifying road. The road, located in Stockholm, is capable of wirelessly charging electric vehicles as they drive over it. The electrifying road is powered by solar panels, and it is expected to reduce the emissions of electric vehicles by up to 80%. The multifaceted approach to capture and deploy renewable energy in efforts to electrify society is well underway.

While Sweden is hitting targets and driving innovations, the country has not been able to avoid the impacts of a market that is growing faster than the structures around it. Demand for strategic land positions has driven land prices to an all-time high, outpacing even markets like Spain. Landowners are cashing in on the market wave, and in doing so making it challenging to find and secure land with conditions that make projects viable. The same can be said for the Swedish grid. Sweden's electricity grid is aging, and it is not well equipped to handle the increasing use of renewable energy. The demand is creating constraints which is pushing time frame for grid connections. As the market struggles to balance itself, with the government deploying capital and processes to address the challenges, the pace of Sweden's transformation hasn't slowed.

"Sweden is taking considerable steps towards an increased electrification with advanced plans for green steel production, the world's first electrified roads being built, and EV sales soon surpassing IC-vehicles. Increasing the electricity production of Sweden by installing a lot more PV in the coming years, will play a significant role in enabling this development," comments Michael Sandberg, Director of JV management in Sweden. Together with our development partner Recap, our projects in Sweden could power up to 100,000 homes.

New wind installations in Europe per country in 2022

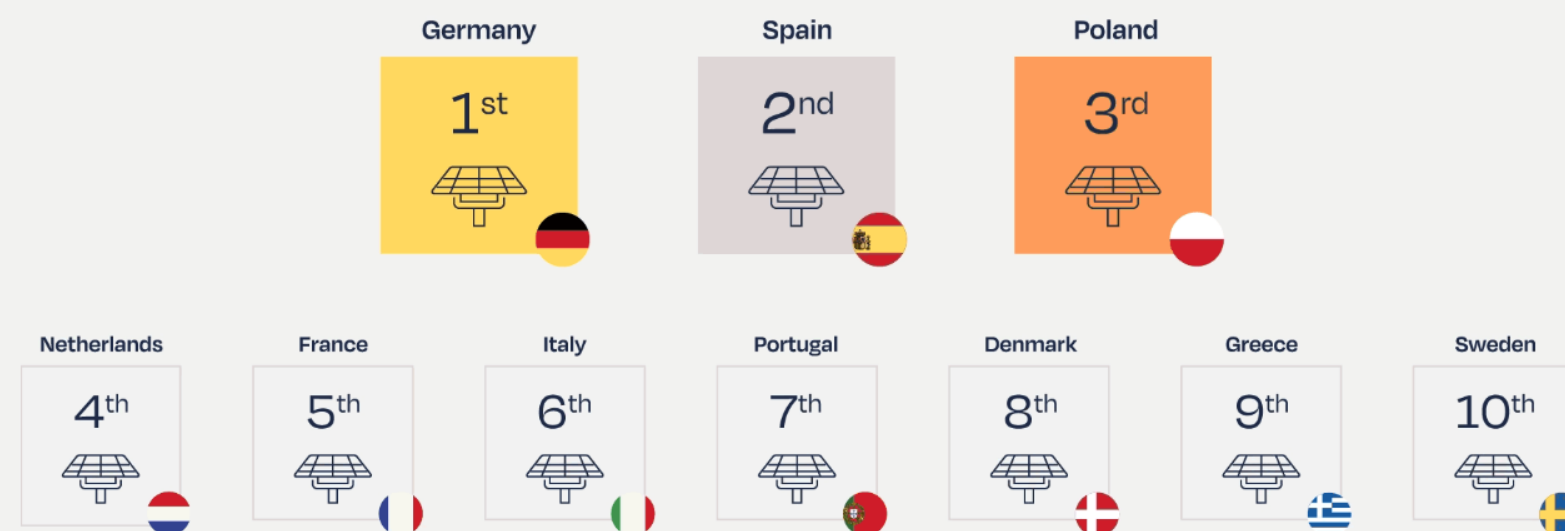


<https://windeurope.org/>

Source: WindEurope

The EU solar leaders

The top 10 countries adding solar capacity in 2022



'We are confident that further annual market growth will beat all expectations, exceed 50 GW deployment level in 2023, and more than double from today to 85 GW in 2026.'
Graphic and Quote source: www.solarpowereurope.org

Country Risk Profile Sweden

Country Risk Index:
LOW

Korkia RE Industry Risk Index:
MEDIUM

The Swedish renewable market demand is stretching the limits of the processes and structures that support it. A new electricity pricing strategy and grid improvements may help alleviate some of the pressures, but these take time to implement.

