Shaping Tomorrow's Energy Landscape:

Balancing Sovereignty, Affordability and Climate Responsibility

WORLD ENERGY MARKETS OBSERVATORY 2023 | 25TH EDITION

IN COLLABORATION WITH: vaasaETT | Enerdata

04

MONEY FLOWS

HOW THE MONEY FLOWS

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Upfront last years market supply and price disruption governments, industry bodies, market facilitators and market participants heavily discussed if the market design is still working and in line with the key objectives of energy policies (cp. figure 1).

The interaction and effects between state interventions and market mechanisms were never so clearly to observe as before. Fact is, the energy goes where the money is.

Especially the goal of sustainability and the transition from traditional, fossil-fuel-based energy to a green and CO_2-neutral energy world is one of the biggest changes and tasks since industrialization. Steering this change in the right direction already requires forward thinking regulation, investment and alignment across borders.

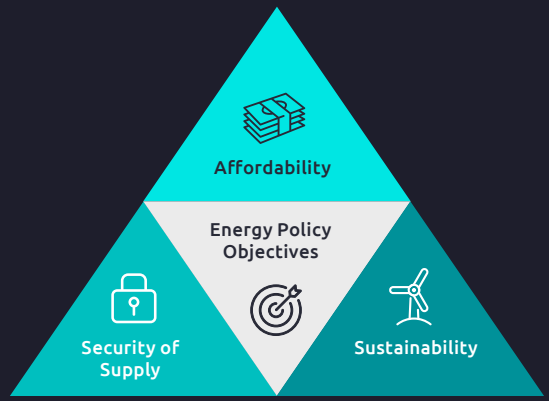
The last year' sky-rocketed gas prices proved, especially in Europe, that structurally weak energy markets were not able to stand the stress test. With a significant portion of electricity being generated from volatile renewable assets and a flexible back-up being produced in thermal power plants burning imported gas, significant price volatility is predestined.

The key question of this chapter therefore is how money is flowing in and across the energy value chain and if even more state intervention is required or not. Therefore, this chapter investigates:

- How wholesale and consumer prices developed in 2022 and to what extent state intervention played a role (article 1)
- Which global interventions took place to answer energy market turmoil (article 2)
- Which discussions are ongoing to adjust the energy market design to make it more robust for further stress tests (article 3)
- How energy market players performed and developed across the globe (articles 4-6)

FIGURE 1

Energy Policy Objectives - the trillema continued



Conclusion

The key facts presented in this chapter lead to the following conclusions:

#1: Intervention sometimes is part of the problem: Looking at the gas price development and regulation, storages needed to be filled with certain percentage rates contributed to the price rally in 2022.

#2: Market design discussions are influenced by market turmoil: The drafts of the new energy market design and related discussions were very much driven by discussions about pricing mechanisms on the energy market. There seems to be no fundamental change, but the time required to discuss this is missing on very concrete proposals and international alignment of recommendations.

#3: Money intervention arrived and helped on consumer side: Looking at the world's energy price composition, there is already quite some state intervention with existing fees, tariffs, and also subsidies. This definitely increased in 2022, when states helped to stabilize end consumer prices and consumption. The discussions if funding of this intervention could be carried by increased company profits took too long and the market (driven by reduced energy consumption) was faster than further regulations, which mostly did not enter into force or remained ineffective.

#4: Security of supply is the clear winner: In 2022, the balance of the above-mentioned energy triangle was clearly shifted towards affordability and also security of upstream supply. There was a huge push for new supply resources (e.g. LNG), both financially, but also wrt. decreasing bureaucracy in infrastructure measures. Also coal-fired power plants experienced some revival as replacement of gas.

#5: Don't forget about the grid: Everyone agrees, that energy transition happens in the grid. Nevertheless, grid expansion and stability of the grid, especially upfront further growth of renewables and increasing volatility was only addressed to limited extent. All discussions encourage flexibility needs, but how to get there and which technologies are supported, especially financially remained vague.

#6: Industry money is following clear signals: Looking at geographies, which were not hit by the energy crisis to the same extent, e.g., Australia, reveals, that new energy market participants and partnerships arise along the value chain, but especially on these parts, where clear regulatory signals (e.g., XX% share of renewables by 20XX or CO_2 neutral country by 20XX). Also, investments in renewable energy and related technologies are constantly on the rise.

FIGURE 2

Energy utilities are **moving from traditional, fossil-fuel-based, one-directional, simple business models** with the energy consumer at the end of the value chain

Central fossil-fuel energy production

Large volume, manual energy trading

Unidirectional energy transmission

Unidirectional energy distribution

Energy consumers with fossil-fuel cars

... **to new composed business models** based on decarbonized, bi-directional, blurring value chains with the prosumer / flexumers* at both ends and profitability outside traditional central energy productions.

Next-gen, intelligent energy production incl. prosumers

Intelligent storage and flexibilities (flexumers*)

Volatile, mixed volume automated energy trading

Bidirectional intelligent energy transmission

Bidirectional intelligent energy distribution

Prosumer / flexumer* with smart meter and e-cars

*Flexumer = Energy Consumer + Energy Producer + Energy Flexibilities

It is possible to develop an electricity market entirely based on renewable and CO_2-neutral energy.

However, this requires a more radical approach to infrastructure refurbishment and development providing substantial incentives to commercialization of currently nascent and new technologies (e.g., batteries of any kind as alternative source of flexibility).

By this, not only (or sometimes exactly not) a simple subsidization of asset development is meant, but also an innovative market regime, allowing new players to find their niche on the market.

Last year showed that the demand for flexibility is inherently there and therefore can be easily monetized. However, market rules with respect to very short-term trading and balancing are not yet mature enough to reduce the associated commercialization risks.

So, 2022 proved that global energy markets are not mature enough to survive without any state intervention, especially on the end consumer/ affordability and supply side. But it is also clear that the market is resistant enough to recover in a short time and the focus of the international state community should not be too short-term at all.

There is rather some evidence, that an aligned, to some degree adoptable and global energy strategy is critical, so global energy market development has a clear direction for market players to contribute and invest in.

04

WORLDWIDE ENERGY PRICE COMPOSITION DEVELOPMENT: INTERVENTION AND REFORM IS CRUCIAL

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TORBEN SCHUSTER, GERMANY

State intervention and market redesign to achieve a sustainable energy future

To assess the development of energy prices worldwide, following components were examined: What role do the wholesale markets play, what are the price regulation practices, and state intervention and market designs. Long-term redesigns of Europe's power market are considered critical to avoiding future price volatility, balancing the needs of consumers and producers, and bolstering investment in new generation capacity.

Starting in 2020, the world has encountered four distinct energy crises:

- The Covid-19 pandemic, which led to a sharp decline in demand for energy resources.
- The subsequent recovery plans, which unexpectedly increased energy demand, potentially jeopardizing supply security.
- Russia's invasion of Ukraine, posing a threat to the security of fossil fuel supplies in Europe.
- The rise in inflation and interest rates, resulting in higher costs for new energy assets such as renewables and nuclear plants. This increase is primarily due to the significant impact of capital expenditure on the levelized cost of electricity (LCOE), which can account for up to 80%

Wholesale electricity and natural gas prices nearly quadrupled from previous records in Q3 2022 (compared to 2021), creating concerns for skyrocketing energy costs for consumers and businesses. These scenarios prompted discussion on state intervention and market designs to safeguard energy affordability. To alleviate the impact of high electricity prices on consumers, several countries have implemented measures such as setting controls on wholesale and retail prices, imposing revenue caps on infra-marginal technologies such as renewables, nuclear, and coal plants, reducing energy taxes and VAT, and providing direct subsidies.

Energy price volatility highlights the structural challenges Europe faces as it seeks to transition its energy system away from carbon-emitting fossil fuels. Following the outbreak of the Russia-Ukraine conflict, European consumers have faced power rates significantly higher than the average production costs. These record high power costs led to high inflation, which became the region's biggest economic problem since 2022.

Fossil fuel consumption subsidies rose globally above $1 trillion for the first time in 2022. According to the International Energy Agency (IEA), in 2022, oil subsidies increased by around 85%, while natural gas and electricity consumption subsidies more than doubled. High fossil fuel prices were the main reason for upward pressure on global electricity prices, accounting for 90% of the rise in the average costs of electricity generation worldwide (natural gas alone was more than 50%).

The most significant surge in Europe's wholesale electricity prices occurred in 2022, with average prices exceeding twice those of 2021. The exceptionally mild winter in 2022/23 helped temper wholesale electricity prices, but prices remain high compared to recent years. Elevated future prices for winter 2023/24 reflect the uncertainties regarding gas supply in Europe over the coming year.

In the European Union, a wide range of responses to the energy crisis have been observed. To reduce reliance on fossil fuels and to increase resilience to price shocks, the European Commission published its REPowerEU plan in May 2022 to accelerate clean energy deployment. At the same time, discussions about electricity market design gained momentum due to soaring wholesale prices. The commission also launched a consultation on market design reform.

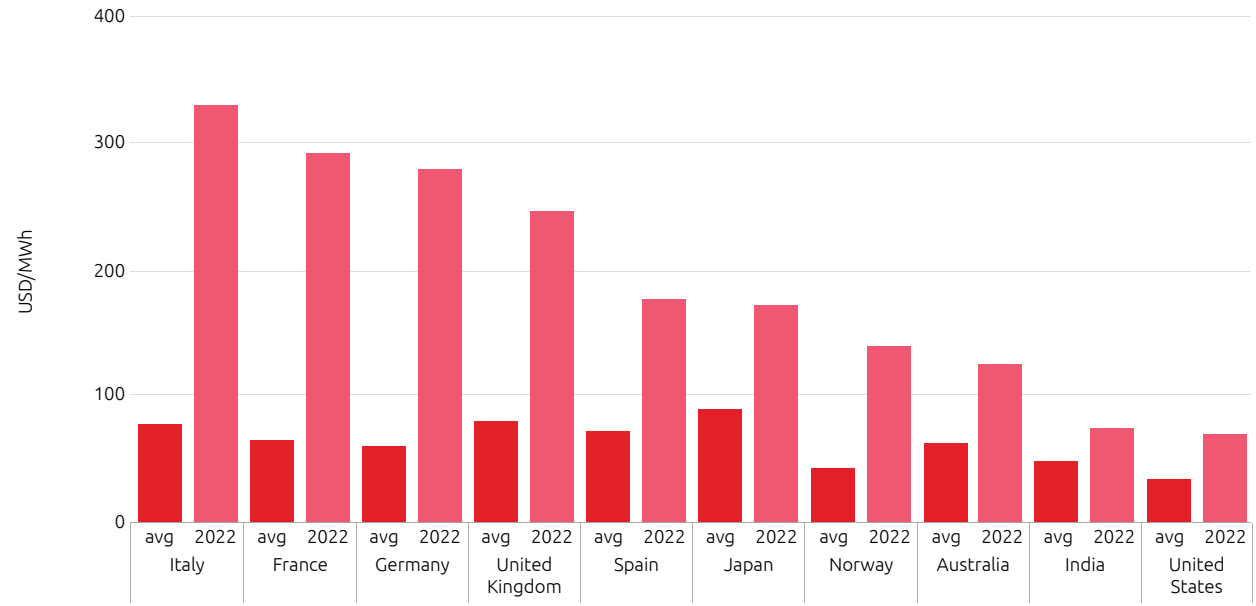
Market interventions can help mitigate the impacts of the energy crisis, but the potential creation of uncertainty in the investment landscape needs to be minimized to ensure that responses to the crisis do not come at the expense of much-needed investment. Electricity markets were impacted differently across the world – Europe being hit the hardest as seen in Figures 1 and 2.

Energy price increases were softened by substantial government intervention. Nearly all EU governments are pursuing either direct payments to households or temporary reductions in bills via lower taxes and other levies. Additionally, the European Union recently adopted a temporary windfall tax on the surplus profits of fossil-fuel companies and on excess revenues made from surging electricity costs.

Several initiatives were particularly noteworthy like the Iberian exception, solidarity contributions, and the German industry support scheme of a EUR 200 billion energy relief plan (called Economic Defense Shield). However, the targeted direct financial support and retail price measures differ significantly.

FIGURE 1

Annual wholsesale prices in selected countries, 2002 and 2017-2021 average

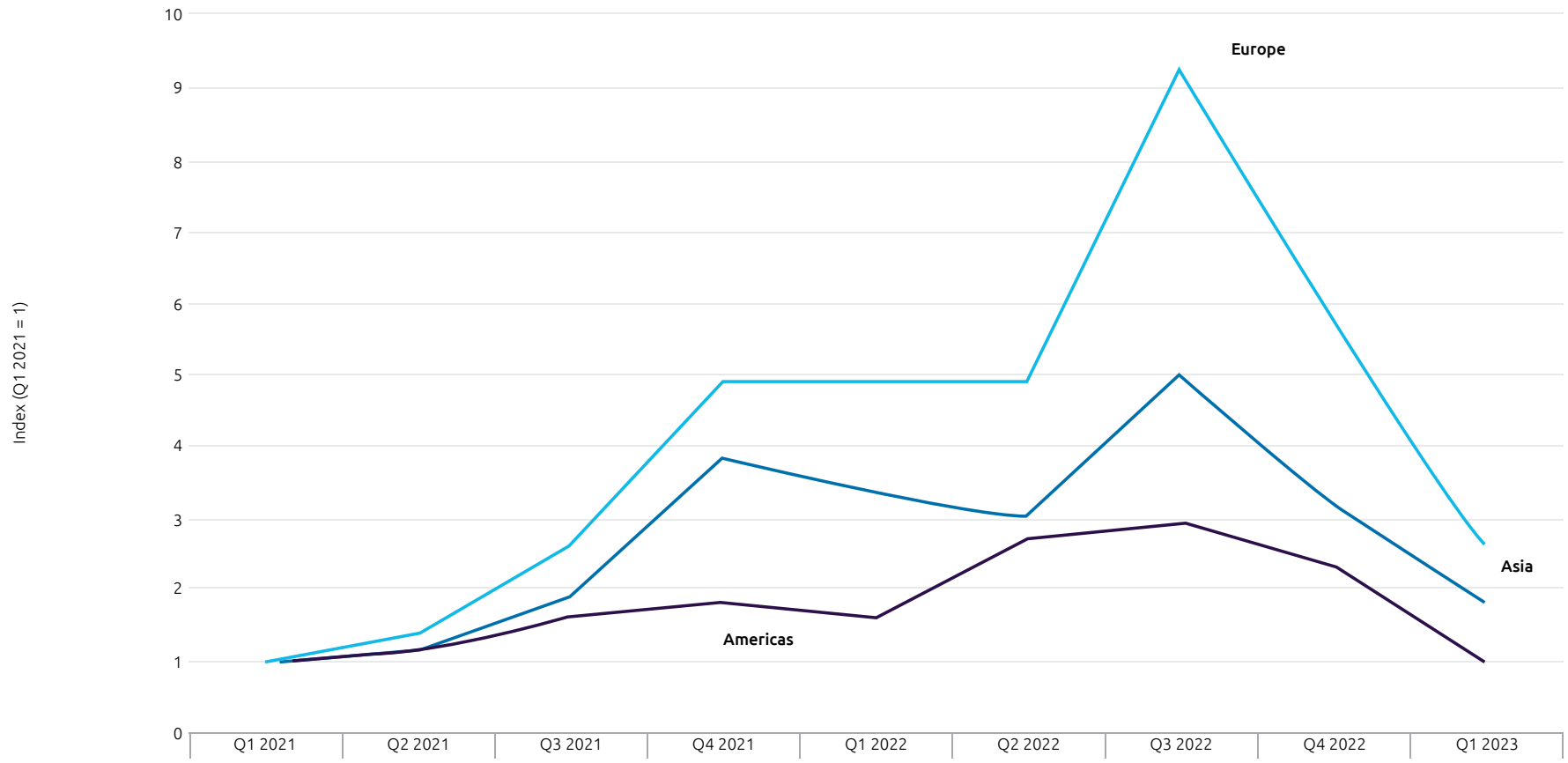


Source: IEA

Note: Avg refers to an average of the years from 2017 to 2021. The annual averages are calculated from the daily wholesale electricity prices

FIGURE 2

Natural gas wholesale price indexes in major markets by quarter, Q1 2021- Q1 2023



Source: IEA

Electricity prices remain elevated in many regions, led by the high cost of energy commodities

Energy markets have tightened since the Covid-19 pandemic, and the situation intensified considerably following the Russia–Ukraine conflict in late February 2022. This contributed to a global energy crisis. Global energy prices surged because of various factors, including the ongoing geopolitical conflict, a rapid global post-pandemic economic recovery, continued high reliance on fossil fuels, and the severe mismatch between energy demand and supply. This resulted in substantially higher wholesale electricity prices in many regions of the world in 2022, as compared to the year prior.

The Russia-Ukraine conflict mainly endangered gas and fossil fuels supply in Europe, boosting gas prices and liquefied natural gas (LNG) market. In H2 2022, wholesale electricity prices (day-ahead spot pricing) in many European countries exceeded the second-half average prices between 2019 and 2021, with France experiencing a fourfold increase. In H2 2022, the average wholesale price reached almost €330/MWh in Germany and surpassed €320/MWh in France; this was exacerbated by nuclear unavailability. By contrast, in Spain, average prices were much lower for the same time at about €130/MWh due to the Iberian price cap. The demand weighted average price for Germany, France, Spain, and the United Kingdom in H2 2022 was almost four times as high as the H2 2019-2021 average.

The elevated futures prices in Europe for winter 2023/24 reflect the continued uncertainties associated with gas supply for Europe, as presented in Figure 3. Futures with delivery in Q4 2023 are €227/MWh in France and €184/MWh in Germany, while those for Q1 2024 are €258/MWh in France and €186/MWh in Germany.

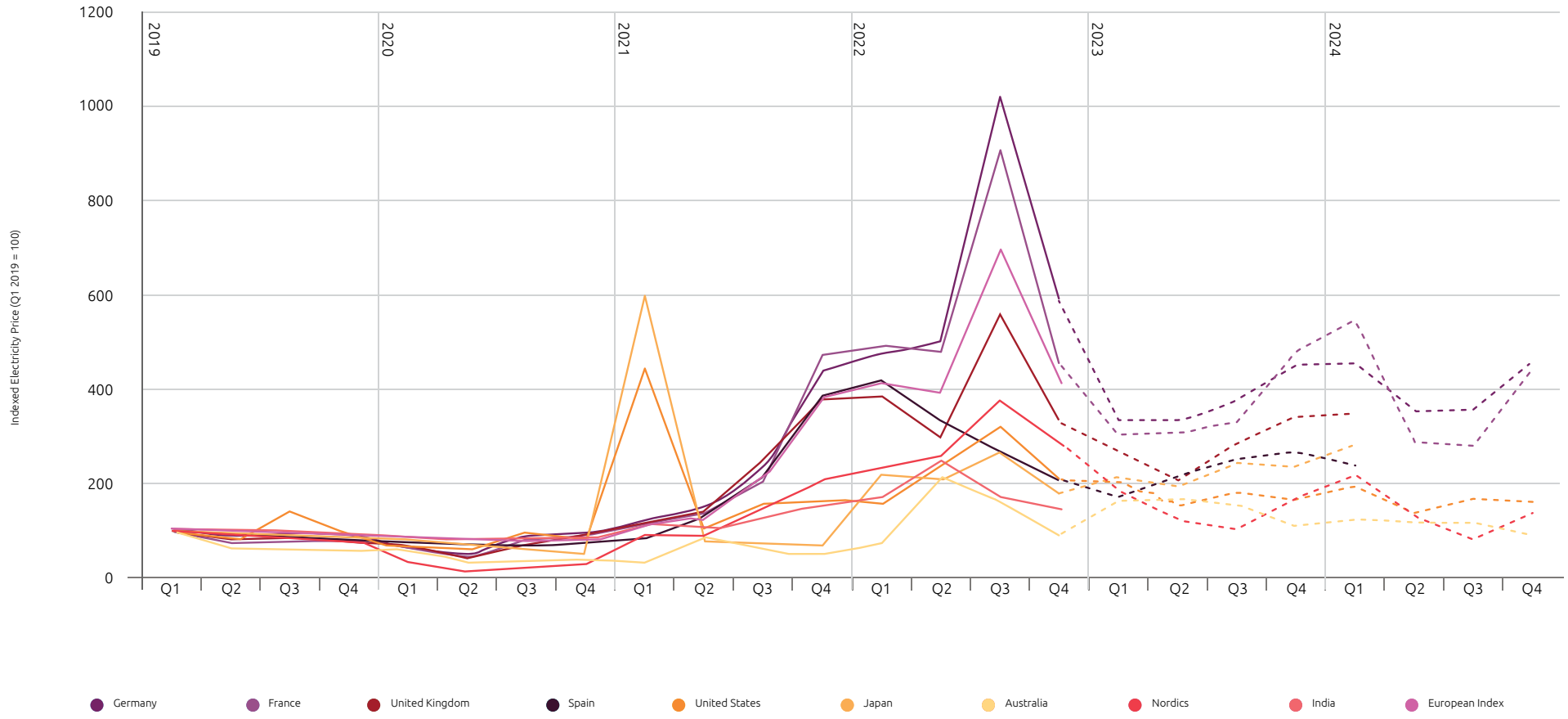
In the United States, the average wholesale price in H2 2022 stood at about $91/MWh, more than twice the 2019-2021 second-half average and 65% higher than the price in H2 2021. This increase was driven by exceptionally high gas prices.

In 2022, Australian wholesale prices averaged AUD $170/MWh, more than double the H2 2021 levels. This was due to surging electricity demand and gas prices.

In India, despite increased coal stocks, higher electricity consumption resulted in a 10% price rise in H2 2022 over the H2 2021 level. The average wholesale price in H2 2022 was INR 5000/MWh (€55/MWh). The strong growth of solar photovoltaic (PV) helped to meet peak loads driven by higher refrigeration and space cooling.

FIGURE 3

Indexed quarterly average wholesale Electricity prices for selected regions, 2019-2024 (EUR/MWh)



Source: IEA, EIA, Eurostat

Supply chain pressure, higher fuel costs and extreme temperature drove the increase of U.S. energy prices

In 2022, the retail price for electricity in the United States stood at an average of 12.5 cents per kilowatt-hour. Average electricity prices for the residential sector were 15.1 cents per kilowatt-hour; the commercial sector was 12.5 cents per kilowatt-hour; and the industrial sector was 8.5 cents per kilowatt-hour.

According to EIA, average price of electricity to U.S. residential customers will increase by 4% in 2023 to 15.7 cents/kWh. Electricity prices rose about 11% in 2022 to 15.1 cents/kWh due to increases in the cost of producing electricity. Reductions in the wholesale price of electricity, largely due to lower natural gas prices in 2023, should help lower residential prices in the future.

In nominal terms, the average monthly electricity bill for residential customers in the United States increased 13% from 2021 to 2022, rising from $121 a month to $137 a month. After adjusting for inflation—which reached 8% in 2022, a 40-year high—electricity bills increased by 5%. A colder winter and a hotter summer contributed to the 2% increase in average monthly electricity consumption per residential customer in 2022. Customers used more space heating during the winter and more air conditioning during the summer.

The cost of fossil fuels (natural gas, coal, and petroleum) delivered to U.S. power plants increased 34%, from $3.82 per million British thermal units (MMBtu) in 2021 to $5.13/MMBtu in 2022. The higher fuel costs were passed along to residential customers and contributed to higher retail electricity prices.

Natural gas prices and consumption increased due to hot weather and rise in air conditioning demand. In 2023, natural gas prices for the electric power sector have averaged about $2.65/MMBtu from June through August 2023, making natural gas a more competitive source of electricity generation compared with coal. In addition, several new natural gas-fired power plants entered service in 2022 and 2023, which increased the electric generation capacity available from natural gas. In 2024, the Henry Hub natural gas spot price could rise by almost 30% over 2023 to an average of about $3.40/MMBtu.

FIGURE 4

U.S. Monthly nominal residential electricity price

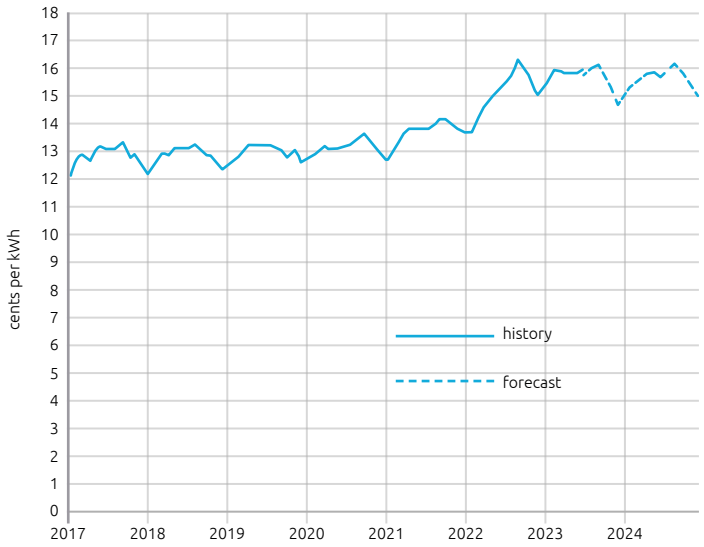
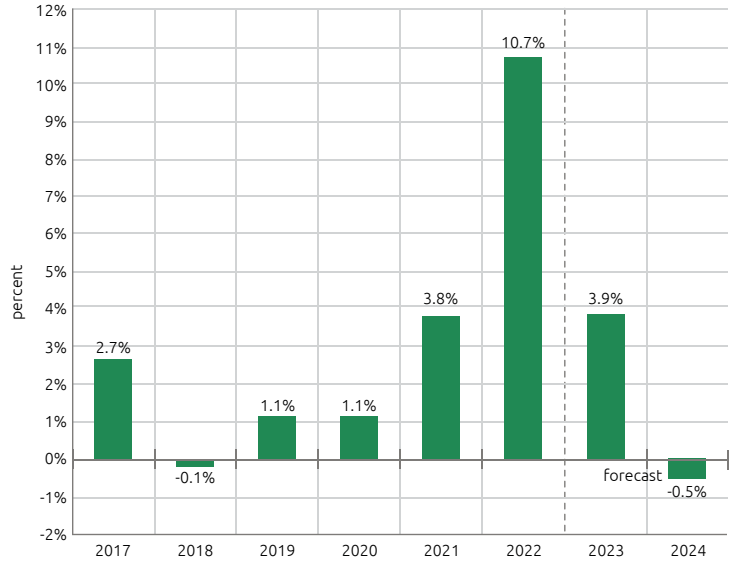


FIGURE 5

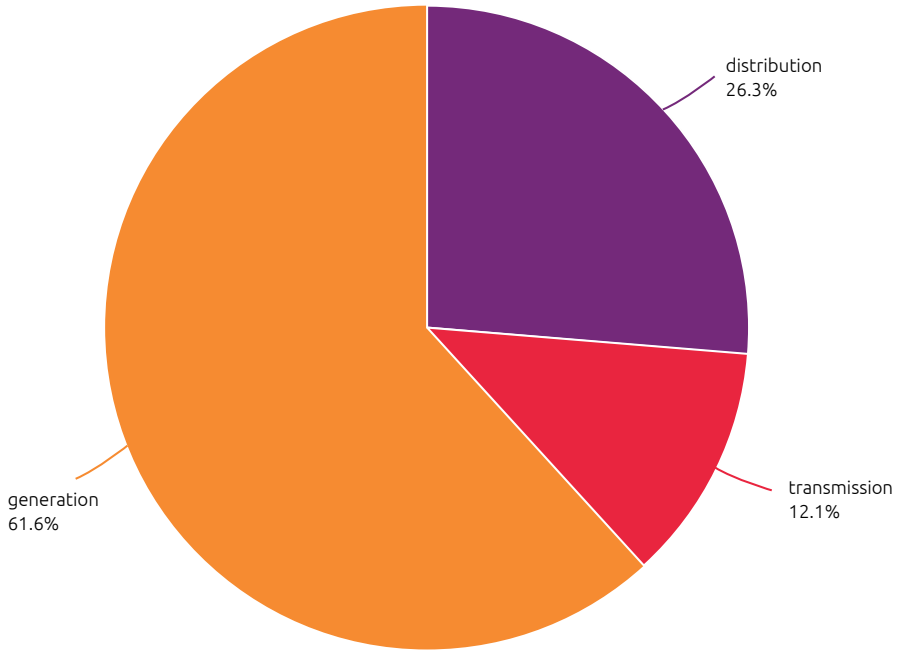
Annual growth in nominal residential electricity prices



Data Source: U.S. Energy Information Administration, Short-term Energy Outlook, June 2023

FIGURE 6

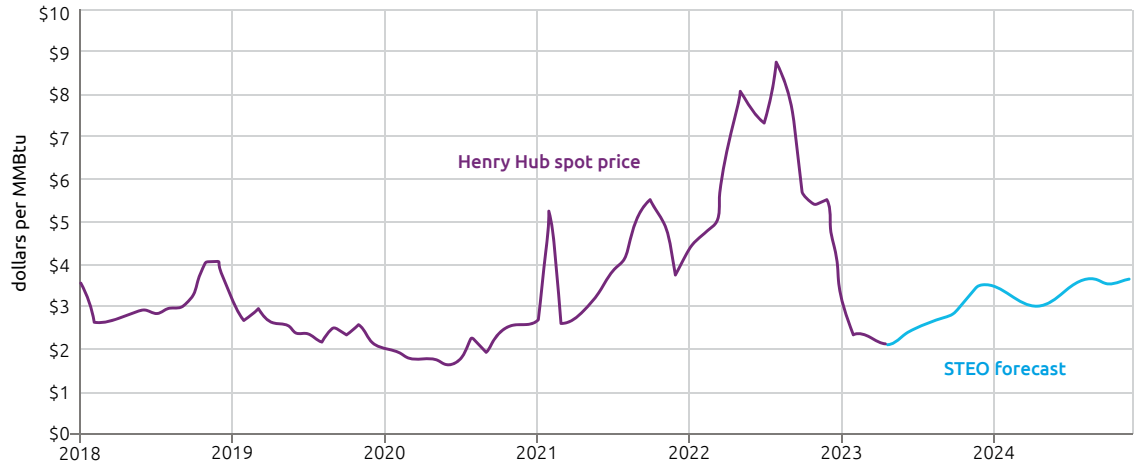
Major components of U.S. average electricity price (2022)



Source: IEA

FIGURE 7

Henry Hub natural gas spot price



Data source: U.S. Energy Information Administration, Short-Term Energy Outlook, June 2023 and Refinitiv, an LSEG Business

Development of European Electricity and Gas prices in H1 2022

The price of energy in Europe depends on a range of different supply and demand conditions, including the geopolitical situation, the national energy mix, import diversification, network costs, environmental protection costs, severe weather conditions, and levels of excise and taxation.

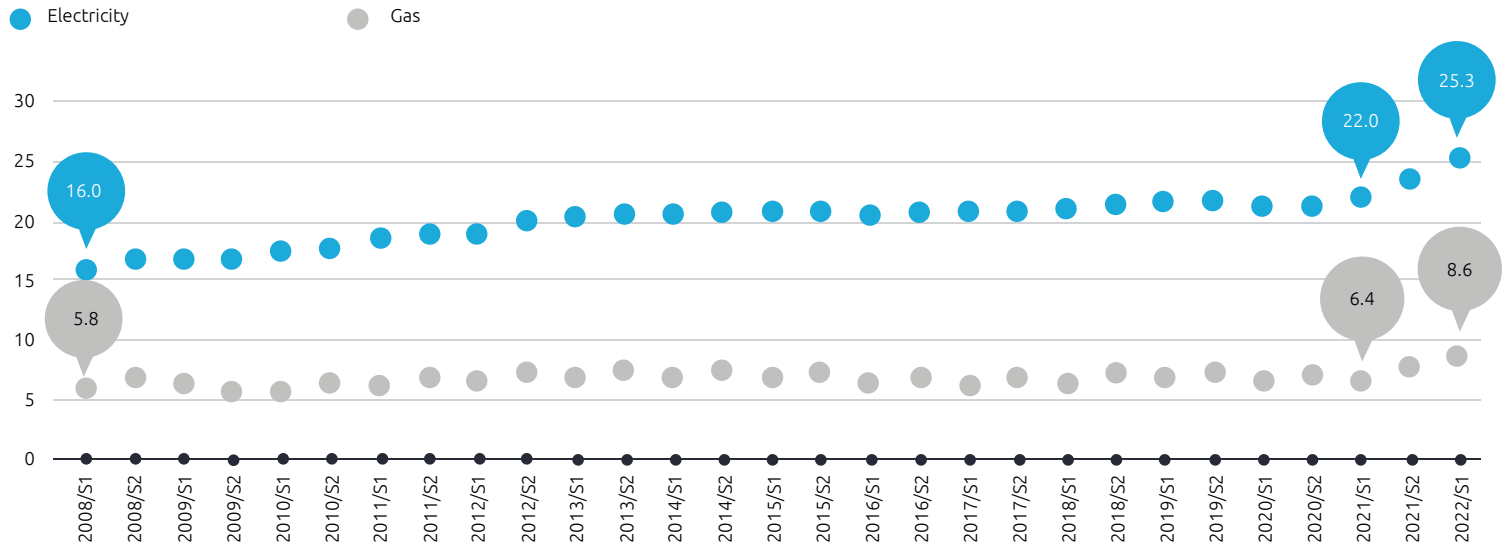
In the first half of 2022, average household electricity prices increased sharply compared to the same period in 2021, from €0.22 per kWh to €0.25 per kWh. Average gas prices also increased compared to the same period in 2021, from €0.06 per kWh to €0.8 per kWh in the first half of 2022.

In the first half of 2022, the weight of taxes and levies in the final electricity and gas bills charged to households decreased significantly when compared to the previous year. This was due to governmental allowances and subsidies implemented to mitigate the high-energy costs. Compared with the first half of 2021, the share of taxes in an electricity bill dropped sharply from 39% to 24% (-15.5%) and in gas bills from 36% to 27% (-8.6%).

Household electricity prices rose in 22 European Union member states in the first half of 2022, as compared to the first half of 2021. The largest increase (expressed in national currencies) was registered in Czech Republic (+62%), Latvia (+59%), and Denmark (+57%). Decreases in household electricity prices in the Netherlands, Slovenia, and Poland were connected to government subsidies and allowances; in Hungary, prices are regulated.

FIGURE 8

Evolution of household electricity and gas prices in the EU
(in € per 100 kWh, all taxes and levies included)



Gas prices surged the most in Estonia (+154%), Lithuania (+110%), and Bulgaria (+108%), mainly driven by the cost of energy. Average household gas prices (€ per 100 kWh) in the first half of 2022 were the lowest in Hungary (€2.9), Croatia (€4.1), and Latvia (€4.6). They were highest in Sweden (€22.2), Denmark (€16.0), and the Netherlands (€12.9).

Development of European household and non-household electricity prices in H2 2022

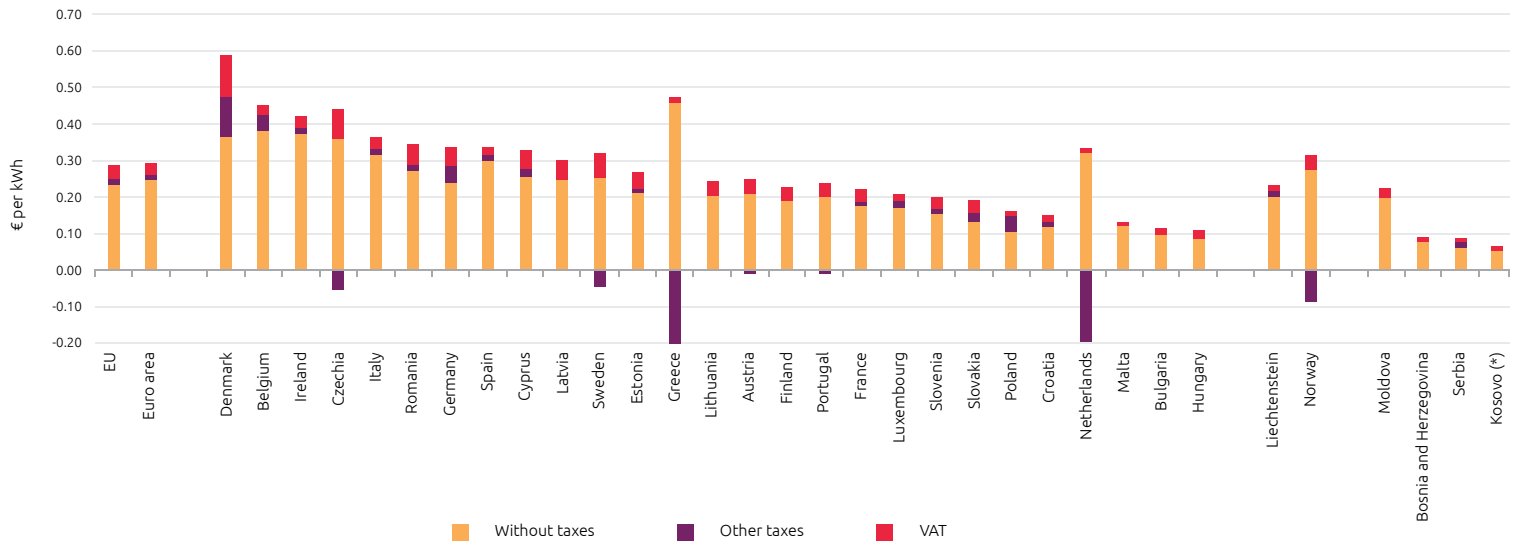
For household consumers in Europe, electricity prices in the second half of 2022 were highest in Denmark (€0.58 per kWh), Belgium (€0.44 per kWh), Ireland (€0.41 per kWh), and Czech Republic (€0.38 per kWh). Energy and supply costs mainly drove the increase. The lowest electricity prices were registered in Hungary (€0.10 per kWh) and Bulgaria (€0.11 per kWh). The average price in the second half of 2022 for electricity by household consumers was €0.28 per kWh.

Various countries opted for measures like reducing taxes and fees, temporary tax waivers to consumers, price caps, providing lump sum support, or allocating vouchers to final consumers; some countries applied regulated prices. The share of taxes in the second half of 2022 was the least in the Netherlands, where the values were, in fact, negative (-136.8%). The Netherlands gave allowances with the most impact to household consumers.

In the Netherlands, electricity prices for household consumers without government intervention, taxes and levies would have been €0.21 and €0.32 per kWh in H1 and H2 of 2022. Also, for Greece, electricity prices for household consumers without government intervention, taxes, and levies would have been €0.30 and €0.45 per kWh in H1 and H2 of 2022. The relative share of taxes was highest in Denmark, making up 38% of the total price. The average share of taxes and levies at the regional level was 15.5%. VAT represented 13% of the total price.