Information Being Tracked:

- Rising land prices
- Switching from a zonal pricing system to a single pricing system

The UK is putting teeth into their plans to become a hydrogen superpower

The forecast for the UK's renewable energy transition is promising. Renewable energy accounts for nearly 40% of the UK's energy generation from solar, wind, biomass and hydropower, including the world front running of offshore wind (6.9GW). However, challenges related to grid balancing, flexibility, interconnection, digitalization, and grid resilience need to be addressed. The government has been playing the blame game for months with little to no relief being visible until recently. With some developers waiting over 10 years for a connection, and £28B of investments 2022 alone, on the line, the UK government and grid operator Ofgem have a massive and urgent problem on their hands. The strategy to solve these challenges is expected this summer, with early positive indications that grid connection times could be halved.

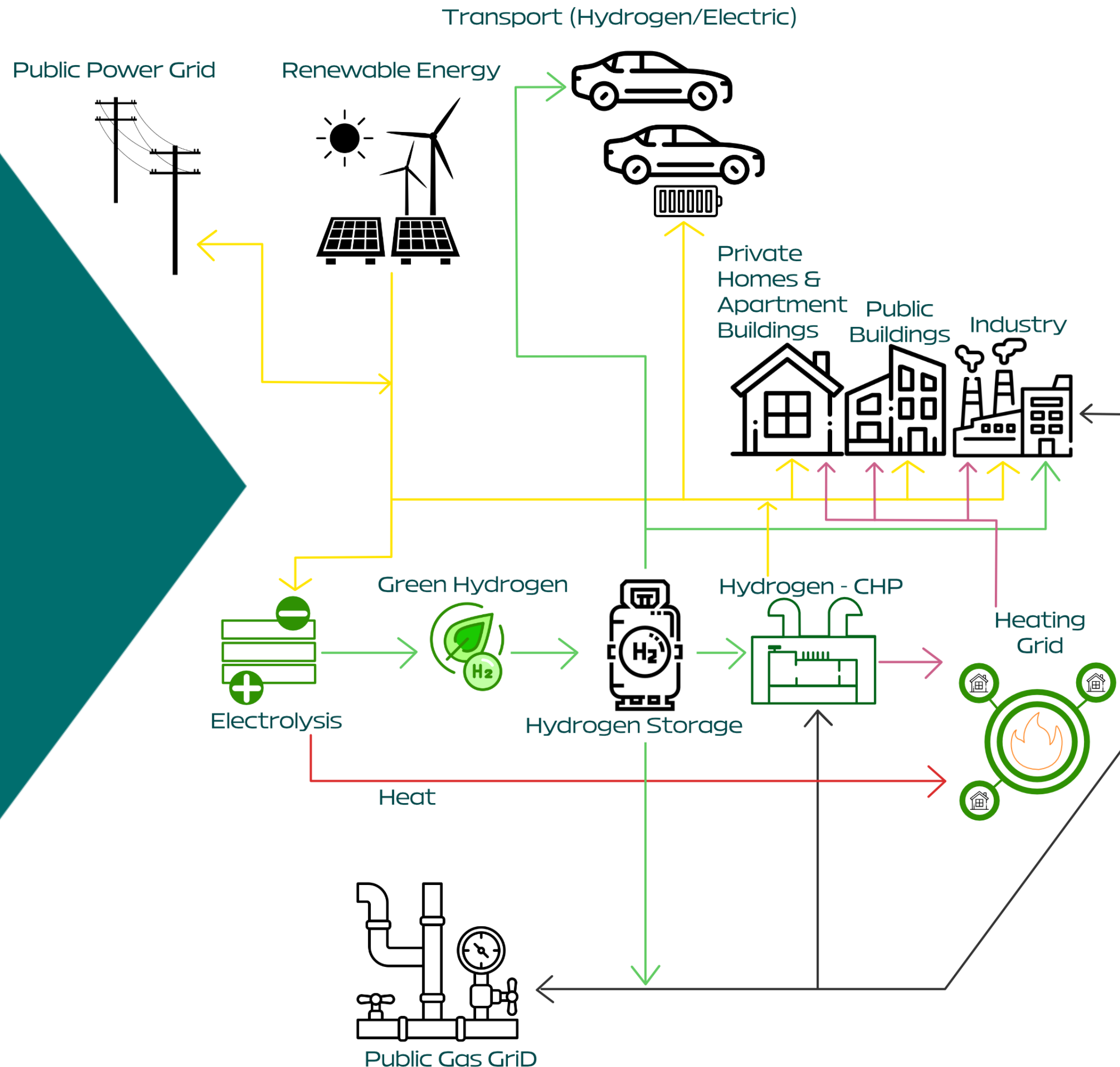
While most of the focus in the UK is on grid, what we are tracking is speed and breadth of hydrogen as a central component to the UK's net zero strategy. In 2022, the UK became the 12th country to release a hydrogen strategy. The target was 5GW, roughly 2% of the total need. In April 2023, the government doubled that number. The government has also put in place a contract for difference (CfD) to help incentivize the production of green hydrogen. The fundamentals are shaping a path for the UK to become a hydrogen superpower. Last year, wind curtailment cost the UK government a whopping £507M. The storage market has not yet caught up with the pace of wind and solar, which makes room for hydrogen to help act as a balancer on the grid. One plan is taking the curtailed green energy and putting it into an electrolyzer which can then be used to help power the downstream. Meaning it will not only reduce the waste, but it will provide energy and revenues, down the value chain.