FIGURE 9

Electricity prices for household consumers, second half 2022



(1) This designation is without prejudice to position on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.
Source: Euarostat (online data codes: nrg_pc_204)

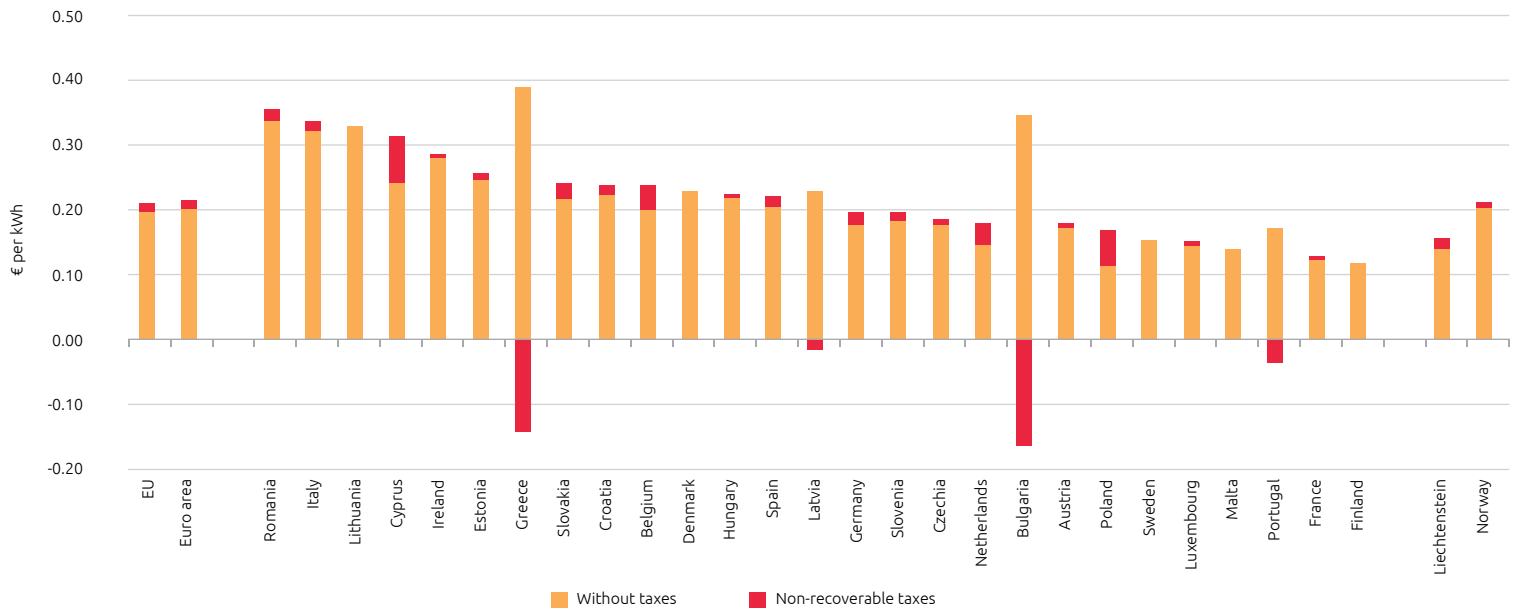
Electricity prices in the second half of 2022 for non-household consumers were highest in Romania (€0.35 per kWh) and Italy (€0.33 per kWh). The lowest prices were observed in Finland (€0.11 per kWh) and France (€0.12 per kWh). The average price in the second half of 2022 was €0.21 per kWh.

Proportion of non-recoverable taxes and levies on the overall electricity price for non-household consumers

In the second half of 2022, the share of taxes was highest in Poland and Cyprus, where non-recoverable taxes and levies made up 34.1% and 22.7% of the total price, respectively. The share of taxes for the European Union stood at 5.6%, a substantial decrease compared to the first half of 2022 (12.6%).

FIGURE 10

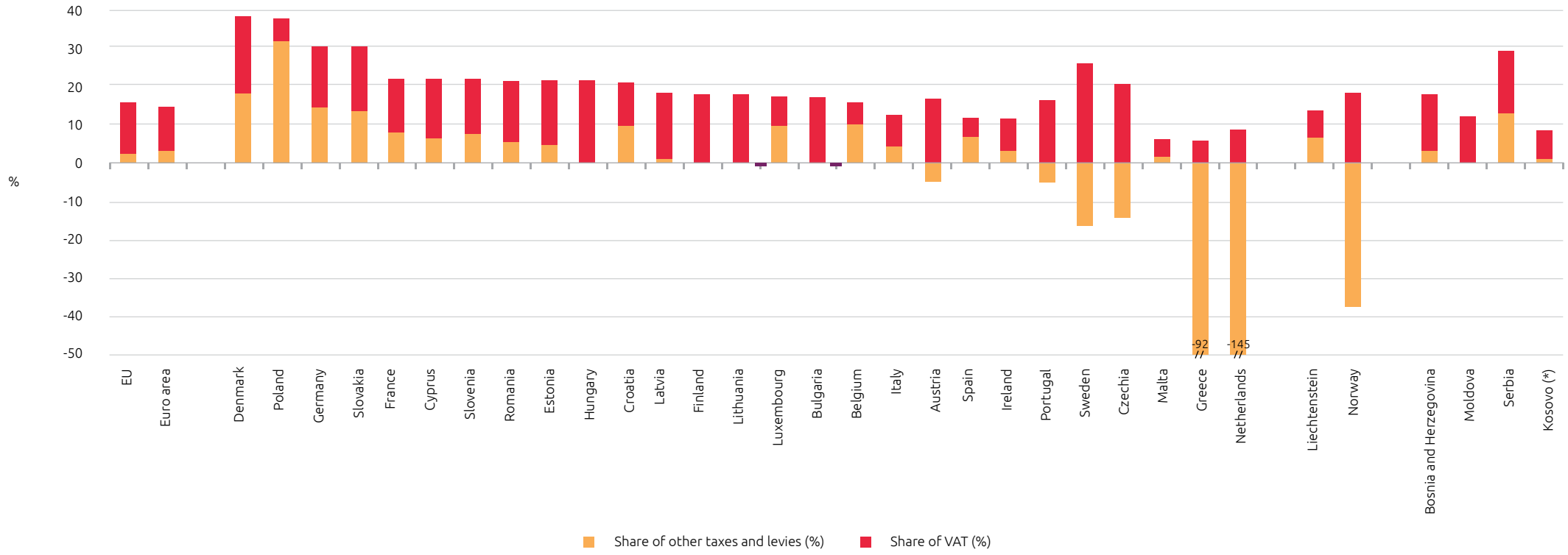
Electricity prices for non-household consumers, second half 2022



(1) This designation is without prejudice to position on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.
Source: Euarostat (online data codes: nrg_pc_205)

FIGURE 11

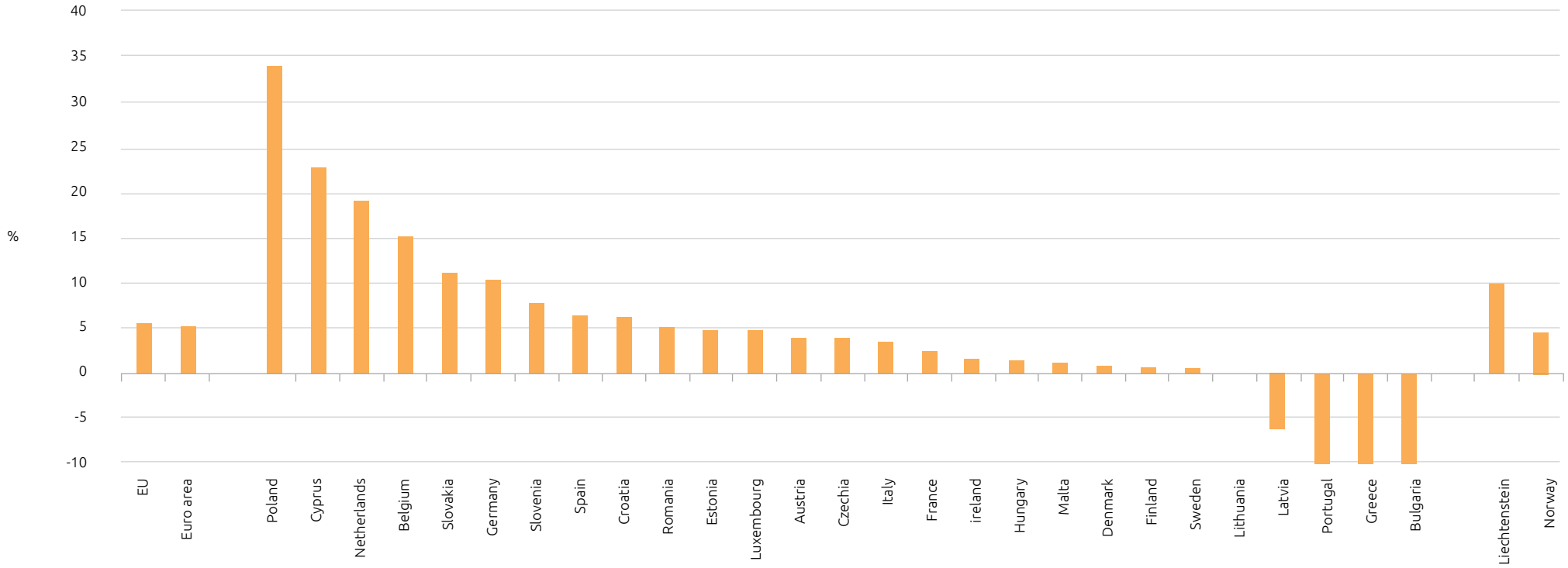
Share of taxes and levies paid by household consumers for electricity, second half 2022



(1) This designation is without prejudice to position on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.
Source: Euarostat (online data codes: nrg_pc_204)

FIGURE 12

Share of taxes and levies paid by non-household consumers for electricity, second half 2022



(1) This designation is without prejudice to position on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.
Source: Euarostat (online data codes: nrg_pc_205)

Development of European household and non-household gas prices in H2 2022

For household consumers, natural gas prices in the second half of 2022 were the highest in Sweden, Denmark, and the Netherlands and lowest in Hungary, Croatia, and Slovakia. The price of natural gas for households in Sweden (€0.2751 per kWh) was more than seven times the price charged in Hungary (€0.0349 per kWh) and 157% higher than the regional average price. The average price for natural gas consumption by household consumers in the EU in the second half of 2022 was €0.1137 per kWh.

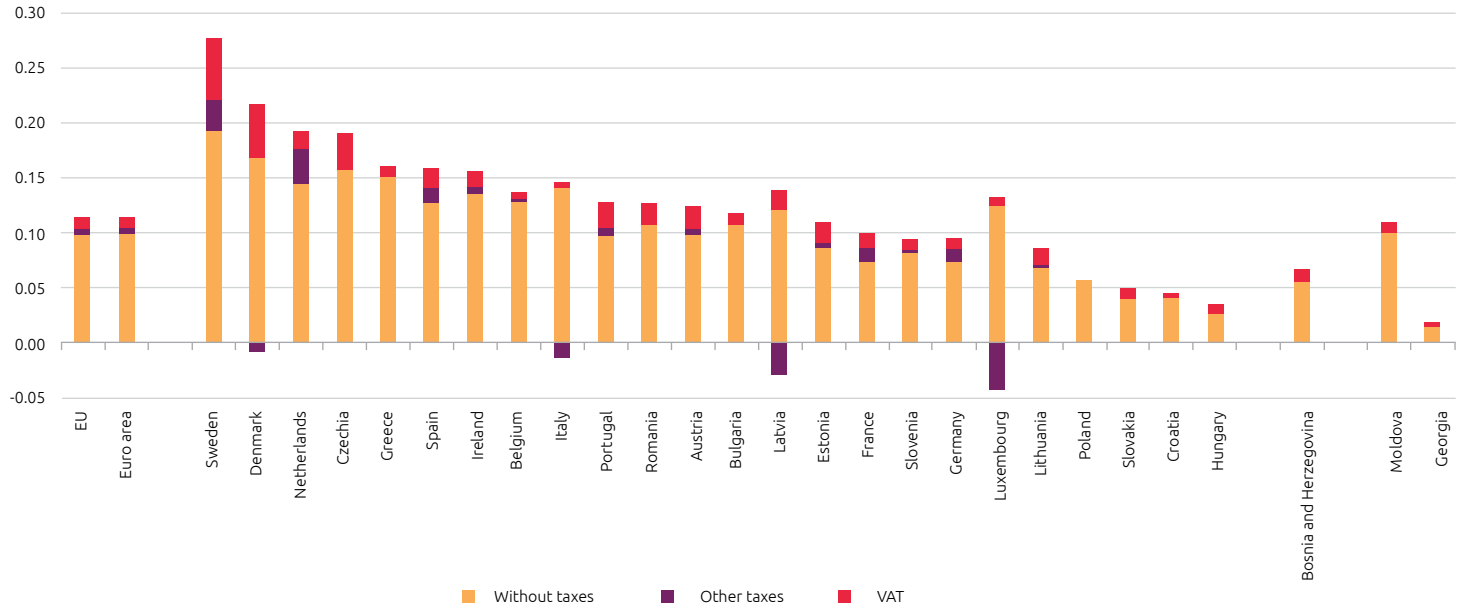
Gas prices for non-household consumers in the second half of 2022 were highest in Finland (€0.1815 per kWh), at more than twice the regional average, followed by Sweden (€0.1662 per kWh). Finland and Sweden have very little natural gas consumption. The lowest prices were recorded in Germany (€0.0613 per kWh). The average price for natural gas consumption by non-household consumers was €0.0812 per kWh.

Taxes and levies paid by household customers for natural gas in H2 2022 were the lowest in Luxembourg. The highest taxes were observed in Sweden, where taxes and levies corresponded to 30.06% of the final price. In the Netherlands, this percentage was 25.71%. The VAT represented 9.67% of the total price. The share of VAT in the total price ranged from 0% in Poland to 23.85% in Denmark.

For non-household consumers, the share of these non-recoverable taxes in the second half of 2022 was 16.6% in Sweden, 15.2% in Germany, and 12.2% in the Netherlands. Greece (-13.7%), Romania (0.5%), and Bulgaria (0.9%) found themselves at the other end of the spectrum, registering the lowest shares of taxes.

FIGURE 12

Natural gas prices for household consumers, second half 2022



Source: IEA, EIA, Eurostat

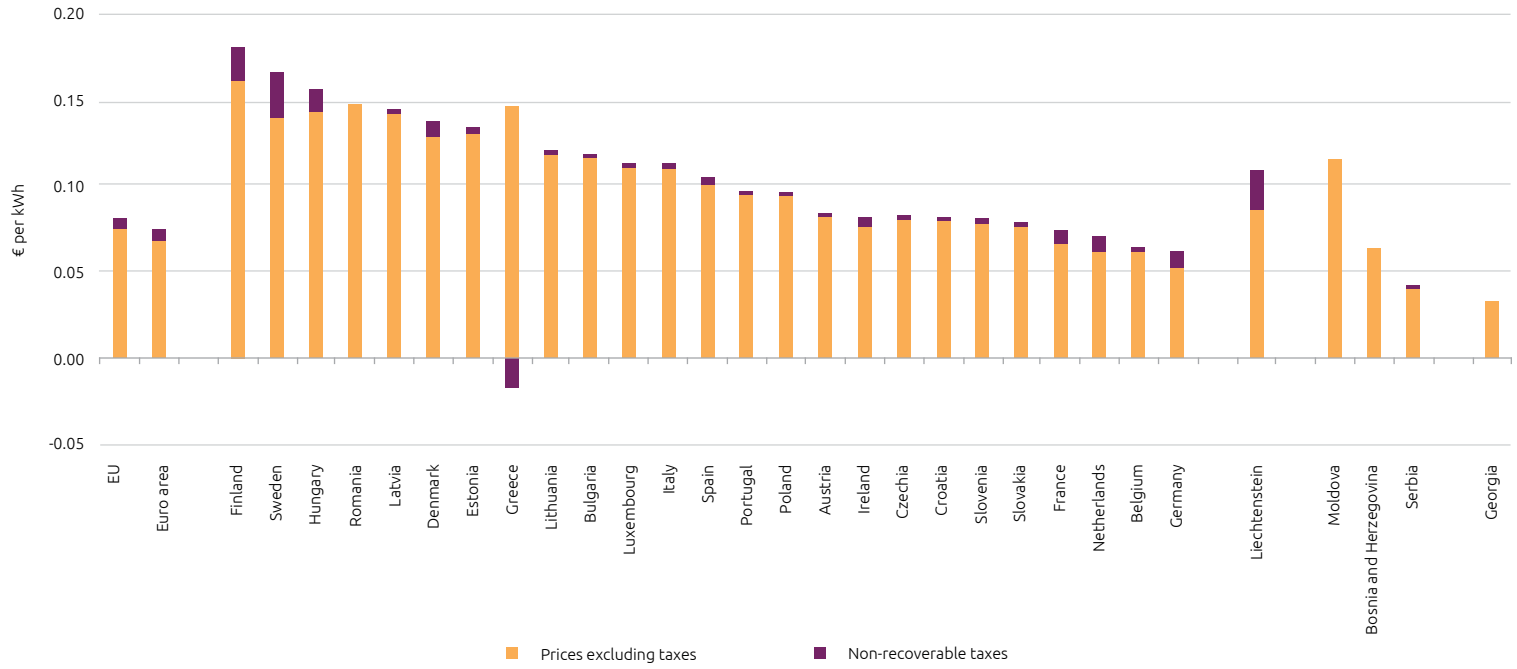
In addition to immediate and temporary measures aimed at lowering prices for energy consumers, European policymakers and regulators are considering several longer-term options to fundamentally reform how the European Union energy market operates and balance the three dimensions of security, affordability, and sustainability. Long-term redesigns of Europe's power market are considered critical to avoiding future price volatility, balancing the needs of consumers and producers, and bolstering investment in new generation capacity.

Since the start of 2023 alone, governments have announced a further $300 billion in short-term consumer affordability measures as households continue to face extremely high energy bills. However, nearly 75% of the support mobilized since the start of the global energy crisis was made available to all consumers, despite calls that the measures would be better targeted to low-income households.

Most of the affordability measures and support were concentrated in Europe and other advanced economies. Affordability will continue to be a challenge for emerging and developing economies.

FIGURE 13

Natural gas prices for non-household consumers, second half 2022



Source: IEA, EIA, Eurostat

Reduced taxes on petrol and diesel in countries across all continents pushed fossil fuel consumption subsidies to an all-time high in 2022. While these measures were mostly temporary in advanced economies, a range of emerging and developing economies continued to provide long-standing subsidies for transport fuels and electricity. Many governments are committed to phasing out fossil fuel subsidies, while financial pressures have pushed some governments to promptly reduce support.

The considerable volume of support measures is not only intensifying financial pressures on governments but also on utilities, most of which cannot pass their higher costs through to consumers. In the medium term, some utilities might raise tariffs to recoup losses that occurred during the energy crisis. However, some energy companies, particularly oil and gas producers, have made substantial windfall profits in 2022. Consequently, some governments have implemented ad-hoc levies on these gains to finance their affordability measures.

However, market reform or design doesn't ensure affordable electricity prices for end users and doesn't promote specifically low carbon energy (renewable and nuclear) energy sources. Thus, it's critical to speed up the clean energy transition by increasing investment in additional low carbon power generation and supply. **Renewable energy such as Wind, PV Solar, as well as new nuclear reactors also need significant upfront capital expenditure to build the assets. Hence to attract necessary investment into low carbon technologies, market design and reform must ensure price certainty and predictability for investors.**

FIGURE 14

Share of taxes and levies paid by household consumers for natural gas, second half 2022

Source: IEA, EIA, Eurostat

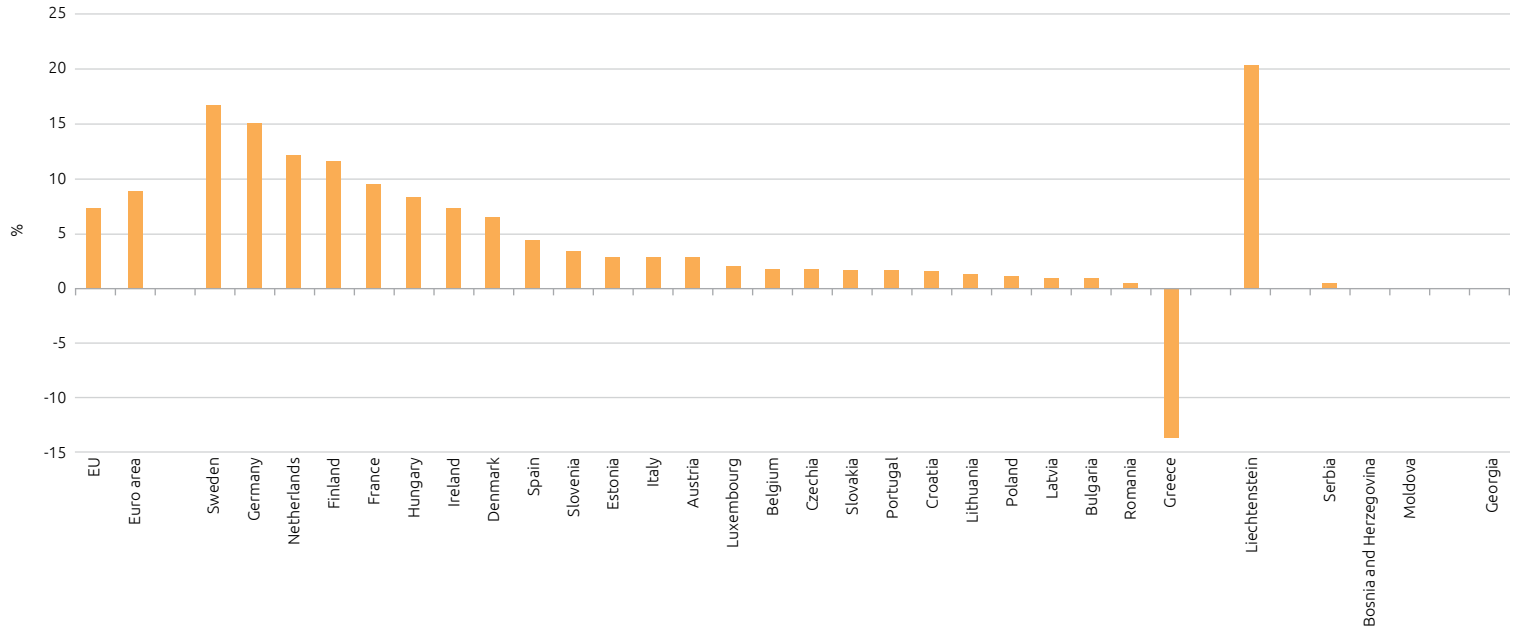
If renewables depend on short-term market price signals, investment will be costly and risky. Furthermore, if the revenues from renewables are subject to market price volatility, investors will be uncertain about their cash flows, leading to higher capital costs. High market volatility is unfavorable for attracting investments in generations with low marginal costs and high upfront capital costs. Hence, there is a strong need to redesign the current electricity market specifically for the European Union. Nuclear reactors of any type – including small modular reactors (SMRs) and European pressurized water reactors (EPRs) represent a huge investment for multiple decades (almost 100 years from the decision to the decommissioning/dismantling). These investments must be secured.

The reform of the region's electricity market design is aimed at maintaining the advantages of a single integrated European electricity market, while also gradually reducing the cost of energy production and usage with renewable sources. Additionally, some countries that are supportive of nuclear power may see the introduction of new nuclear. This is also expected to improve the access to markets to more stable longer-term contracts through Power Purchase Agreements (PPAs), which can drive investments in renewables, as well as secure long-term prices for large consumers. The CfD (two-way Contracts for Difference), where member states guarantee a stable price to producers and consumers, will foster support for new low-carbon energy investment.

PPA and CfD instruments will be key to enhancing the stability and predictability of energy costs across the European Union and, therefore, essential in boosting its competitiveness.

FIGURE 15

Share of taxes and levies paid by non-household consumers for natural gas, second half 2022



Source: IEA, EIA, Eurostat

HOW DID EUROPEAN GOVERNMENTS REACT TO THE BIGGEST ENERGY CRISIS OF THE CENTURY?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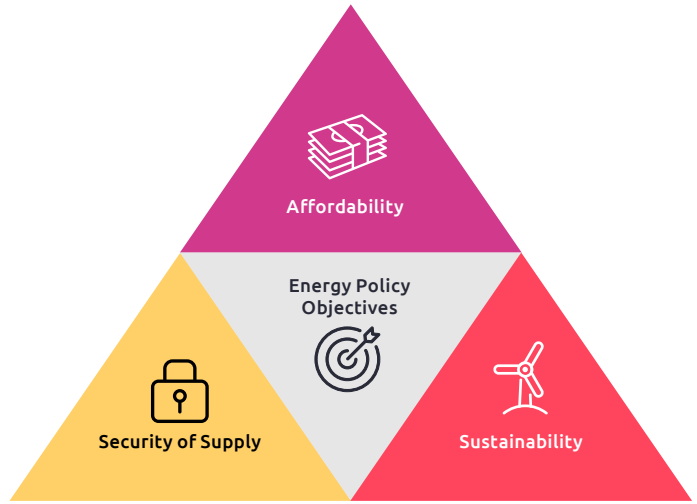
Facing Russia's invasion

Putin's war on Ukraine revealed Europe's strong dependence on Russian fossil fuels by causing turmoil in energy markets. To regain control over the energy market and price hikes, the European Union (EU) and more individual countries decided to intervene with important measures. These measures intended to diminish the effect of the energy crisis by pursuing three main goals: ensuring the security of electricity and gas supply, making sure people had the ability to pay their electricity and gas bills, and pushing Europe's green transition by accelerating the expansion of renewable energy.

Energy prices experienced an all-time high in 2022 mainly because of Russia's invasion of Ukraine, but it was not the only reason. Prices were already increasing in Europe and the war was only the third step of four successive crises. Indeed, during COVID period the demand collapsed, and the recovery plans made the demand boom and endanger the security of supply and value chain disruptions. After Russia's invasion, the inflation and interest rates increased the price of any asset, having an impact on energy and electricity prices. On top of that, in 2022, the reduction of hydropower due to droughts and French nuclear power outages, added to the high energy prices. In fact, the wholesale price of electricity in the EU countries is based on the Merit Order, which links supply and demand. When the demand is very high, the power plants with the highest cost of production are the ones determining the market price. This establishes a relationship between the wholesale electricity price and the price of natural gas, which is mostly imported into the EU. Consequently, the reduction of Russian gas supplies in Europe strongly affected the price of natural gas, the price of electricity overall and made the market very volatile, as gas-fired powerplants provide flexibility when adjusting supply and demand. Most importantly, the uncertainty of not achieving enough gas supplies for the approaching winter of 2022 threatened Europe.

FIGURE 1

The measures taken by the EU and individual countries during the energy crisis followed the three main goals of energy policy:
Energy policy triangle



As a response, the European Commission and other countries like the United Kingdom (UK) acted immediately, adopting several emergency regulations to address the high prices, secure gas supplies, and support citizens and businesses strongly affected by the energy crisis. In this article, the regulations taken by the EU, its member states, and other countries are illustrated, explained, and compared to provide a general picture of the exceptional state interventions taken since March 2022.

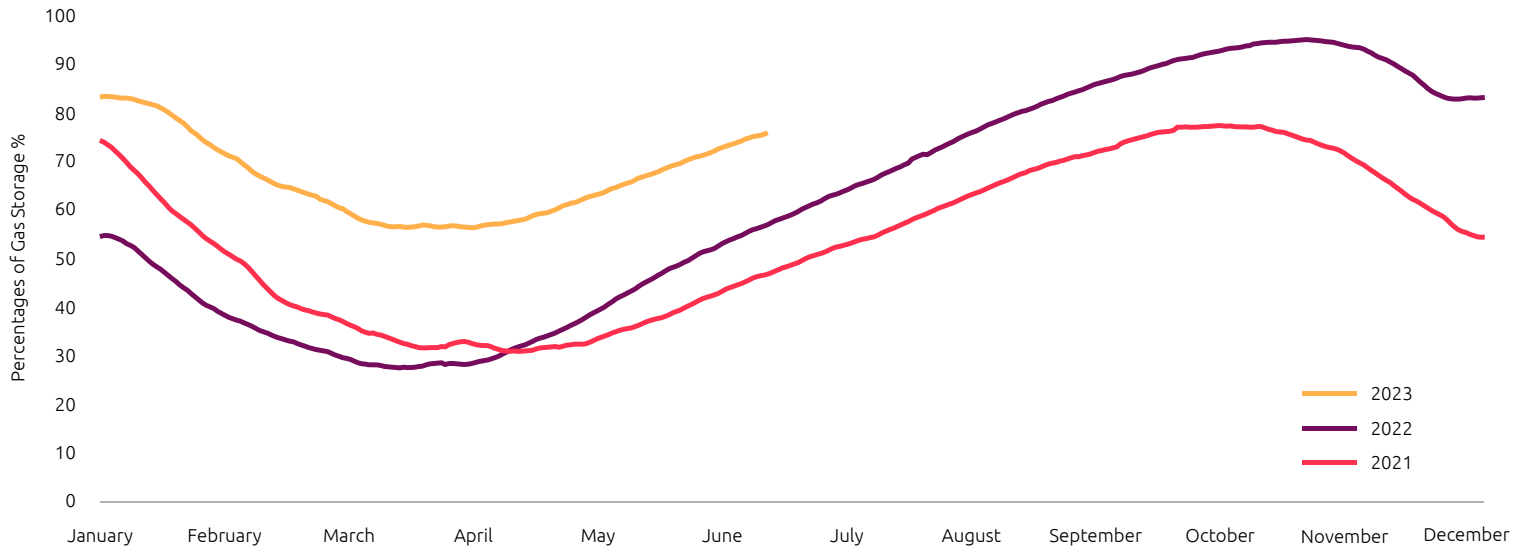
Both generally and in times of crisis, energy policy pursues three main goals - security of supply, affordability, and sustainability. Even though the three goals can be hard to reconcile, all of them must be addressed and balanced. The measures taken as a response to the energy crisis that erupted in 2022 can be organized along this energy policy triangle.

Security of Supply:

Following the escalation of the war, the biggest fear of governments was the short- and long-term security of supply, with the possibility of gas shortages happening in the following winter. Russia, as the main fossil fuel provider in Europe up until 2022, threatened to cut supplies (and later indeed did so). To address this threat and become less dependent on single suppliers, the EU made it a priority to diversify its gas supplies, supporting the efforts of individual countries to generate new sources and intensify existing ones, and coordinating joint purchases. Increased supplies from established gas producers like the **US, Norway, and the UK compensated for a large share of Russian imports.** To a large extent, new supplies came in the form of liquefied natural gas (LNG): LNG imports in the EU rose by 60% in 2022 compared to 2021. The necessary infrastructure was yet to be built in many cases, like in Germany, where the government worked together with the private sector and managed to charter and connect the first Floating Storage and Regasification Unit (FSRU) in a record time of just under 10 months. Another goal was to increase gas storage levels as much as possible to ensure Europe had enough supply to get through the winter. On June 27, 2022, the Commission introduced the **Gas Storage Regulation,** requiring all EU countries to fill gas storage facilities to 80% by November 1, 2022, and 90% in the years to follow.

FIGURE 2

Gas storage levels in Europe



Source: Aggregated Gas Storage Inventory EU

Europe filled up gas storage tanks to 95% of their full capacity by November 2022, increasing significantly the storage compared to 2021

In the UK, the government decided to increase domestic gas production and increase LNG deliveries in Q4 2022 as well as reopen gas storage facilities to face the winter.

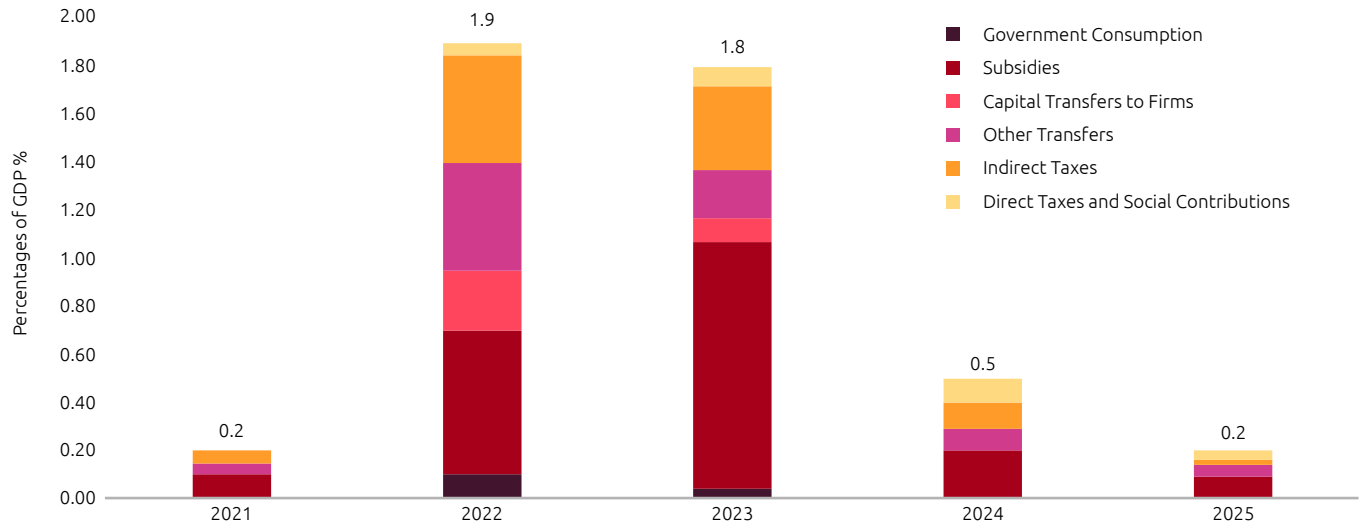
Ensuring the security of supply in Europe included not only great efforts on diversified supply and increased storage but also on savings and demand reduction. Many countries introduced a mix of sobriety measures, including reduced heating of public buildings and facilities, reduced lighting of monuments, and tax incentives to lower consumption, complemented by public campaigns. Besides these governmental stipulations, high prices in the market, as well as ethical reasons had an impact on consumption. On July 20, 2022, the European Commission published a communication called **"Save gas for a safe winter"**, which included demand reduction measures aimed at all citizens and small businesses with the target of reducing gas demand by 15%. After that, on August 5, 2022, the **Regulation on Coordinated Demand Reduction Measures** for gas was published, valid until March 30, 2023, when it was prolonged to ensure a demand reduction of 15% for another 12 months. Targets were exceeded: this winter gas consumption in the EU dropped by almost 20% with the largest savings registered in Finland (–57.3%), Lithuania (–47.9%), and Sweden (–40.2%).

The last steps taken in the battle against a shortage of supply were announced on December 2022, when the EU Commission launched a new mechanism called **AggregateEU.** This regulation was aimed at companies and allowed demand aggregation and joint gas purchases through a new trading platform. The results were seen immediately when the regulation went live on May 2023, where up to 63 European companies submitted requests for a total of 11.625 billion cubic meters (bcm) of gas demand. All international gas suppliers except Russia were allowed to submit tender bids.

While it is hard to attribute gas savings to the different causes over time, analyses show that both industrial and small consumers significantly reduced consumption already before obligations came into force, pointing to market-induced effects. The International Energy Agency (IEA) **estimates** that in the buildings sector, behavioral changes were responsible for gas savings of as much as 7bcm, second just to weather effects (18bcm).

FIGURE 3

Size of fiscal support and composition by instrument with a projection horizon of three years



Source: European Central Bank

Affordability:

The most dramatic consequences of the stratospheric electricity prices were suffered by small companies and low-income households, which found themselves struggling to pay their energy bills at the end of the month. To take away some of the price pressure, the EU and individual countries drastically intervened in the market. The EU increased the percentage of GDP used for fiscal policies in 2022 by 1.7% compared to 2021, where the biggest percentage corresponds to an increase in subsidies and a reduction in indirect taxes to alleviate the pressure caused by the energy crisis and high inflation. These fiscal policies are also significant in 2023 but should start decreasing from 2024 onwards, reaching the original value of only 0.2% of the European GDP in 2025.

Even before the escalation of the war in Ukraine, France introduced an "energy price freeze" in 2021, along with one-off payments for low-income households, to face rising energy prices and overall inflation. This group of measures called the "tariff shield" resulted in a reduction of inflation effects. Without these measures, the inflation between the second quarter of 2021 and 2022 would have nearly doubled. When the war escalated in February 2022, many countries followed the same pattern and started freezing energy prices.

With winter within sight, the EU Commission decided to adopt a new emergency intervention to address the high energy prices on October 6, 2022. A temporary **revenue cap on electricity producers was installed (180€/MWh),** which mainly affected low-cost energy producers like renewables, lignite, and nuclear, as they were the ones profiting the most from high electricity prices.

In addition, excess profits from oil, gas, coal, and refinery companies were taxed by the individual EU countries and redirected to energy consumers as a solidarity measure. To ensure small businesses had resources and recommendations on how to tackle the crisis, the IEA teamed up with the EU Commission and published a recommendation newsletter called "Coping with the crisis" on October 21, 2022. The report included EU support measures which were made available for small businesses and step-by-step explanations on how to become more energy efficient and wise, making them more resilient and secure against the crisis.

In addition, on December 19, 2022, the EU Commission proposed a new regulation to ensure affordability: the Market Correction Mechanism. The regulation comprised a mechanism to control the gas market, ensuring the Title Transfer Facility (TTF) was below a certain cap price and comparing it to the reference base price for LNG imports. This ensured volatile gas prices were controlled and the measure was extended on March 31, 2023, to trading applications other than the TTF.

With respect to additional measures taken by individual countries, the UK launched several packages to help deal with high prices. In fact, the International Monetary Fund said last year that British households have been the worst hit in Western Europe because of the high dependence on gas. To face this the Government introduced the Energy Bills Support Scheme (EBSS), the Energy Price Guarantee (EPG) for domestic households and business customers, and a general Price Cap calculated by Ofgem. The EBSS, was first implemented by the Government and included a £400 discount on every household's energy bill for winter 2022 to 2023. In addition, the government's EPG subsidy which limited the unit electricity and gas price was implemented in October 2022 and has been prolonged until March 2024. Until June 2023, this measure limited the average household bill to £2500 a year, which was below the £3280 set by the Price Cap, but as of July 1, 2023, the Price Cap fell for the first time under the EPG limiting electricity prices to £2074. According to the UK government, without the implemented domestic schemes and price guarantees, the typical household dual energy bill would have more than tripled between October 2021 and January 2023.

FIGURE 4

European Union Regulation timeline

Source: European Commission

Sustainability:

The longer-term response to Russia's invasion of Ukraine was to accelerate the transformation of Europe's energy system by increasing the share of renewables in the electricity mix as much as possible, to break the reliance on Russian fossil fuels while also pursuing the climate and energy targets. The Commission proposed the increase of EU's 2030 target for renewable energy (RE) from 40% to 45% and launched the **REPowerPlan.** The **REPowerEU Communication** was presented on the 8th of March 2022 and contained a comprehensive set of actions intended to save energy resources, expand RE generation, and diversify Europe's energy supplies. With this strategy, the total RE generation capacities would be pushed to 1236 GW by 2030 from 570 GW in 2022, increasing substantially the target in the Fit-for-55 strategy (1067 GW). To meet the higher targets imposed by this new plan, the Commission needed to complement it with measures to accelerate RE deployment. A new temporary regulation was proposed to reduce the time taken for the permit granting in solar energy, repowering of RE plants, and heat pumps installations called the **Emergency Regulation to Accelerate Renewable Energy Permitting** on December 19, 2022.

Besides enhancing sustainability, boosting RE expansion had the aim to increase energy sovereignty, by ramping up electricity sources within Europe. With an increasing RE share and the gradual electrification of other sectors, the EU hopes to depend less on foreign suppliers to cover their future energy needs.