We are already seeing major investments into hydrogen in the UK. Sumitomo announced a joint development agreement for low-carbon hydrogen production in the vicinity of the Bacton gas terminal, which handles roughly one third of the UK's gas production. Stuart Payne, CEO of the NSTA of the UK government stated that 'the Bacton project, could provide decades of clean energy for up to 20 million homes...'. A similar project, albeit smaller, was also recently announced in the Port of Felixstowe. Scottishpower secured £2M for a feasibility study for hydrogen fuel hubs.

With aim to help electrify the shipping industry and rid the seas of carbon heavy ships, the UK is putting teeth into their plans to become a hydrogen superpower. To hit their intended 70GW of renewable energy by 2035, additional technologies are going to be required. Those innovations come with R&D costs, legislative needs, government incentives and high capacity, high efficiency grid. How the government tackles the immediate pressure on the grid will set the stage for the UK's ability to hit their targets and will set the course on the UK's ambition to redefine their economic might and power through energy.

Our portfolio in the UK is pushing 3,500 MW. Together with our local developers Evolution Power and Climate ER our projects could power up to 1,500,000 million homes.

H2-CHP in the build environment



Country Risk Profile United Kingdom

Country Risk Index:
LOW

Korkia Risk Index:
MEDIUM

The UK renewable energy market is nearly at its current infrastructure limits. New policies are expected in summer 2023 to help reduce the volume pressures. As it remains unclear what these new policies will be, we are on active market watch.

Information Being Tracked:

- Release of the UK Government's grid improvements plan
- Port developments
- Micro grid/rural community development

Alberta is leading Canada in utility scale solar and wind projects

Canada recently announced its new Investment Tax Credit (ITC) as part of its 2023 Federal Budget. A 30% tax credit on capital costs, refundable when the asset is constructed, could draw \$15 billion in clean energy investments by 2025. The tax credit is cash refundable, making it a nonperformance related cash injection into the asset. It is also available for tax exempt entities, opening the field to new players.

The new ITC is just another positive variable in Korkia's investment portfolio in Alberta. The province itself is leading Canada in utility scale solar and wind projects. Out of the 1.8 GW in newly installed RE in Canada a whopping 75% was in Alberta. CANREA (Canadian Renewable Energy Association) has forecasted, that by 2025, Canada will add another 5 GW of wind, 2 GW of solar and 1 GW of energy storage capacity. Compare that to what Alberta Electric System Operator (AESO) recently published, 'the province has 3,500 MW of wind, solar and storage initiatives are under construction, while an extra 4,000 MW has been approved by the Alberta Utilities Commission.' Alberta alone is on track to reach the total national forecasts.

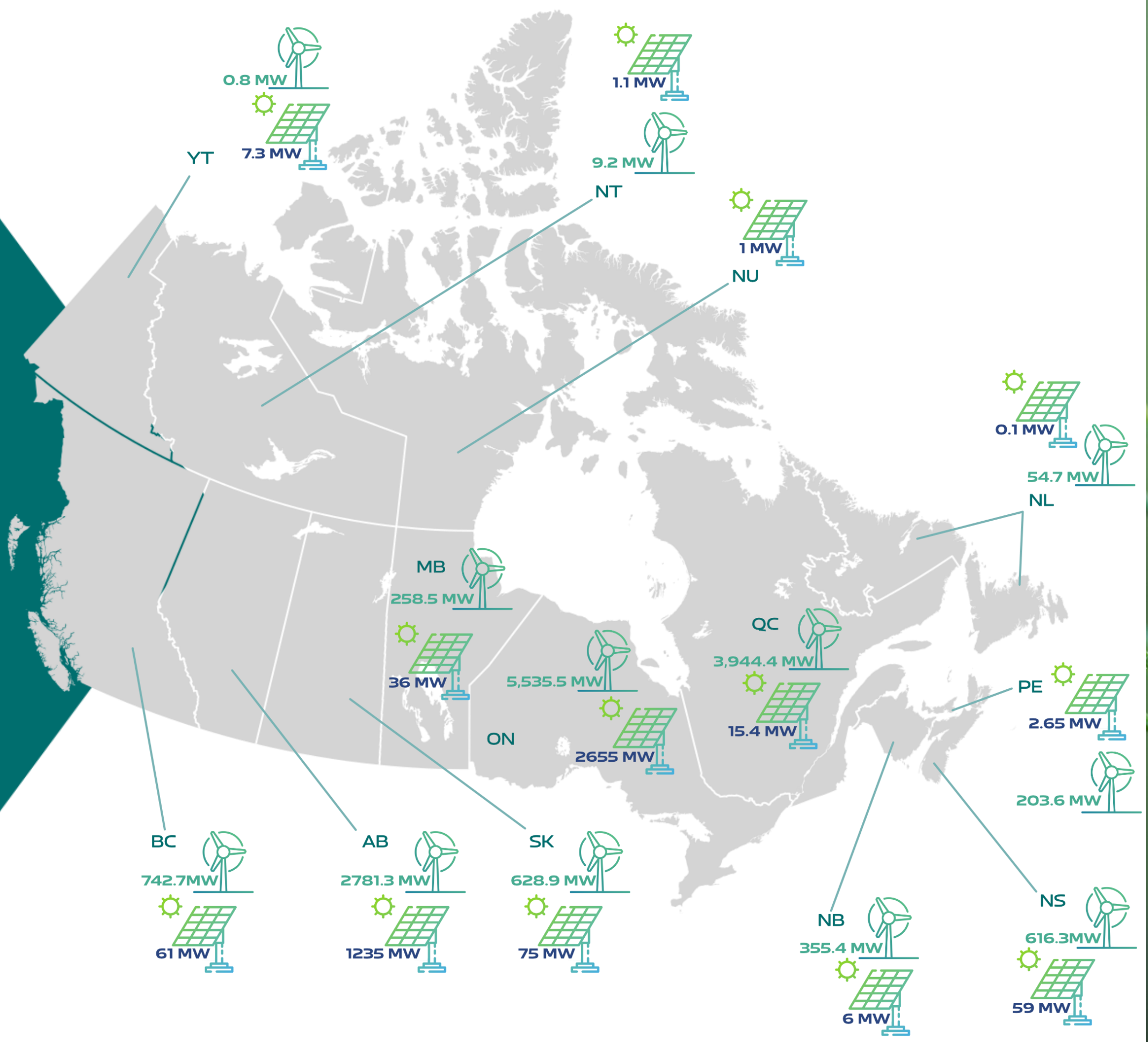
Solar power is already cheaper than natural gas power in Alberta and is forecasted to be 16% less expensive by the end of the decade, and wind power is set to be 40% cheaper than gas-fired-power by 2030.

All the demand has created pressures on the market. AESO is transitioning to a cluster application process to analyze projects regionally for overall fit and need. The process, in theory, will be faster, more transparent, and more holistic in solving provincial energy needs. Developers are racing to hit fast approaching transition deadlines. AESO is stretched to accommodate the demands. Banks are taking a conservative approach, and buyers are waiting to see the outcomes. With so many moving parts, it could be viewed with a pessimistic lens. But what we are seeing in Alberta has happened in many other markets. A cleaning process, removing non-viable projects from the queue to make way for high quality, well-funded projects. The result, if following the pattern from other markets, will be an efficient market ready for proper growth.

Alberta is an energy juggernaut. It is used to, and incredibly skilled in, navigating an evolving energy market. It is also the only deregulated market in the country, enabling private developers to build new projects and sell the electricity, along with the associated renewable energy credits, to corporate customers. It has the ambition, the capabilities, the regulation, and pro-business environment to deliver big in Canada's effort to reach net zero targets.

Our portfolio in Alberta is ~1,300MW and growing. Together with our local developer Universal Kraft Canada Renewables, our projects could power up to 500,000 thousand Albertan homes.

Current Installed Wind and Solar Energy Capacity



(source Canadian Renewable Energy Association: Dec 31, 2022
Note: this also includes 2022 data for rooftop & behind-the-meter solar

Country Risk Profile Alberta, Canada

Country Risk Index:
LOW

Korkia RE Industry Risk Index:
MEDIUM

The renewable energy market is reaching its first peak. Market entry barriers and stay barriers are being introduced to remove speculators and increase the efficiencies of the development process. As this is in the early stages, we are watching the market development.

Information Being Tracked:

- AESO developments and timeframe under new processes
- Growth in presence of large European Infrastructure funds

Don't take your eyes off Greece

With a prime location for both sun and wind, Greece has, for some time now, enjoyed heavy investments and deployment of renewable energy projects. With €2.5 billion worth of PV projects earmarked for development by 2030 and investments yields that are, comparatively, close to 30% higher than its Northern EU counterparts, Greece is taking full advantage of its natural resource. It already boasts **10GW installed RE capacity**, and in October 2022, the entire country managed to run entirely powered on renewable energy. Greece is one of only 9 countries that have double digit PV penetration. It is tied for second, with Chile, only behind Spain. Demands for connections are stretching system operators and the grid. To help combat the backlogs and demand, legislators are continuously improving regulations and processes. Renewable energy development in Greece comes with its fair share of bureaucracy and administration but there is no denying Greece's potential, speed, and ambitions when it comes to renewable energy development.