In 2022 wind and solar energy generated a fifth of the EU electricity demand (22%) for the first time, reaching an important milestone

Regarding the heating and cooling systems in the EU, where Russian gas and fossil fuels have always played an important role, the EU had already taken measures before the conflict with a modification of the Energy Efficiency Directive (EED) in July 2021. This established greater energy efficiency targets for the EU as well as decarbonizing heating and cooling systems with electrification, heat pumps, and new energies by 2050. In March 2023, the European Parliament also published a new 11.7% energy efficiency target for 2030. The high electrification demand expected when fossil fuels stop being the main source for heating and cooling in Europe only stresses the importance of accelerating renewable energy sources and deployment for a long-term energy transition.

Individual countries, too, decided to boost renewables expansion as a solution to the energy crisis by setting higher targets and simplifying bureaucratic processes. However, some of them (e.g., Germany) resorted to stronger use of coal as well. While the aim to strengthen the security of supply may have been fulfilled, it was a major setback from a climate perspective to bring back GHG-heavy coal plants out of retirement. Similarly, research activity for alternative gas sources like hydrogen increased across the globe.

High energy prices and gas scarcity were beaten thanks to a combination of government regulations and behavioral changes from market consumers

The EU and its member states addressed all three pillars of the energy policy triangle. The most immediate market interventions happened regarding the security of supply and affordability, where governments decided to diversify gas supplies and implement affordable prices. In some cases, effects were quickly visible, e.g., regarding increased LNG imports and the build-up of the necessary infrastructure. In other cases, like gas savings, the impact of market behavioral changes appears to have been at least as strong as by policy, as the objectives were not only reached but surpassed significantly. On affordability, early price caps and one-off payments helped to reduce the price pressure on consumers, but many other measures, like the EU-wide price cap, were introduced when the worst was already over.

The energy crisis of 2022 and the actions taken by governments revealed once again that the three aspects of the energy policy triangle can pose a “trilemma” and have a complex relationship. For instance, the price hikes that hardly hit many consumers had a positive impact on security of supply by incentivizing saving gas. Similarly, the (limited) revival of coal power helped increase security of supply but was a drawback for sustainability. Beyond the trilemma, governments were and are aiming at regaining energy sovereignty, to which the accelerated RE deployment and diversified supplies are hoped to contribute.

In summary, governments took extraordinary measures in the face of extraordinary problems in the energy market. The repercussions of the energy crisis, which may not have been entirely foreseeable, provided some lessons to be learned for politics, regulators, and businesses.

ELECTRICITY MARKET DESIGN: HOW MUCH INTERVENTION IS NEEDED?

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The EU's proposal to prepare its market for the energy transition

The turmoil on global energy markets caused by the Russian invasion of Ukraine has accelerated the existing debate on market design reform in Europe. But the shortcomings of the current market design have been highlighted by experts for years, as energy systems undergo fundamental changes across the value chain. The electricity market reform needs to account for the ongoing paradigm shift to successfully facilitate the energy transition. The European Commission's draft reform tries to reconcile security of supply, affordability for customers, and the energy transition towards renewables.

Rather than a mere fuel or technology switch, the energy transition represents a real paradigm shift. With the advent of renewable energy sources (RES) like solar and wind as the dominant energy sources, many fundamental features of the energy market system are changing. Power generation is increasingly decentralized and intermittent, as opposed to the centralized and programmable load from conventional sources, posing major challenges for the power grid. Consumers are evolving to prosumers by (partly) covering their own demand. At the same time, electrification of transportation and, in part, heat will increase the power demand in the mid- and long-term.

Markets need to adapt to these fundamental changes in order to distribute energy reliably, sustainably, and at affordable prices in the future. To align these three goals, the market design must facilitate development and evolution across the energy supply chain, from generation to distribution and consumption.

Because of the enormous challenges, the European Commission proposed to reform the market in March 2023. This article will use the proposal to illustrate how regulators deal with the transformative challenges, and touch upon what this could mean for players in the European electricity market.

Electricity market design in the European Union

Market design shapes the structure and ruleset under which market participants operate to achieve desired outcomes, such as efficiency, competitiveness, sustainability, or reliability. In the EU it is codified through the Electricity Directive (2019/944/EU), Electricity Regulation (2019/943/EU), and others.

To enable the energy transition, the rules and incentive structures for all parts of the value chain need to adapt to the intermittency and decentralization of RES. Current regulation and infrastructures can cause far-reaching imbalances in the power market, for the system as well as consumers. For instance, spot markets and especially intraday trading can become a source of flexibility by moving generation, trading, and consumption closer together to help balance supply and demand even when projected RES generation is higher or lower than expected.

Right now, spot markets based on the merit order (see Chapter 2) are generally efficient, but susceptible to price volatility (e.g., due to intermittent RES, or fuel crises like in 2022 caused by Russia's invasion of Ukraine). If consumer prices are closely linked to spot market prices, electricity bills can become an existential threat to many people and businesses. In the recent energy crisis, governments had to intervene in the market to protect consumers (see Chapter 2).

In general, investments in new large-scale, low-carbon infrastructure must be incentivized. Regarding generation, gas-fired power plants that can use hydrogen will be needed in the future as a predictable power source. Smart metering would also facilitate improvements for demand-side management (DSM), where consumers can react to current prices and shift parts of their consumption, thereby easing the pressure on the grid. Finally, more storage capacity is needed to take in surplus power and give it back when generation is low.

The Commission's proposal

As the 2022 energy price crisis highlighted the shortcomings in the current electricity market design, the Commission proposed a reform to address these limitations. The Commission has three goals: to protect consumers; secure energy supply; and incentivize investments in low/zero-carbon technology and infrastructure.

Protecting the consumer and guaranteeing affordability for households

The crisis in 2022 highlighted the vulnerability of households as prices soared and energy poverty in the EU rose to 9.3% in 2022, a situation in which excessively high energy bills negatively impact a household's health and well-being. To protect consumers, the Commission has proposed the following:

Ensure fixed-price contracts remain available

Currently, the Electricity Directive does not stipulate access to fixed-price contracts. As a result, during the 2022 energy crisis, suppliers prematurely terminated fixed-price contracts or stopped offering them altogether. These consumers were forced to close more expensive variable contracts, with prices in 2022 in some Member States between €0.40/kWh and €0.49/kWh for power and over €0.12/kWh for gas. To compare, in 2019, the prices for power and gas were at roughly €0.30/kWh and €0.04/kWh respectively. The Commission's proposal aims to give consumers the right to access to fixed-price contracts with stable prices. Moreover, suppliers will not be allowed to terminate fixed-price contracts prematurely or amend contractual conditions throughout the contract term.

Fixed-price contracts generally carry more risk for the supplier because the energy is purchased in advance on the wholesale market, without the certainty that the contracts on the retail market will remain intact. Consumers can switch suppliers against a relatively cheap early-termination fee and leave the supplier with the purchased energy.

Some Member States have already implemented the Commission's proposal. For example, the Dutch Authority for Consumers and Markets (ACM) introduced new rules in June 2023 to incentivize fixed-price contract offerings. Fixed contracts must remain unchanged but the previously low early termination fee can now match the loss incurred by the supplier. Consumers will still have 14 days to annul the early termination, if they consider the fee too high.

Facilitate renewable energy sharing

The Commission intends to make it easier to share excess renewable energy among households. Prosumers currently sell their excess power back to the grid. However, with the focus on grid balancing, generated power is ideally directly consumed. The Commission therefore wants to make energy sharing easier: Prosumers will be able to share their excess power directly with their neighbors and can set the price themselves, even offering it for free.

It will be the responsibility of the Member States to provide an IT structure for the price calculation based on generation and consumption and ensure that transmission system operators (TSOs) and distribution network operators (DSOs) monitor, collect, validate, and communicate (metering) information. The Agency for the Cooperation of Energy Regulators (ACER)/Council of European Energy Regulators (CEER) are generally in favor of energy sharing but note the need for smart meters.

Securing supply through an efficient and interconnected market

The Commission aims to achieve security of supply by improving efficiency and interconnection. The market must be prepared for the further influx of renewables with flexibility and power should flow across borders more freely. Concretely, the Commission proposes the following measures:

Establishing national flexibility objectives

Generally, to enhance flexibility in the EU, as of 2025, Member States must submit biennial reports to ACER where they assess their flexibility needs. TSOs and DSOs must support Member States by providing the information needed for the reports.

Member States must also set national objectives to meet those needs. Where the objectives set are insufficient to meet the flexibility needs, Member States can utilize flexibility support schemes to incentivize investments. European Power exchange (EPEX) SPOT calls for market-based and technology-neutral flexibility support schemes so that price and dispatching signals are not negatively affected.

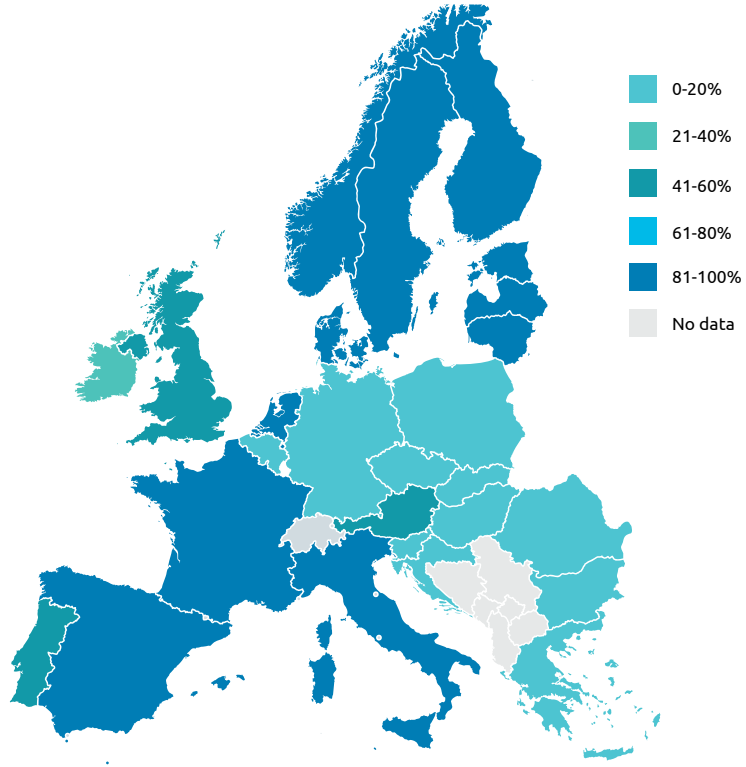
Dynamic pricing contracts for demand-side flexibility

Besides fixed contracts, dynamic contracts should be another option for consumers. While dynamic pricing is climbing up the agenda in Europe, several U.S. states like California have experimented with and expanded such schemes over the last decades. Dynamic contract customers usually regulate their own consumption more closely (e.g., through smart energy monitoring devices) and can tailor their energy use to the actual energy prices. This user group is particularly useful for DSM and can help improve power system flexibility.

However, dynamic pricing requires accurate and real-time meter data. The further roll-out of smart meters is therefore necessary. On average, only 54% of European households have a smart meter, with some countries (such as Germany) even below 20%. The target for smart meter roll-out was set at 80% by 2020 in the Electricity Directive but the implementation depends on the outcome of cost-benefit analyses conducted by national authorities, causing the pace in roll-out to vary among Member States. Comparatively, the roll-out of smart meters in the United States was at 69% in 2021 and is supported by policy and legislation, since smart meters are considered pivotal to create a smart grid and address today's challenges in the energy sector. According to the United States Federal Energy Regulatory Commission (FERC), regulators even support diverting from a traditional cost-benefit analysis and allow alternative approaches for the calculation, showcasing a proactive form of state involvement to speed up the roll-out of smart meters.

FIGURE 1

Share of European households with smart meters (Dec 2021)



Source: CEER

Improving interconnection and liquidity

The Commission aims to enhance interconnection in the EU by requiring transmission rights to be available for longer periods (at least one year), to improve inter-zonal transmission capacity. It also wants to increase liquidity by shifting from bidding zones (BZ) to a hub. A regional virtual hub (RVH) should aggregate BZ prices and provide a single reference price to market participants. These prices would be particularly useful for forward contracts and hedging. Although the RVH is not an exchange, its derivatives could be traded on exchanges or bilaterally. By pooling the liquidity of several BZs in a hub, the liquidity of the forward market should increase, which in turn should lower bid-ask spread and risk premium for market participants.

It is important to note that a similar hub already exists in the Nordics (the Nordic System Price) but it has not solved the illiquidity in the Nordic markets. It is recommended that we examine what can be learned from the Nordic System Price.

Shorter lead times on cross-zonal intra-day markets

Since renewable energy generation is intermittent, trading and delivering directly once it is produced can alleviate uncertainty and reduce imbalance. The intraday cross-zonal gate closure time (IDCZGCT) is currently 60 minutes ahead of real-time, except at the Finnish-Estonian border where it is 30 minutes. However, by January 1, 2028, the IDCZGCT in the entire EU must be reduced to 30 minutes, according to the Commission's plans.

To compare, the national gate closure time in Member States is much closer to delivery. Some Member States (e.g., Belgium, the Netherlands, Germany) already have a five-minute lead time, and Finland is even piloting 0-minutes.

The European Network of Transmission System Operators for Electricity (ENTSO-E), however, has warned that TSOs would have less time (only up to 30 minutes) for balancing, and it would exclude flexibility resources that require more than 20 minutes to activate (e.g., the replacement reserve and TERRE). Moreover, costs and CO_2 emissions would increase, as the resources with short activation time are more expensive and have higher emissions.

Still, increasing the granularity in the short-term markets to enhance flexibility and efficiency is no novelty. From a global perspective, Australia has been a front-runner, introducing five-minute dispatch periods in the 1990s. For the day-ahead market, the California Independent System Operator (CAISO) has proposed moving from hourly to 15-minute scheduling, so generation can follow the load curve more closely.

Incentivizing investment in low-carbon infrastructure

To meet the energy transition and climate objectives, investments in renewable energy are needed in the EU. As Figure 2 shows, Europe and most other parts of the world have recently seen a decline in RES investments (e.g., due to faltering policy support and permitting challenges). To ensure that the energy transition does not slow down, creating the right environment for investments is pivotal. The Commission aims to incentivize investments with the following:

Incentivizing roll-out of Power Purchase Agreements (PPAs)

The Commission also aims to incentivize (green) PPAs, which are agreements between a renewable energy generator and an off-taker, where prices and supply are locked in for a period of 10-15 years. As generators are assured of long-term supply and constant revenue, it becomes more interesting to invest in renewable projects. It is also attractive to off-takers, as they have stable prices for longer periods.

In January 2023, 65 corporate PPA deals were closed in Europe, increasing the cumulative volume of corporate PPAs by 19% compared to Q4 2022.

Countries outside Europe have also embraced PPAs. For example, in the U.S., big tech corporations like Amazon, Microsoft, and Meta are driving PPA demand. South Korea, also introduced PPAs to the otherwise monopolistic electricity market only in 2021. An existing concern with PPAs was that the PPA market is currently only accessible to large consumers. Therefore, the Commission stipulates that Member States take measures to make PPAs accessible to smaller off-takers such as SMEs, as these currently struggle to enter the PPA market, mainly due to creditworthiness constraints. Member States must remove barriers (e.g., through support or guarantee schemes or certain tender evaluation criteria that include SMEs). According to ACER/CEER, it is still uncertain how interesting it will be for smaller off-takers to lock in prices for a longer period, but at least the PPA market will be accessible for SMEs.

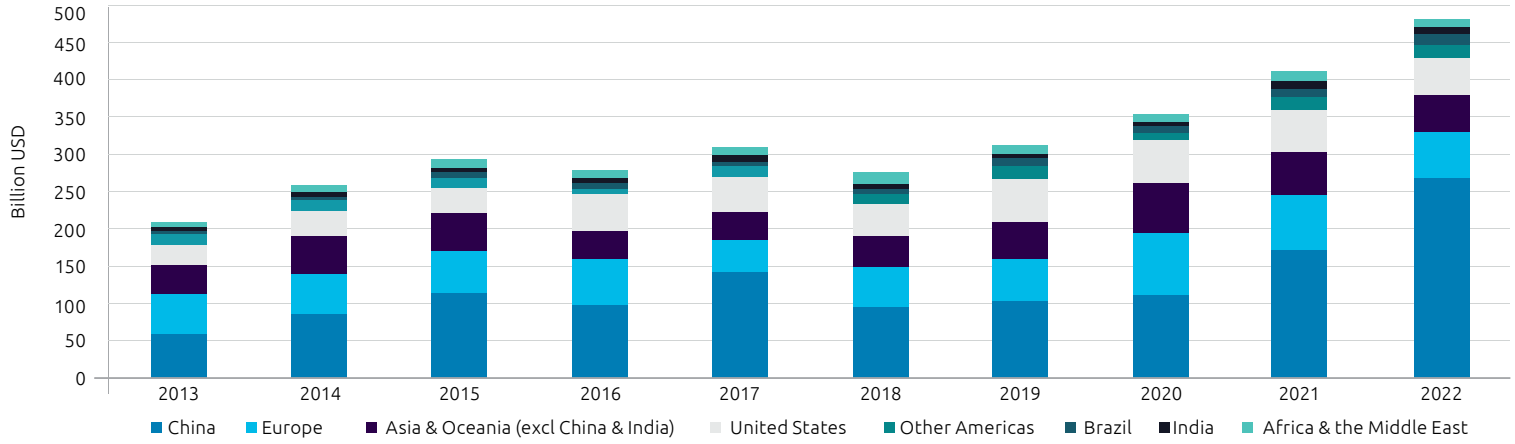
Introducing two-way Contracts for Difference (CfD)

Currently, governments financially support investments in renewable projects through one-way Contracts for Difference (CfDs). The Commission has now proposed financing through two-way CfDs, similar to the CfD design introduced in the U.K. in 2014. Generators will still receive compensation when energy prices are low, but excessive revenue in times of high prices will be channeled back to the public, either through direct redistribution, the financing of direct price support schemes, or extra investments to reduce electricity costs. This way, CfDs will provide additional revenue to Member States when energy prices are high and affect consumers. The distribution of excessive revenue must be proportionate to the investment and consumption of end-users, and should still leave some price exposure for consumers to incentivize demand reduction.

While the proposal also mentions companies besides household consumers as beneficiaries to receive excess distributions that the state generates, so far it is not specified who would ultimately receive payouts and if state-owned energy producers would be included. Additionally, it remains unclear whether existing power generation assets (especially nuclear power generation) should be eligible to be included in the CfD scheme.

FIGURE 2

Investments in renewable energy per region



Note: Europe including non-EU countries; Hydropower projects larger than 50MW not included. Source: BloombergNEF, „Energy Transition Investment Trends 2023"

Although ACER/CEER and ENTSO-E generally support the two-way CfDs, ENTSO-E advises decoupling CfD remuneration from the generated output. EPEX SPOT advises making two-way CfD an option for Member States but allowing them to also choose other forms of support schemes.

Compensations and transparency for new projects

Further investments and scaleup of offshore renewable energy projects is slowed down due to challenges connecting to the onshore, interconnected markets. In the future, if an offshore plant operator is not able to export its full capacity to the onshore network, the TSO responsible for the lost capacity must compensate the offshore plant.

Onshore projects require grid information about the area that is being considered for a project. For example, an area can already be congested, making it a less attractive location for developers. Therefore, TSOs and DSOs must publish information about the available capacity and be transparent to developers regarding the connection requests.

Conclusion

Since the EU Commission's proposal to reform the electricity market design in March 2023, the Energy Ministers, as well as the EU Energy Committee, discussed ways to create the desired interconnected European electricity network.