Greece is also one of the EU's front runners when it comes to Agri Voltaics. With triple land use benefits: optimum crop & energy production and reduction of water consumption there are many ongoing Agri PV pilots well underway with legislation expected to shortly follow. The General Secretary of the Ministry of Rural Development & Food of Greece opened the 2022 Agri PV conference by touting that Agri PV will be the next big thing in Greece. We are seeing a host of Greek companies driving innovations in Agri PV technologies, with the ambition that Greece becomes a solar innovation hub.

Greece has also been making some serious moves when it comes to regional energy power plays. In March, Greece, Israel and Cyprus announced plans for the EuroAsia Interconnector, a 2GW cable to drive energy security across the region. A third of the funding will come from the EU. In April, ERBD approved a loan of €88M for the development of undersea cables to connect mainland Greece with their islands. The investment will not only help to lower the cost of energy but will also allow for serious offshore wind growth. In May, Greece announced its' role in the Med9 Alliance, a regional effort to drive offshore RE growth across the Mediterranean and Africa. And if that was not enough, Greece has also submitted a proposal to the EU Commission that seeks to overhaul the European grid, with the hopes to release some of the 600GW of wind and solar projects on hold across EU and UK due to grid limitations.

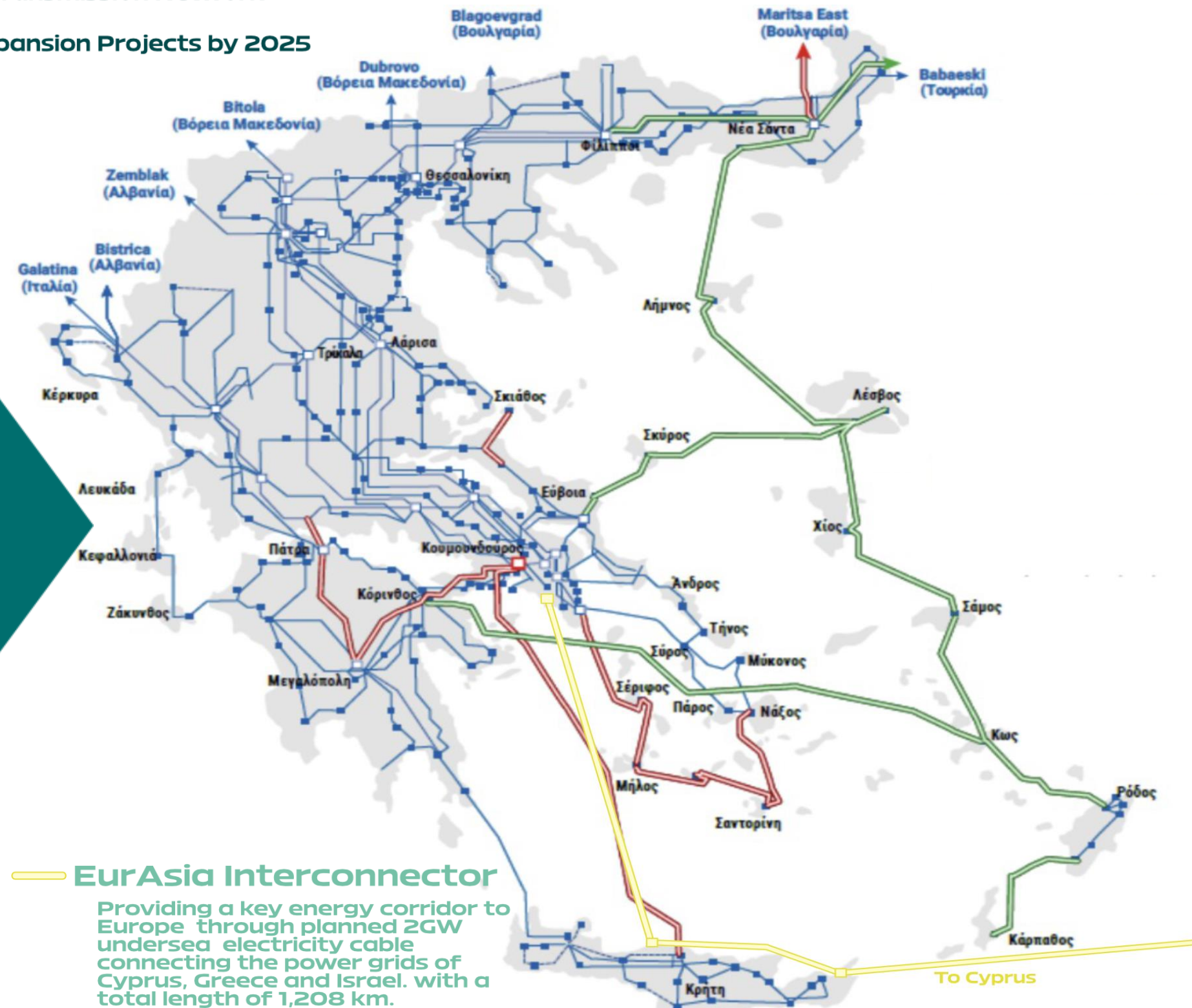
Greece's growth in renewable energy is reflective of the country's dramatic economic turnaround. After over a decade of holding the unenviable brand of Europe's problem child, Greece's economy is booming. Posting one of the EU's strongest GDP gains post-Covid, and with the expectation that it will regain its investment grade rating, Greece has been able to turn around what many believed to be unsavable, unsustainable economy.

Our portfolio in Greece is currently ~1,000 MW. Together with our local developers GH Energy and 2A Green Energy our projects could power up to 500,000 homes across Thessaly and Crete.

Korkia Forecasted Grid (Ongoing & Proposed Investments)

— Current Transmission Network

— Major Expansion Projects by 2025



Country Risk Profile Greece

Country Risk Index:
MEDIUM

Korkia RE Industry Risk Index:
MEDIUM

The renewable energy market is in the maturity phase. Market entry barriers and stay barriers are enforced, speculators are out of the queue. What remains is a highly competitive, administratively heavy development environment.

Information Being Tracked:

- Movement in regulation and process for grid connections and Agri PV
- Greece's growing efforts to take a leadership role in the EU's energy transition

Agrivoltaics – the next big solar wave

Typically ground-mounted solar photovoltaic (PV) systems are used only for solar energy production. However, combining solar and agriculture activities on the same land, also known as Agrivoltaics, is on the rise. Agrivoltaics (or Agri PV) co-locates the production, such as crop or livestock production or pollinator habitats, underneath solar panels or adjacent to solar panels. The result is that we can harvest the sun and generate food, and/or protect the environment. Agri PV started with sheep grazing around the panels, serving both as food source for the animals and as maintenance on the land, protecting the panels from overgrowth. That concept has been evolving and we are now seeing Agri PV installation for crops ranging from broccoli, celery, peppers, lettuce, spinach and tomatoes to field crops like potatoes, corn and wheat. Agri PV can also be used for bee farming, in vineyards, over canals to prevent water evaporation, and in sensitive biodiversity areas to protect natural grasses and habitats. In addition to helping secure the supply chain of food, it has the added benefits of reducing temperatures, improving crop yield, revitalizing soil quality and protects against extreme water evaporation.

The life cycle analysis of agrivoltaics, which assesses its impact from its conception to use, [found that these solar-covered farms emit 69.3 percent less greenhouse gases and demand 82.9 percent less fossil energy compared to separate food farms and solar farms-based production.](#)

Until recently Agri PV was used in small scale installations or in research projects, but we are now seeing large scale Agri PV projects across the globe. It is used a lot in Asia and Africa where extreme heat and drought impact food supplies. We are also seeing it in Italy, France, and UK. In fact, Agri PV is developing at such a rapid pace that countries are already enacting legislation to incent, and regulate, its development. Italy is leading Europe in this area, with full development legislation already available for landowners and developers.

According to a study done in the US, [81.8% of respondents](#) said they would be more likely to support solar development in their community if it integrated agricultural production. With the ability to create green energy, grow crops or raise animals, protect water supplies, and the soil, Agri PV is fast becoming the solar wave of the future.

As each installation requires a customized design, there are some challenges and innovations still to be solved before Agri PV is fully mainstream, but with the added environmental and societal benefits it brings, it is fully expected that Agri PV will soon be front and centre in contributing to both the global green transition and to protecting our national food supply.

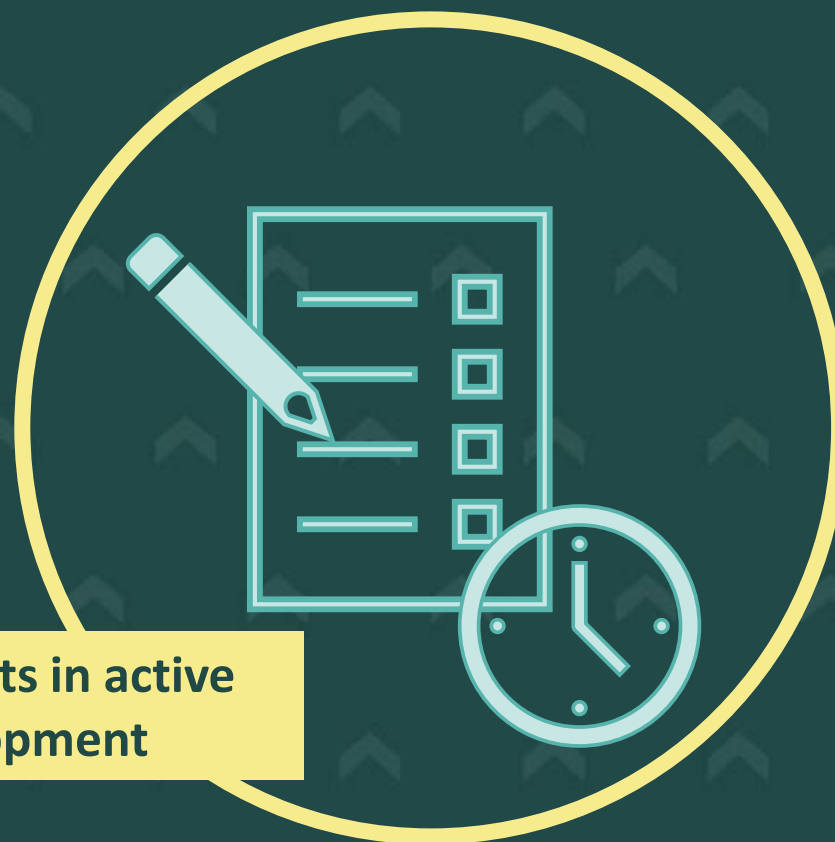
Prosumers: the rapid rise of decentralized energy