In July 2023, the EU Energy Committee once more stressed extending the utilization of PPAs and CfDs in order to ensure reliable revenue for renewable energy producers and subsequently improve price stability for consumers. The European Commission, in collaboration with the Nominated Electricity Market Operators, was instructed to establish an EU database and market platform for PPAs by the end of 2024.

However, much remains to be done as central market players such as ACER/CEER, ENTSO-E, and EPEX SPOT have raised concerns and reservations how measures like the increased use of PPAs or the establishment of RVHs could affect the liquidity in the market.

Additionally, after months of negotiations between Member States there is still no consensus on whether CfDs should also apply to existing assets – in particular, nuclear reactors. While a group of members in favor of nuclear power led by France welcomed the initial proposal that supports existing nuclear capacities, other Member States, such as Germany and Austria, sent a distortion of competition. This is because nuclear assets are often already amortized and thus could benefit disproportionately from (potentially) higher CfD striking prices, which are meant to incentivize investments in renewable energy.

Since the European parliament is expected to publish a formal stance on the reform later this year, Member States have plenty of upcoming negotiations ahead to deliver on the proposed customer-centered, secure, and sustainable redesign of the electricity market.

EUROPEAN PLAYERS - PRIORITIES, INVESTMENTS AND FINANCIAL RESULTS

DEBARGHYA MUKHERJEE, INDIA

TORBEN SCHUSTER, GERMANY

Energy & Utility companies' performance in their financial fiscal year, the reactions, and Europe's strategic priorities

Market players' reaction to the established market design, their financial performance, M&A, and investments in the European Energy & Utilities market

Many energy companies and associations agree that market reform is needed. However, they warn against market interventions, taxing windfall profits, or forcing a mandatory contract for difference (CfD) on existing power plants, as this could deter much-needed investment in renewable and low-carbon electricity. **According to an alliance of major European energy companies (including Vattenfall, EnBW, E.ON, RWE, and Uniper), adopted emergency measures to counteract very high or very low prices should not be confused with a structural market reform.** The alliance proposed the following:

- Long-term contracts, such as power purchase agreements (PPAs) and CfDs, must remain voluntary and well-designed to maintain competition and deliver long-term investment signals.
- With long-term contracts, energy consumers are better shielded from high prices and extreme volatility.
- The incentives for final customers and retailers should be aligned to respect the different needs of both domestic and industrial customers.
- Regulatory stability and long-term price signals are needed to foster future investments. Any reform effort must focus on setting the right investment signals in the market to ensure massive renewable and low-carbon investments that the European Union (EU) needs – without a retroactive effect.
- A well-designed market is needed. That includes the tools to tackle different kinds of crises, guaranteeing consumers' protection and confidence from investors.

The reaction from key stakeholders and market players on reforming the design of the EU's electricity market

A reform of electricity markets can only help if the root causes of the crisis are also addressed and if the objectives for such reform are made clear upfront. Market design changes alone won't cut our dependence on fossil fuels, solve nuclear reactor issues, or prevent droughts hitting hydropower generation."

Jean-Michel Glachant
President of the International Association for Energy Economics

• • •

While CfDs could initially be good for hedging new power generation deals, one should think twice about how much of a role states should play. One has to think carefully whether the state's intervention in the market is really necessary, because, among other things, it can cost taxpayers and above all customers a lot of money. Moreover, it was important that the reform ensures predictability and investment."

Frank van Doorn
Head of trading at Vattenfall

• • •

The German Renewable Energy Federation (Bundesverband Erneuerbare Energien or BEE) has criticized key elements of the EU proposal to reform the design of the bloc's electricity market. The lobby group claimed that strict rules about the shape of future subsidies for new low-carbon electricity generation facilities were not the best route forward for Germany's renewables industry. They also believe that the reforms could have similar effects to a mechanism that took away revenue from producers during the energy crisis, which led to high costs for them, as well as distortions in the market.

Other reactions in Germany were less critical. An industry association from Bundesverband der Deutschen Industrie (BDI) and energy industry lobby group, Bundesverband der Energie- und Wasserwirtschaft (BDEW), welcomed the fact that no drastic changes to the system were proposed.

The proposal contains small steps in the right direction but is not enough to spread the benefits of renewables to consumers. While Austria agrees that on the way to a renewable, climate-friendly electricity system, pricing must also be improved and people should also benefit from cheap green electricity from Europe, the reform falls short of expectations"

Leonore Gewessler
Austrian minister for climate action

• • •

France wants the EU's electricity market reform completed by the end of the year. France hopes that the deal will draw on the European Commission's recent renewable energy law that recognizes the role of nuclear energy.

> *[the proposal is] a gift for the nuclear industry, as it supplied massive subsidy promises to the industry, even though it is not compatible with a future, flexible electricity system; more possibilities for low-income households to get cheaper electricity contracts, and to rather empower the people to produce and store electricity than support fossil corporations."*
>
> **Michael Bloss**
> Green Party member of the European Parliament

Eurelectric – the federation of the European electricity industry – issued its policy recommendations, 'Electricity Market Design: Fit for Net Zero' at the end of March 2023. It proposed an evolution building on the existing market structure, with three new pillars: to empower consumers; incentivize clean energy investments; and ensure security of supply. It supports the use of long-term instruments (such as PPAs and CfDs), together with improved liquidity in forward markets. Rather than top-down hedging obligations, it calls for a flexible resilience framework to ensure supplier robustness, ease collateral regulations, and enhance cross-border hedging opportunities. It also pleads for the removal of legislative barriers from long-term instruments such as private PPAs, and favored state-backed CfDs.

SolarPower Europe welcomes the proposal as it maintains the foundation of EU electricity markets and allows easier access to PPAs for homes and businesses, which de-risks schemes for long-term energy supply contracts. SolarPower Europe also states that "only new solar projects which benefit from state support will be put under government-organized two-sided CfDs." They also welcome the provisions outlining the legal framework for electricity sharing, and support grid flexibility and the recognition of electricity grids, as this facilitates access to green energy and connects solar to the grid.

> *It has been a tumultuous time for the European electricity market, after the energy crisis sparked a flurry of market interventions. However, the time has come to coordinate and harmonize efforts to restore regulatory stability and investor confidence"*
>
> **Maria Popova**
> director for carbon neutrality and renewable electricity at the European Federation of Energy Traders (EFET)

Financial situation of major European utilities

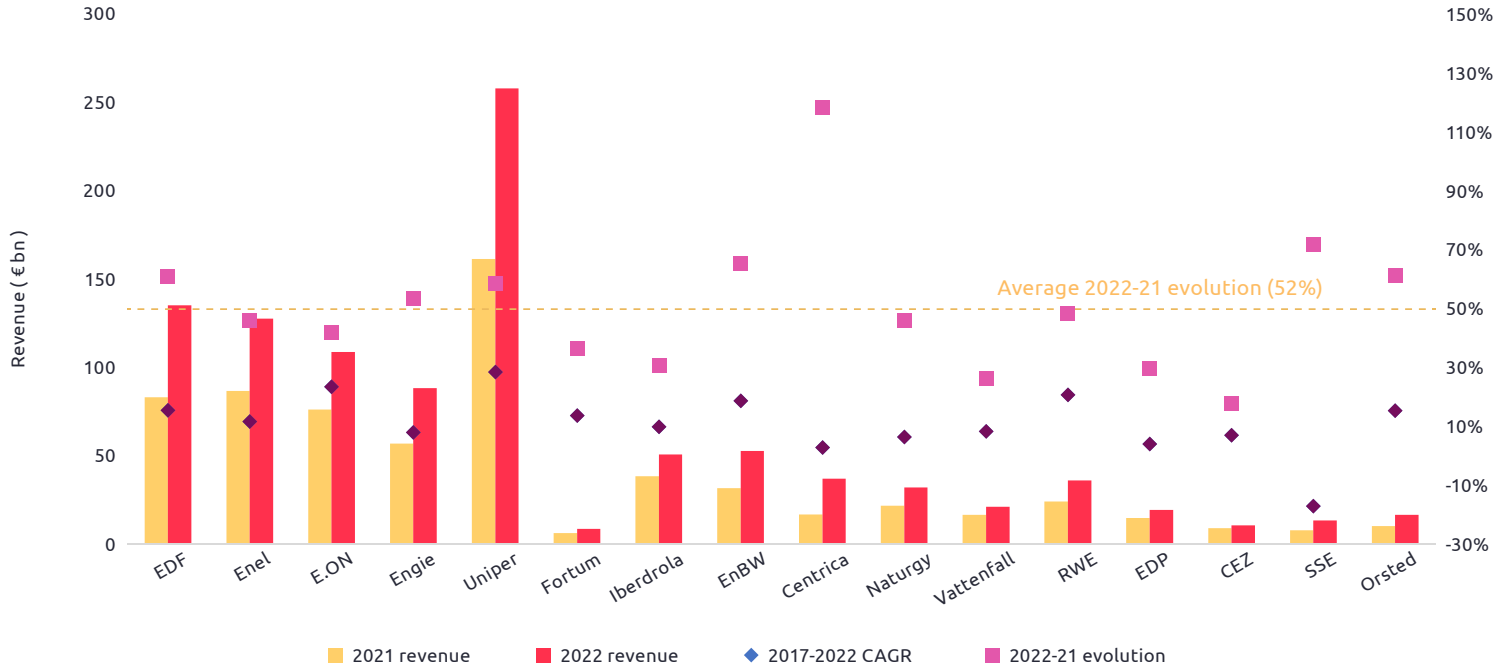
The financial statements of large European utilities indicate higher revenues resulting from steep fossil fuel and electricity prices in 2022 compared with 2021. However, unlike for oil and gas majors, higher revenues for European utilities have not always translated into profits in recent months because utility companies have diverse business profiles, allowing them to compensate losses in one business segment with profits from another. Europe's major energy utilities see renewables and decarbonization as a way out of the dueling energy and climate crises.

EDF revenue grew more than 60%, with 12% growth in their wind and solar project portfolio and 3% growth in their customer portfolio. Uniper's significant increase in revenues resulted primarily from the higher average market prices in the power and gas business. Centrica's growth is driven largely by the impact of higher wholesale commodity prices on ENERGY MARKETING & TRADING AND UPSTREAM business unit, and the impact of higher wholesale prices on retail tariffs in British Gas Energy, Bord Gáis Energy, and Centrica Business Solutions.

Enel's growth was driven by increasing average prices, the volume of energy produced and traded, and volumes sold (mainly in Italy and Spain). Furthermore, tariffs were adjusted in Brazil, and higher volumes of electricity were distributed in Latin America. The exchange rate also had a positive effect.

FIGURE 1

2021 and 2022 revenues and CAGR 2017-2022



Note: Uniper higher revenues mainly due to the higher own-use contract prices and spot-market transactions, a significant portion of this increase is attributable to the contracts involving physical settlement that Uniper enters into (failed own-use contracts), which are presented at the spot price applicable on the settlement date

Source: Thomson Reuters EIKON, Secondary sources

The average 2022 earnings before the interest, taxes, depreciation, and amortization (EBITDA) margin was less compared to 2021. This is mainly due to the significant decline in EBITDA margins for major players like Vattenfall, EDF, Uniper, and Engie.

Vattenfall's decline of operating profit is partly attributable to lower achieved electricity prices in the Nordic countries, higher gas prices, and operating expenses.

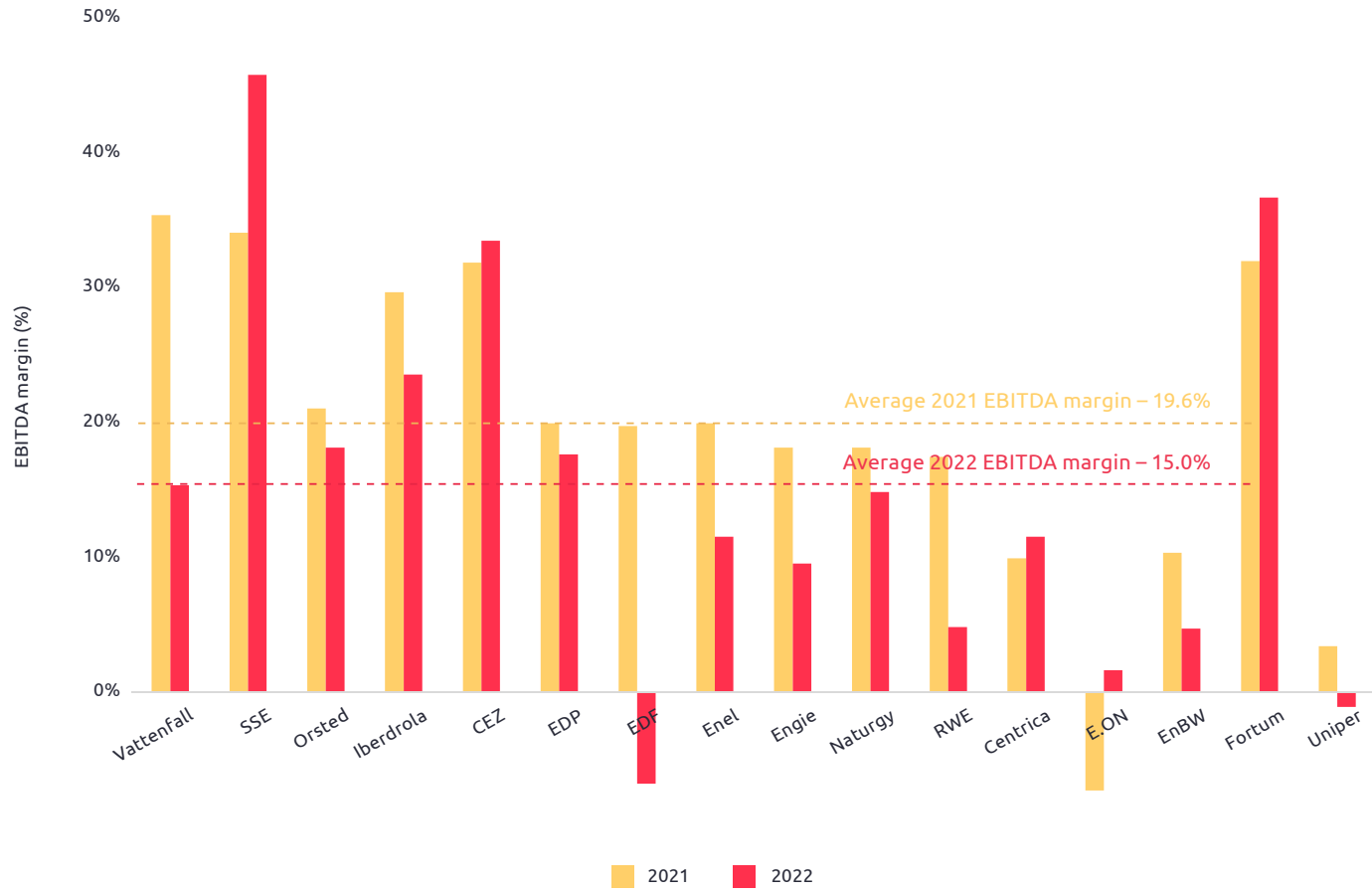
For EDF, despite a significant increase in sales supported by electricity and gas prices, EBITDA was down significantly in 2022. In France, this decrease is essentially explained by the decline in nuclear output linked to corrosion under constraints and related maintenance, as well as a government price capping decision to limit price increases for consumers in 2022. Low-capacity availability and significant demand obliged the Group to purchase electricity at a time when market prices were very high.

Uniper's profitability was impacted by direct effects on earnings arising from the loss of Russian gas supplies and the need to purchase corresponding replacement volumes directly on the market at a significantly higher price level as a result of the supply cuts. The German government provided support measures and took over 99% of the company in order to secure Germany's energy supply.

As their profitability soars, SSE plans to spend £40 billion over the next 10 years in vital low-carbon energy infrastructure.

FIGURE 2

2021 and 2022 EBIDTA margins



Source: Thomson Reuters EIKON, Secondary sources

Leverage ratio is one of several financial measurements that look at how much capital comes in the form of debt and assesses the ability of a company to meet its financial obligations.

For EDF, 2022 group cash flow amounted to -€24.6 billion, down significantly from the -€1.5 billion of 2021. Net financial debt reached €64.5 billion in 2022. EDF is now aiming to reduce the ratio of net debt to EBITDA to 2.5.

Enel's net financial debt at the end of 2022 totaled €60.1 billion, which reflects financial needs for capital expenditure in the period, the payment of dividends, the acquisition of ERG Hydro S.r.l., and the negative effect of exchange rates.

Engie's economic net debt stood at €38.8 billion, up €0.5 billion compared to 2021, mainly due to the increase in asset retirement obligation provisions and other variations.

Fortum's financial net debt in 2022 was €1,084 million. The company has set long-term financial targets, aiming for a net debt-to-comparable EBITDA ratio of 2.0-2.5 times.

Centrica had adjusted net cash of €1.3 billion at the end of 2022, compared to adjusted net debt of nearly €4.5 billion three years ago. The reduction reflects an ongoing strong focus on capital discipline and cash generation.

FIGURE 3

Leverage Ratios for 2021 and 2022

	Leverage ratio 2021	Leverage ratio 2022	Evolutions
EDF	2.39x	-	↑ *19%
ENGIE	2.25x	2.67x	↑
ENEL	3.14x	3.82x	↑
Iberdrola	3.22x	3.16x	↓
EnBW	2.09x	2.44x	↑
EDP	4.92x	4.34x	↓
SSE	3.84x	2.01x	↓
Vattenfall	0.03x	-	↑ *18%
Centrica	0.98x	-	↓
Orsted	1.71x	1.61x	↓
CEZ	1.75x	1.41x	↓
Fortum	4.71x	2.30x	↓
Naturgy	3.14x	2.42x	↓
Average	**2.63x**	**2.62x**	

Note:
1. Leverage ratio = Net debt/EBITDA;
*2. *Long term debt evolution 2022-2021*

Source: Thomson Reuters EIKON, Secondary sources

2022 Standard & Poor (S&P) credit ratings

For most actors, the credit rating remains stable:

- S&P Global Ratings affirmed the BBB credit rating of EDF; outlook is stable.
- Vattenfall's outlook changed from stable to positive with a BBB+ rating.
- Centrica's outlook changed to BBB with a stable outlook.
- S&P affirms Uniper's long-term credit rating at BBB-, with a negative outlook in 2022.
- SSE's credit rating updated to BBB+ positive outlook. This reflects the continuing resilience of SSE's business mix and its ability to create value and respond to volatile market conditions.

FIGURE 4

Standard & Poor (S&P) credit ratings

Company	2017	2018	2019	2020	2021	2022
EnBW	A-	A-	A-	A-	A-	A-
CEZ	A-	A-	A-	A-	A-	A-
EDF	A-	A-	A-	BBB+	BBB	BBB
Engie	A-	A-	A-	BBB+	BBB+	BBB+
SSE	A-	A-	BBB+	BBB+	BBB+	BBB+
Vattenfall	BBB+	BBB+	BBB+	BBB+	BBB	BBB+
Ørsted	BBB+	BBB+	BBB+	BBB+	BBB+	BBB+
Iberdrola	BBB+	BBB+	BBB+	BBB+	BBB+	BBB+
Enel	BBB	BBB+	BBB+	BBB+	BBB+	BBB+
Centrica	BBB+	BBB+	BBB	BBB	BBB+	BBB
Fortum	BBB+	BBB	BBB	BBB	BBB	BBB
E.ON	BBB	BBB	BBB	BBB	BBB	BBB
Naturgy	BBB	BBB	BBB	BBB	BBB	BBB
Uniper	BBB-	BBB	BBB	BBB	BBB-	BBB-
EDP	BB+	BBB-	BBB-	BBB-	BBB	BBB

Source: Thomson Reuters EIKON, Secondary sources

M&A and investment trends

The upward trend in M&A among renewables developers is occurring in multiple regions. Europe has experienced the highest deal activity globally in the past four years—with roughly 40% of deals involving a Europe-based target. North America is the second-largest market, with growth accelerating in 2022; there were 17 deals, representing nearly $6 billion in combined deal value. The Asia-Pacific region (APAC) and the rest of the world have also experienced growth, reaching a total deal value of $1.4 billion in the first half of 2022.