As residential solar energy increases, homes will not just consume energy, they will produce and distribute it to the grid. The rise of the 'prosumer' is rewriting the energy rulebook. As at-home solar and battery storage adoption grows, vast networks of "mini-power stations" are being built. With the potential to connect back to the central grid, these networks are becoming 'virtual power plants' (VPPs), serious contributors to the energy mix that could very well contribute to national grids furthering the pivot away from carbon-emitting balancing solutions. As power continues to be democratized, we could see peer-to-peer energy trading enabled by blockchain technology – electricity produced on the roof, stored in the car, then sold to nearby households, helping to reduce energy inequality and energy poverty.

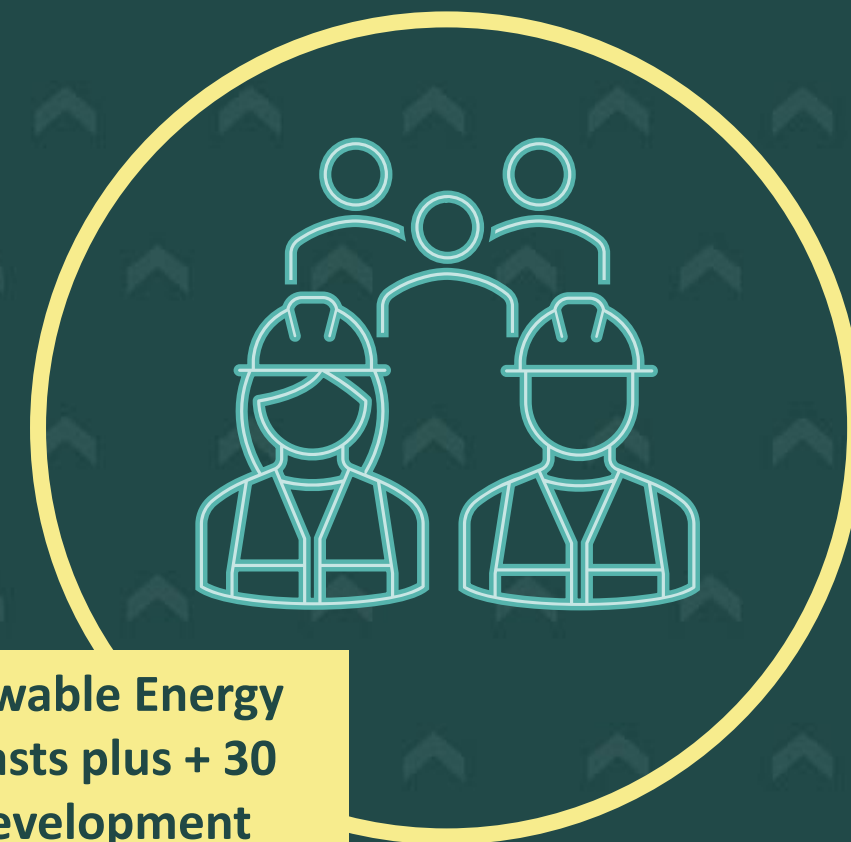
It is estimated that as much as 83% of all EU households could contribute to renewable energy production, demand response, and/or energy storage by 2050. The EU Commission has tabled legislation (the Renewable Energy Directive and in the Internal Electricity Market Directive) that will allow homes and small businesses to create local energy hubs, selling surplus energies to neighbors and communities.

In all the markets we are active in or currently investigating, we are seeing strategic moves to build prosumer generation into local energy strategies. In Spain it was announced 5% of their grid capacity will be carved out for prosumers. A move that will not only assist in the transition to net zero but will also play a role in stabilizing consumer energy prices. In Finland, the national farmers association (MTK) is working to help create energy communities with solar being one technology used to help cover local energy needs. In Alberta, local trainings are being rolled out educating building owners on energy communities, energy aggregation and possible implementations.

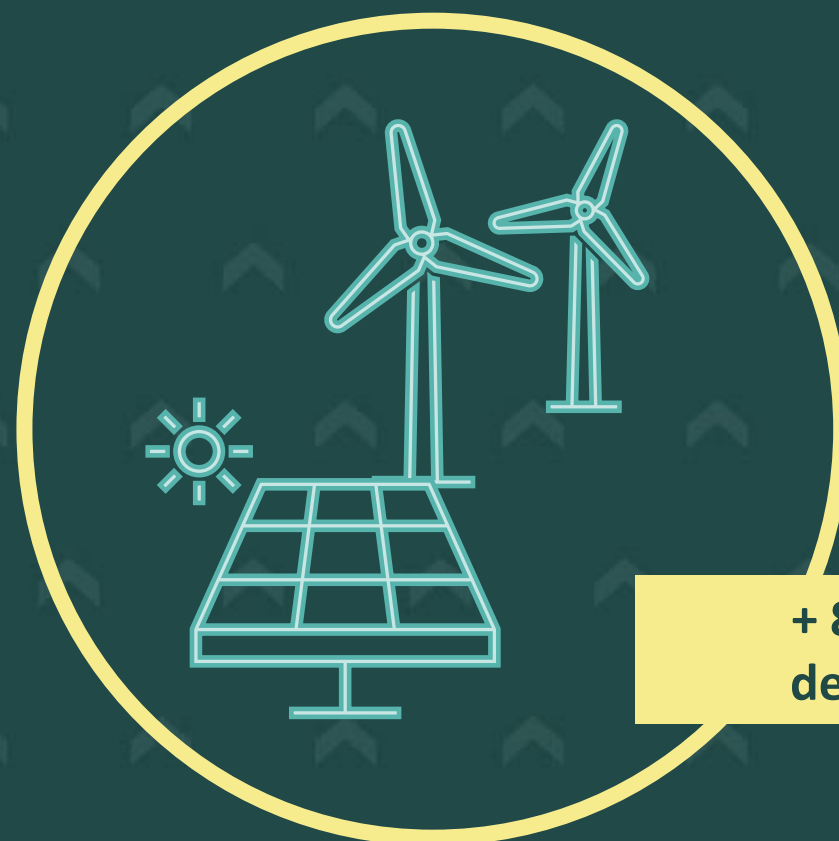
Building owners are awakening to the additional values their assets could bring, not just as cost savers but as revenue generators. Legislatures are pushing energy community regulations. As technology prices continue to decrease while innovations increase, the rise of home generation is picking up speed. Farming the sun is becoming accessible to a whole new demographic. What this means to traditional developers, grid and transmission operators, and ultimately consumers has yet to play out, but it is safe to say that the wave of new producers is well underway.



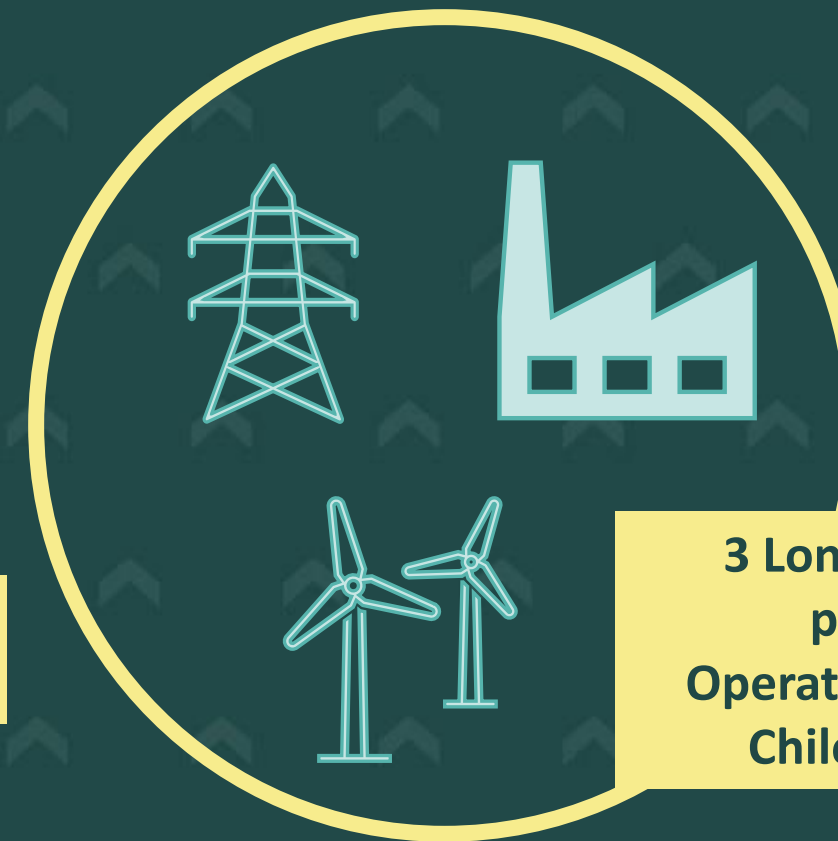
+70 Projects in active development



40 Renewable Energy enthusiasts plus + 30 local development experts



+ 8GW under development



**3 Long term asset portfolios
Operational assets in Chile and Spain**