Although traditional sources of debt capital today are more expensive and harder to obtain, strengthened balance sheets from high commodity prices—plus alternative sources of supply, such as credit funds—will enable management to pursue acquisitions.

Utilities and IPPs acquire ~10 GW of offshore wind assets in Europe, YTD May 2023

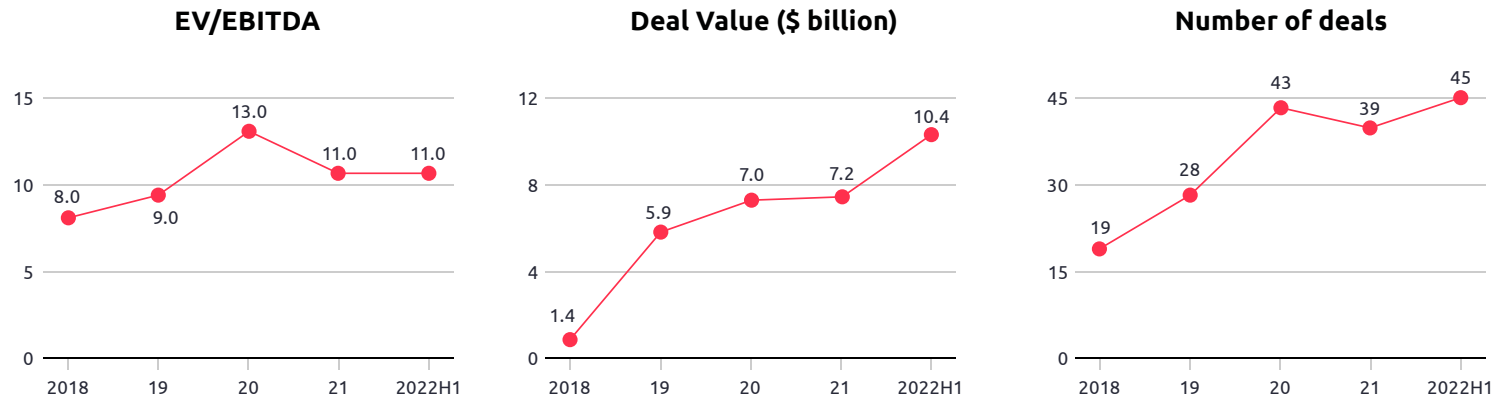
Europe has witnessed a surge in acquisitions for offshore wind assets by utilities and independent power producers (IPPs), with the region collectively accounting for 50% of the M&A activity. This is a significant rise compared to the activity observed during 2022, during which utilities and IPPs accounted for ~30% of the deal volume. The rest of the activity was driven primarily by European private equity (PE) firms, such as Copenhagen Infrastructure Partners (CIP), The Renewables Infrastructure Group (TRIG), Greencoat, and Global Infrastructure Partners (GIP).

A surge in interest in offshore wind assets is attributed to improvements in the financing and project development environment, which is a result of recent measures taken by the EU. The measures include the European Investment Bank's (EIB) $21 billion budgetary guarantee, InvestEU, which enhances utilities and IPPs' access to development capital at low interest rates.

Equitix Group recently acquired a 50% stake in a 2.4 GW operating offshore wind portfolio in UK from Macquarie Group. Other major transactions in the current year include Daiwa Securities' farm-in to the 1.2 GW Hornsea 1 offshore wind farm and INPEX's acquisition of a stake in the 950 MW Moray East wind farm.

FIGURE 5

Aquisitions of wind and solar developers



Note: EV/EBITDA = Enterprise value to EBITDA multiple

Source: McKinsey, Enerdatics, Energy Monitor, Secondary sources

Northland Power divested a 24.5% stake in the 840 MW Spiorad na Mara and 1.5 GW Havbredey offshore wind projects in the U.K. to Irish utility ESB. The deal aligns with Northland's selective partnership strategy to sell interests in certain development projects on or before financial close. The company intends to utilize non-recourse project-level financing as the primary source of funding, with its equity requirements expected to be supported by cash on hand, proceeds from sell-downs, asset sales, the use of corporate hybrid debt, and equity issuances under its at-the-market (ATM) equity program.

Further, recent EU regulations limit the permitting period for offshore wind projects to two years, reducing risks associated with development and construction and further improving operators' access to non-recourse financing. The combined effect of both policies helps debt-reliant buyers offset the impact of cost inflation and increases their appetite for capital-intensive projects with a long lead time.

The $1.7 billion acquisition of Hitachi Energy by Hitachi: ABB has reached an agreement to divest to Hitachi, Ltd. (Hitachi) its remaining 19.9% equity stake in the Hitachi Energy joint venture that was formed from ABB's Power Grids.

Siemens Energy gets go-ahead for full integration of Siemens Gamesa: In May 2022, Siemens Energy launched a €4.05 billion takeover proposal for the remaining third of shares that it did not already own in the turbine maker.

Gren agrees to acquire 11 heat and power generation assets in the U.K. The acquisition of these U.K. assets supports Gren's expansion into one of the fastest growing district heating markets in Europe. Gren will play a key role in helping the U.K. decarbonize its energy sector.

European Investment Bank (EIB) has agreed to lend €450 million (~$485 million) to Portugal-based energy company Redes Energéticas Nacionais (REN) for renewable energy integration and upgradation of the transmission network. This financing will contribute to REN's five-year investment program, which aims to increase the efficiency of Portugal's electricity transmission network and integrate 4.2 GW of new renewable energy sources by 2026. It would also enable REN to maintain the reliability and quality of the electricity supply.

The green loan committed by the EIB is part of the wider REPowerEU Plan to boost green energy and support the EU's autonomy and competitiveness. The total €30 billion EIB contribution to REPowerEU is expected to mobilize over €115 billion of additional investment by 2027 in support of green technologies and Europe's energy independence.

Iberdrola Secures $1 billion from EIB to build 19 solar power plants and three onshore wind farms in Spain, Portugal, and Germany with a total installed capacity of 2.2 GW. In addition, the project will have an innovation component, as it will facilitate the integration of renewables into grids, undoubtedly one of the great challenges in achieving Europe's climate objectives. Some of the photovoltaic projects will include hybridization with wind power and battery systems for energy storage.

The new installations will generate sufficient energy to power more than one million households with electricity annually, with 70% of the projects deployed in rural areas, areas affected by the industrial transition to net zero, and cohesion regions. A part of EIB's financing package supports the European Union's REPowerEU plan; the collaboration will accelerate Europe's efforts to completely cut dependence on fossil fuel imports while boosting supply security.

Serbia gets its first commercial PPA and financing is secured for Krivača wind farm. The PPA was signed with Swiss renewables producer and trader Axpo. Serbia's MK Group and Slovenia's ALFI Green Energy Fund have secured €155 million for the Krivača wind farm project from a consortium of lenders led by Erste Group. It will be the first renewable energy project in Serbia with a commercial PPA.

EIB to finance modernization of ČEZ's distribution grid and connection of new renewable energy sources with a record-breaking loan of €790 million. The loan will promote the Czech Republic's energy independence by enabling ČEZ to connect around 2.2 GW of new renewable energy sources, upgrade and expand the country's electricity distribution grid, and help provide a more reliable electricity supply for businesses and households across the Czech Republic.

Utility businesses are optimizing their portfolios, including shedding non-core assets and funneling more capital towards energy security, decarbonization, and energy-transition areas. As the market moves to an electric future, utilities will continue to focus on several areas: generation and storage, heating decarbonization, electric vehicle charging, hydrogen infrastructure, technology to maximize existing infrastructure, and relocating renewables.

NORTH AMERICAN PLAYERS - PRIORITIES, INVESTMENTS AND FINANCIAL RESULTS


TORBEN SCHUSTER, GERMANY


ALEXANDER RODRIGUEZ, USA

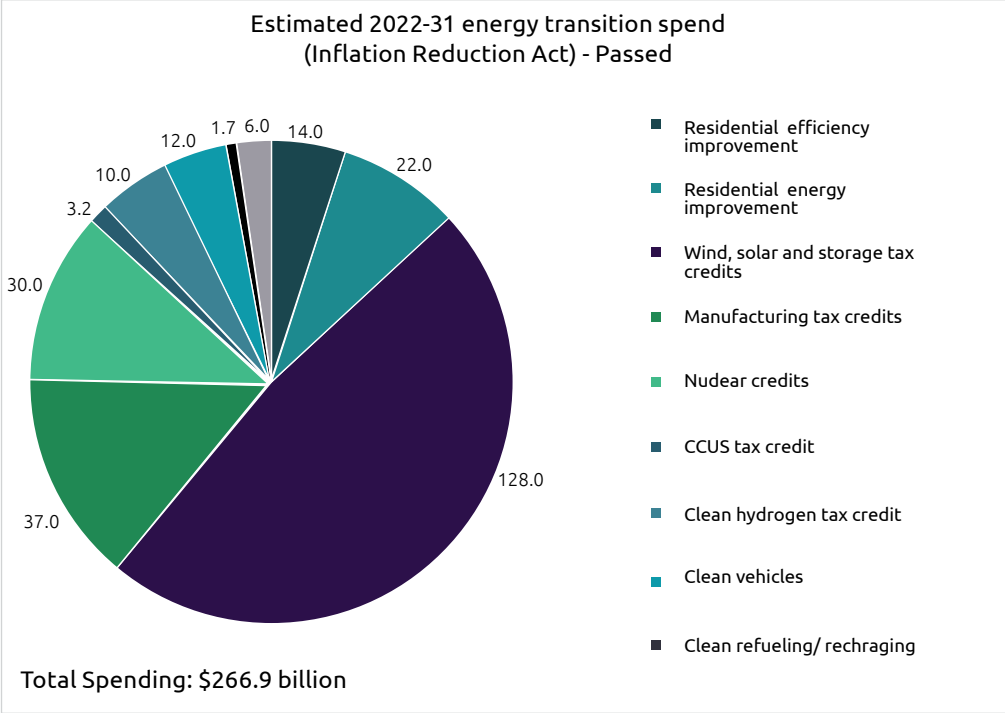

SARA STRITHARAN, USA

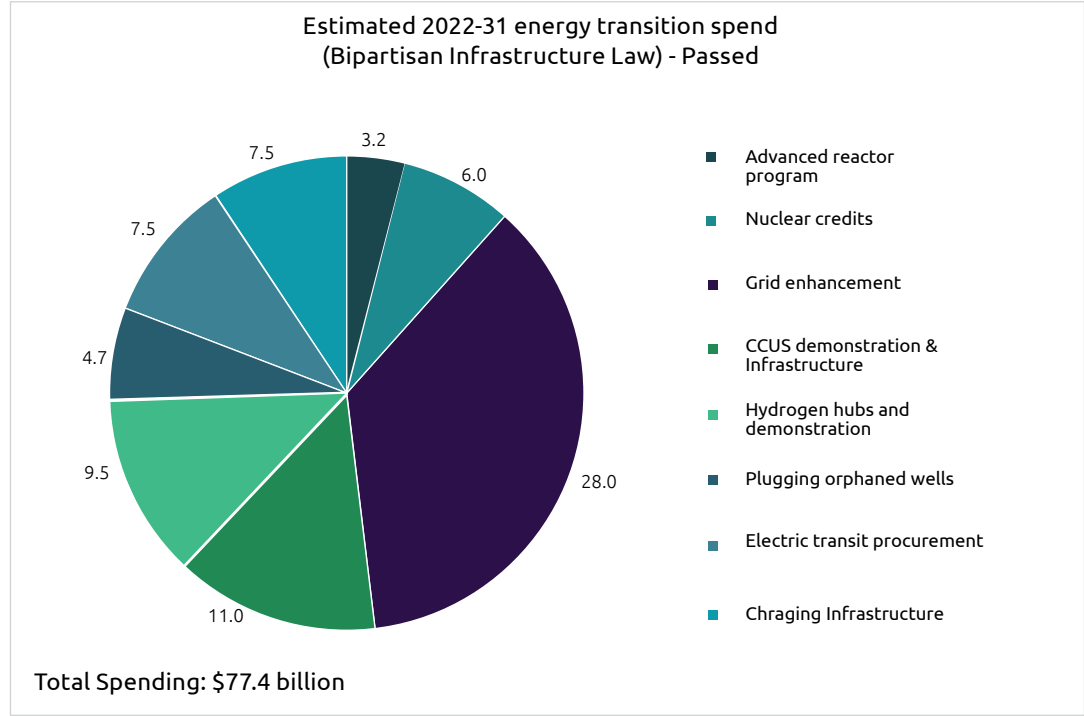
The Inflation Reduction Act (IRA) would provide at least $369 billion in support to energy transition technologies

- Inflation Reduction Act contains Wind, solar and storage tax credits of $128 billion, Nuclear credits of $30 billion, and carbon capture, usage, and storage (CCUS) tax credit of $ 3.2 billion and clean hydrogen tax credit of $13 billion.
- The law aims to place the nation closer to the Biden administration' s ambition of halving economy-wide CO_2 emissions by 2030 (vs. 2005) and in 2023 and 2024, the Treasury Department targets to write many of the rules in 2023 on how these and other tax policies are to be implemented.
- While the IRA is considered to be the most significant, it is not the sole piece of climate legislation to be passed during the 116th Congress. The Bipartisan Infrastructure Bill (Infrastructure Investment and Jobs Act) of 2021 and the CHIPS and Science Act of 2022 both contained significant support for climate-related sectors.
- Prior to the IRA being passed, many wind solar and storage projects were put on hold by operators and utility companies. Since August, there has been an uptick in demand for battery energy storage systems and this is put a strain on the supply chain as well as contractor availability. As a result, the cost of these projects has increased.
- IRA domestic content requirements has created a race to move manufacturing of BESS components to the US. Various technology providers are entering into agreement with local manufacturing to complete assembly of their product. As a result, we are going to see money flowing into US based BESS manufacturers, integrations, EPC, etc.

FIGURE 1

U.S.: Tax credits and clean energy investment-2022





Source: BNEF ~ Sustainable Energy in America Factbook, 2023

U.S. utilities revenue: In 2022, utility companies have continued to demonstrate revenue growth and were focused on making significant investments in clean, safe, reliable, and affordable energy to their customers

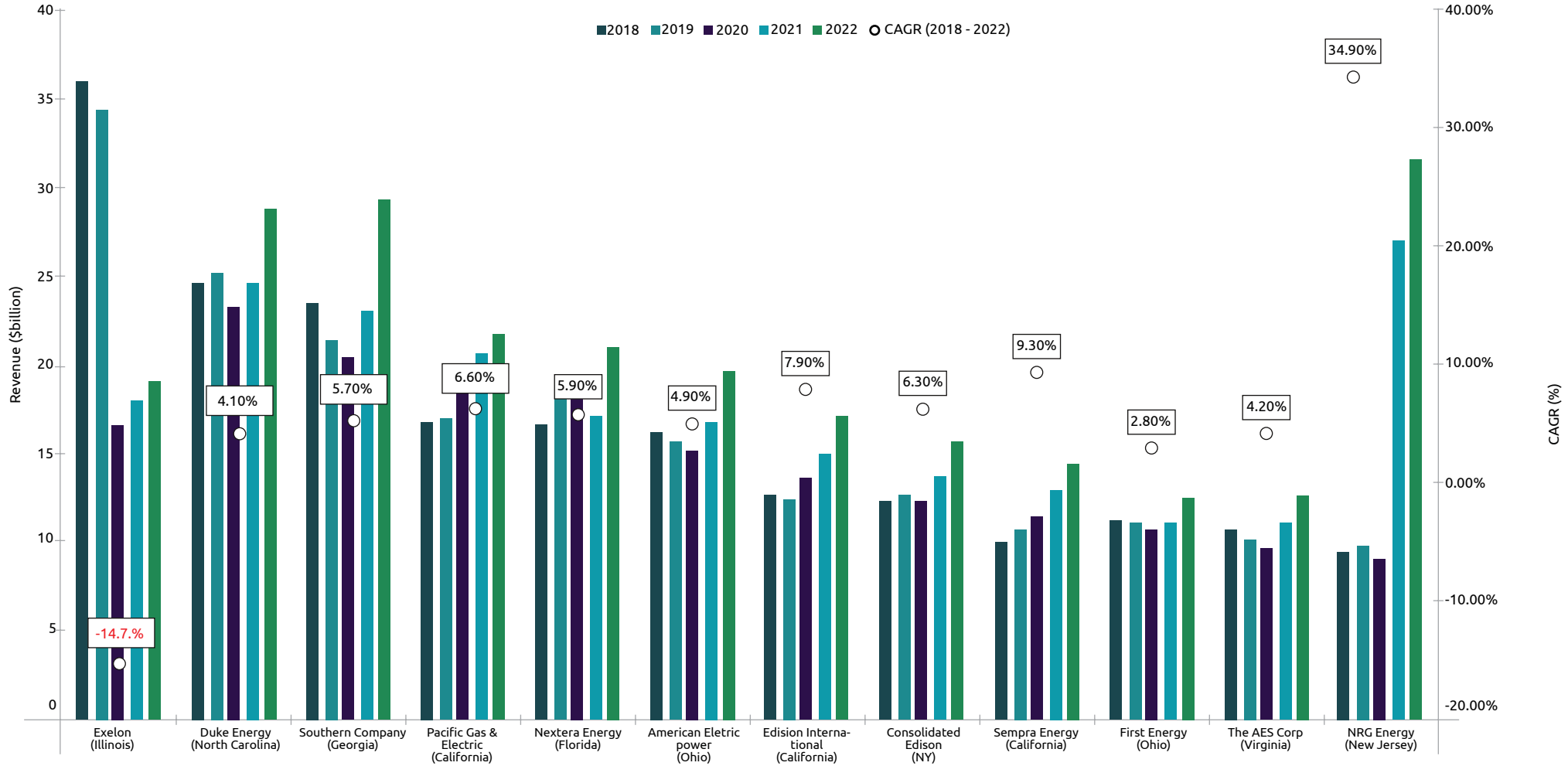
Global investment in the low-carbon energy transition totalled $1.1 trillion in 2022, which is considered to be a new record and a huge acceleration from the year before, as the energy crisis and policy action drove faster deployment of clean energy technologies, according to Bloomberg NEF.

Despite 2022's impressive results, global investment in lower-carbon technologies remains woefully short of what is needed to confront climate change. Bloomberg NEF estimates that for the world to get on a 2050 "net-zero" CO2 emissions trajectory, such investment must immediately triple.

- American Electric Power has achieved an increase of 17% in the total revenue of 2022 as compared to 2021, with the company being one of the largest electricity producers generating around 31,000 megawatts of electricity, including over 6,900 megawatts of renewable energy.
  - Julie Sloat, President and CEO of American Electric Power has stated that their strategic vision focuses on delivering clean, and reliable energy and aims to make significant capital investment of $40 billion in transmission, distribution and renewable energy, from 2023 through 2027.
- According to Southern company, they experienced another remarkable year in 2022 with an increase of 26.7% in operating revenue primarily driven by higher fuel costs. The company believes that the positive outcomes were also due to their employees' efforts in providing clean, safe, reliable, and affordable energy to their 9 million residential and commercial customers.
  - The company has transitioned from fossil fuels to clean energy sources and its electric generating mix consists of 22% coal and 51% natural gas in 2022. This transition has partially been feasible with the company retiring over 6,700 MWs of coal-fired generating capacity since 2010.
  - In addition, the company's capacity mix comprises over 11,500 MWs of renewable and storage facilities through ownership and long-term PPAs.
- According to John W. Somerhalder II, the board chair, interim president and CEO of FirstEnergy, the company executed transformative equity investments to strengthen their financial position and drive their customer-focused investment strategy in 2022.
  - The company attributes the increase in financial results to their customer-focused regulated investments of over $3.2 billion, higher investment income, lower interest expense and increased customer demand as compared to 2021.
- Duke Energy attributes the increase in company's revenue as of 2022 over 2021, to higher electric volumes and favorable weather, in addition to rate case contributions.
  - Further, in its efforts to clean energy transition, the company is investing in major electric grid enhancements and energy storage and exploring zero-emission power generation technologies such as hydrogen and advanced nuclear. In view of this, the company states that its five-year capital plan increases to $65 billion with over 80% funding investments in the grid and clean energy transition.

FIGURE 2

U.S.: Revenues and associated CAGR (average), 2018-2022 ($billion)



Exploring the Resilient EBITDA Margins of Major U.S. Energy Players

Most U.S. and Canadian utilities continued to see a decline in their recurring EBITDA margin in 2022, as compared to 2021. It has been observed that many of the profitable U.S. and Canadian utilities recorded a negative year-over-year change in recurring EBITDA in 2022.

American Electric Power's earnings before interest, taxes, depreciation and amortization (EBITDA) for 2022 was 36.3%, as compared to 37.2% in 2021.

- American Electric Power witnessed a $253 million increase in cash from Net Income, after non-cash adjustments including depreciation and amortization, Rockport Plant, Unit 2 lease amortization, deferred income taxes, and amortization of nuclear fuel.

There has been a marginal decrease in EBITDA of Duke Energy in 2022 (42.6%) as compared to 46.7% in 2021.

- There has been a $320 million increase in net income after adjustment for non-cash items.
- This increase can be primarily attributed to higher revenues from rate cases in various jurisdictions, favorable weather and volumes, partially offset by an estimated impairment on the Commercial Renewables Disposal Groups.

Southern Company's earnings before interest, taxes, depreciation and amortization (EBITDA) for 2022 was 33.5%, as compared to 39.7% in 2021.

- Consolidated net income attributable to Southern Company was $3.5 billion in 2022, an increase of $1.1 billion, or 47.3%, from 2021.
- The rise was mainly driven by higher earnings from retail electricity, stemming from rate adjustments, increased sales, and greater revenue from natural gas due to base rate hikes and ongoing infrastructure upgrades. However, this increase was partially balanced out by higher non-fuel operational and maintenance expenses, as well as increased interest costs.

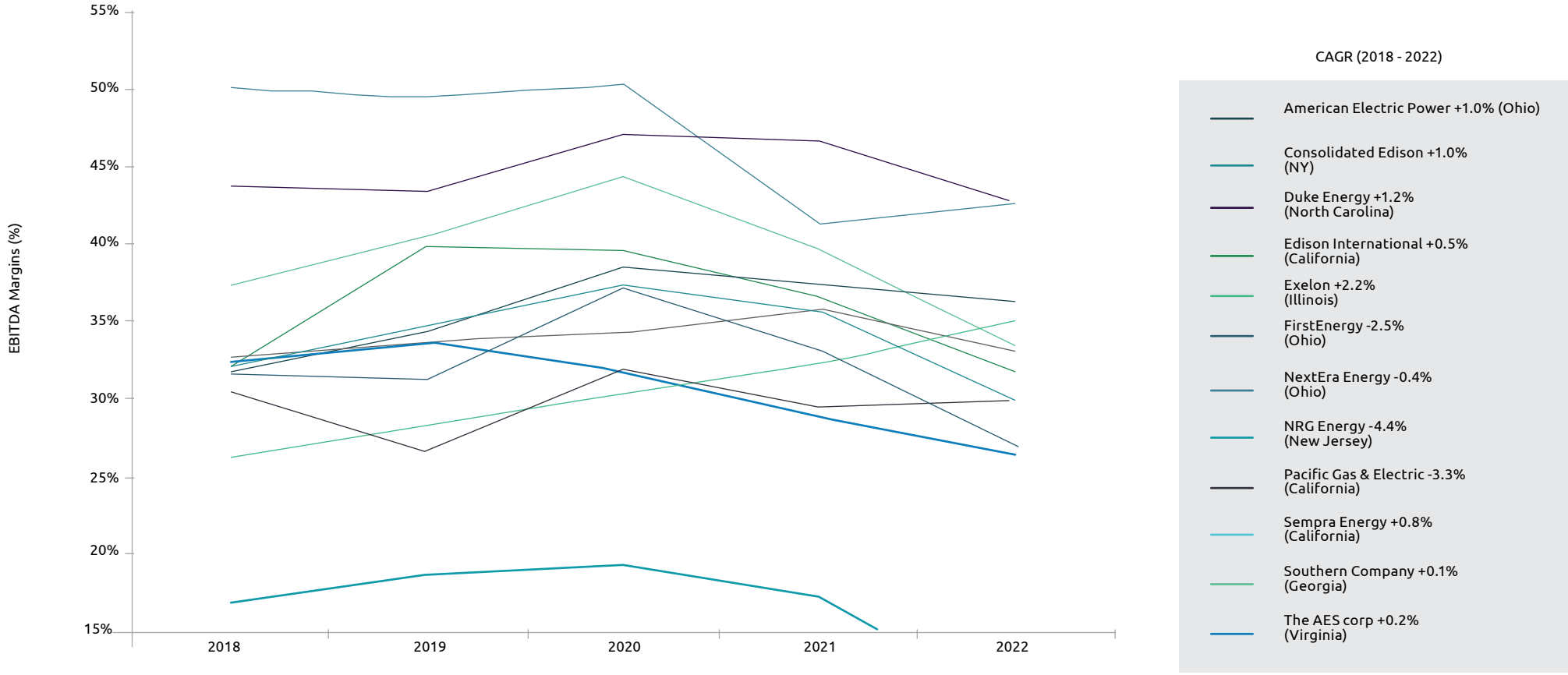
When the energy giants posted huge profits, benefiting from surging natural gas and fuel prices that have boosted inflation around the world and led to fresh calls to further tax the sector. It has been observed that the U.S. President Joe Biden slams the energy companies.

In 2022, the sheer size of the profits has revived calls from politicians and consumer groups to impose more taxes on the companies to raise funds to offset the hit to households, businesses, and the wider economy from higher energy costs. They have also criticized the major energy companies for not doing enough to raise production to offset rising fuel and heating costs.

Equinor Chief Executive Anders Opedal has stated that the Russian war in Ukraine has changed the energy markets, slashed energy availability and intensified prices.

FIGURE 3

U.S.: EBITDA margins and associated CAGR, 2018-2022



U.S. utilities relied less on debt in 2022 for capital needs, as the sector manages energy transition costs and an influx of federal funds from U.S. President Joe Biden.

Holding companies, including NextEra Energy Inc., Exelon Corp., and DTE Energy Co., and operating companies, including Pacific Gas and Electric Co. and Duke Energy Progress LLC, had some of the largest amounts of debt maturities occurring in 2022, according to S&P Global.

- AES Corporation had a leverage (debt/equity) ratio of 14.7 in 2022, as compared to 9.48 in 2021.
  - This increase in the leverage ratio indicates that AES has a significant amount of debt. The company states that they had approximately $23 billion of outstanding indebtedness on a consolidated basis, as of December 31, 2022.
  - Most of the debt of AES Corporation's subsidiaries is secured by substantially all the assets of those subsidiaries. A considerable portion of cash flow from operations must be used to make payments on their debt.
- American Electric Power had a leverage ratio of 1.71 in 2022, as compared to 1.63 in 2021.
  - The increase in the leverage ratio can be attributed to an increase in debt taken on to support distribution, transmission, and renewable investment growth, as well as increased working capital needs due to higher deferred fuel costs.
- Southern Company had a leverage ratio of 1.89 in 2022, as compared to 1.93 in 2021.
  - Southern Company has witnessed an increase of $2.5 billion in total equity primarily related to net income and the issuance of common stock to settle the purchase contracts entered as part of the Equity Units
  - There was also an increase of $2.7 billion in long-term debt related to new issuances
- Sempra Energy had a leverage ratio of 1.1 in 2022, as compared to 0.98 in 2021.
  - This can be attributed to the increase in long-term debt, offset by a decrease in short-term debt and increase in equity primarily from comprehensive income exceeding dividends and the sale of non-controlling interest (NCI).
- They rely on long-term debt to fund a significant portion of their capital expenditures and repay outstanding debt. Additionally, they rely on short-term borrowings to fund a significant portion of day-to-day business operations.
- Sempra may also seek to raise capital by issuing equity or selling equity interests in their subsidiaries or investments.
- **International Energy Agency (IEA) estimates that around $2.8 trillion will be invested in energy in 2023. More than $1.7 trillion is going toward clean energy, including renewable power, nuclear, grids, storage, low-emission fuels, efficiency improvements and end-use renewables and electrification.**
- **Clean energy investments have been boosted by a variety of factors, including improved economics at a time of high and volatile fossil fuel prices; enhanced policy support through instruments like the US Inflation Reduction Act and new initiatives in Europe, Japan, and China.**

FIGURE 4

U.S.: Leverage (debt/equity), 2021-2022 evolution

Utilities	2021	2022	Evolution
American Electric Power (Ohio)	1.63	1.71	↑
Consolidated Edison	1.22	1.15	↓
Duke Energy (North Carolina)	1.42	1.56	↑
Edison International (California)	1.98	2.32	↑
Exelon (Illinois)	1.23	1.62	↑
First Energy (Ohio)	2.75	2.13	↓
Next Era Energy (Florida)	1.47	1.66	↑
Pacific Gas & Electric (California)	1.59	1.74	↑
Sempra Energy (California)	0.98	1.1	↑
Southern Company (Georgia)	1.93	1.89	↓
The AES Corp (Virginia)	9.48	14.70	↑

Canadian utilities have continued to demonstrate revenue growth in 2022, with electricity generation in the country edging up 2.0% from 2021 levels to 640.3 million MWh

Electric generation from renewable energy sources, including hydro, wind, solar and others increased 4.1% from 2021. While generation from nuclear (-5.8%) and combustible sources (-0.8%) decreased year over year, largely due to refurbishment and maintenance activities at Ontario and New Brunswick's nuclear generating stations.

- The increase in the total revenues of Hydro One in 2022 can be attributed to the significant increase in transmission and distribution revenues by 13.9% and 5.6% respectively, as compared to 2021.
    - The increase in transmission revenues were primarily due to higher revenues resulting from Ontario Energy Board (OEB) approved 2022 rates and greater peak demand. While the increase in distribution revenues were driven by higher purchased power costs, higher revenues resulting from OEB-approved 2022 rates and a lower deferred regulatory adjustment associated with the Earnings Sharing Mechanism in 2022.
    - Hydro One continued making capital investments of $1.5 billion in 2022, to expand the electricity grid and renew existing infrastructure. The company's recently approved 2023–2027 Investment Plan aims to reduce the impacts of power outages, renew or restore critical transmission and distribution infrastructure, enable economic growth and prepare for climate change.
- According to Ken Hartwick, President and CEO of Ontario Power Generation (OPG), the company achieved strong operational results in 2022, with hydroelectric generation accounting for over a third of total electricity production and significant progress across its nuclear fleet.
    - Ontario Power Generation's total capital expenditures increased by 23.3% in 2022, as compared to 2021 driven by higher expenditures for the Regulated-nuclear generation business segment.
    - In particular, the capital expenditure of the Regulated-nuclear generation business segment increased by $115 million mainly for the higher refurbishment activities at the Darlington GS. While, the capital expenditure of this segment, excluding the Darlington Refurbishment Project increased by $196 million.
- British Columbia Hydro and Power Authority states that the increase in the revenue in 2022 was primarily driven by higher trade revenues and higher domestic revenues.

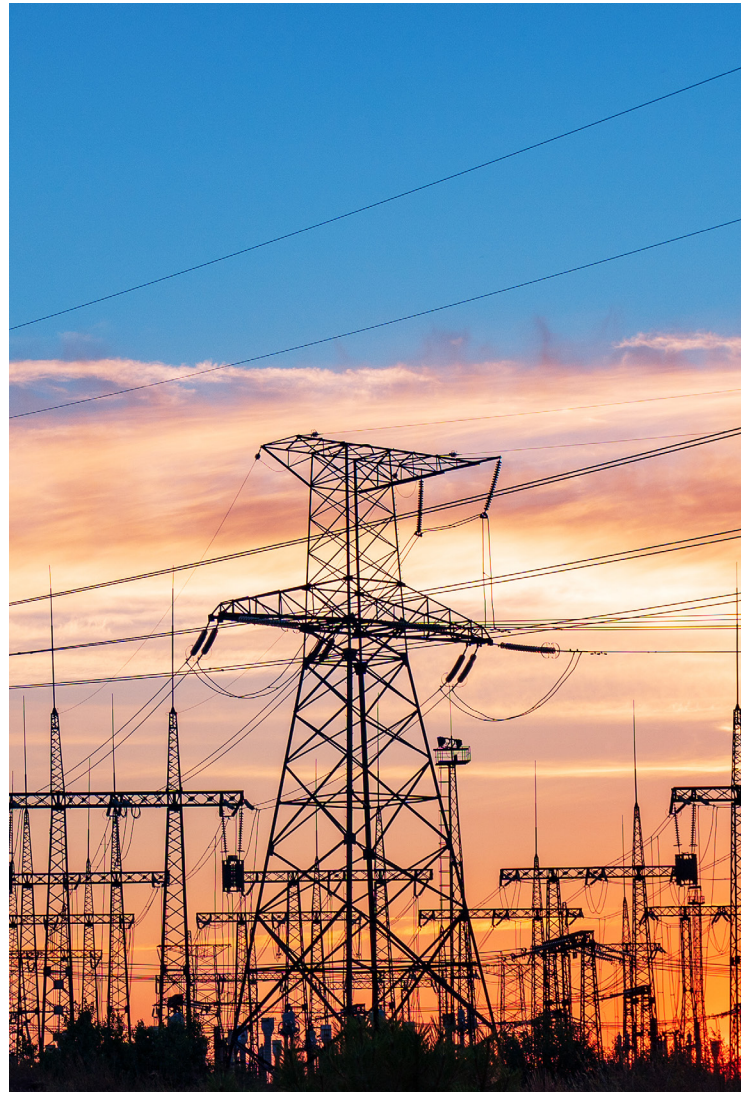
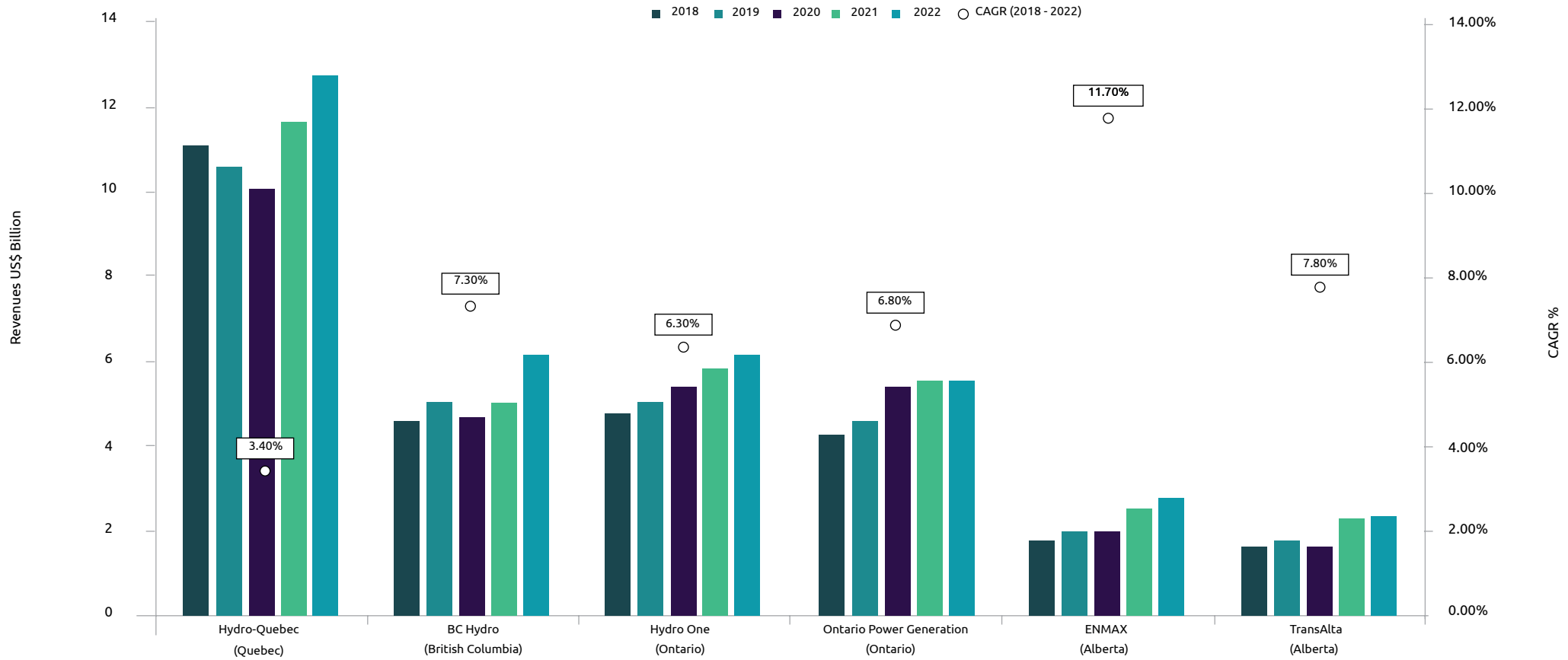


FIGURE 5

Canada: Revenues and associated CAGR (average), 2018-2022 (USD $billion)



There has been an increase in the net income contributing to a better EBITDA for Canadian Utilities in 2022

Hydro-Québec's net income was $3.40 billion in 2022, an increase of $1.0 billion, or 28%, from 2021.

- The significant increase in net income has contributed to a strong EBITDA in 2022.
  - Hydro-Québec states that favourable conditions in export markets had a major impact on the profit improvement (an increase of 60% in the export revenue).
  - There was an increase in domestic demand which consequently led to an increase in the revenue from sales to Quebec-based customers.

The EBITDA margin of BC Hydro was 37.9% in 2022, as compared to 39.4% in 2021.

- The decrease in EBITDA margin can be attributed to a decrease in 2022 net income compared to 2021.
- The lower net income was primarily due to higher operating costs as a result of higher than planned project and asset write-offs that were not subject to deferral to regulatory accounts.

The EBITDA margin of Ontario Power Generation increased to 29.0% in 2022, as compared to 28.7 % in 2021.

- The increase in EBITDA margin can be attributed to a significant increase in net income.
  - Ontario Power Generation's net income rose by 22.8% in 2022 compared to 2021.
  - There was also an increase of 19.5% in the earnings before interest and income taxes in 2022, as compared to the previous year.
  - This increase in earnings before interest and income taxes was primarily due to lower operations, maintenance, and administration (OM&A) expenses from the Regulated- Nuclear Generation business segment.

In 2022, Energy corporations in Canada have effectively been allowed to reap super profits as most Canadians were left to manage a cost-of-living crisis. During the 12-month period preceding the second quarter of 2022, the rise in industry-wide margins were led by the energy and mining sectors where soaring prices fuelled an increase in margins. The considerable impact of higher commodity prices, particularly energy, and supply chain disruptions that began at the onset of the pandemic persist across Canadian industries resulting in the current inflation rates.

The rise in profit margins necessitates specific price regulations to control how much companies can gain from disruptions in sector-specific areas, such as the energy industry. This could include measures like excess profit taxes, which would then be used to provide fiscal support for consumers..

FIGURE 6

Canada: EBITDA margins and associated CAGR, 2018-2022

U.S. and Canadian dividend per share (DPS): Utility dividend growth in 2022 can be attributed to the increase in revenue and positive cashflow

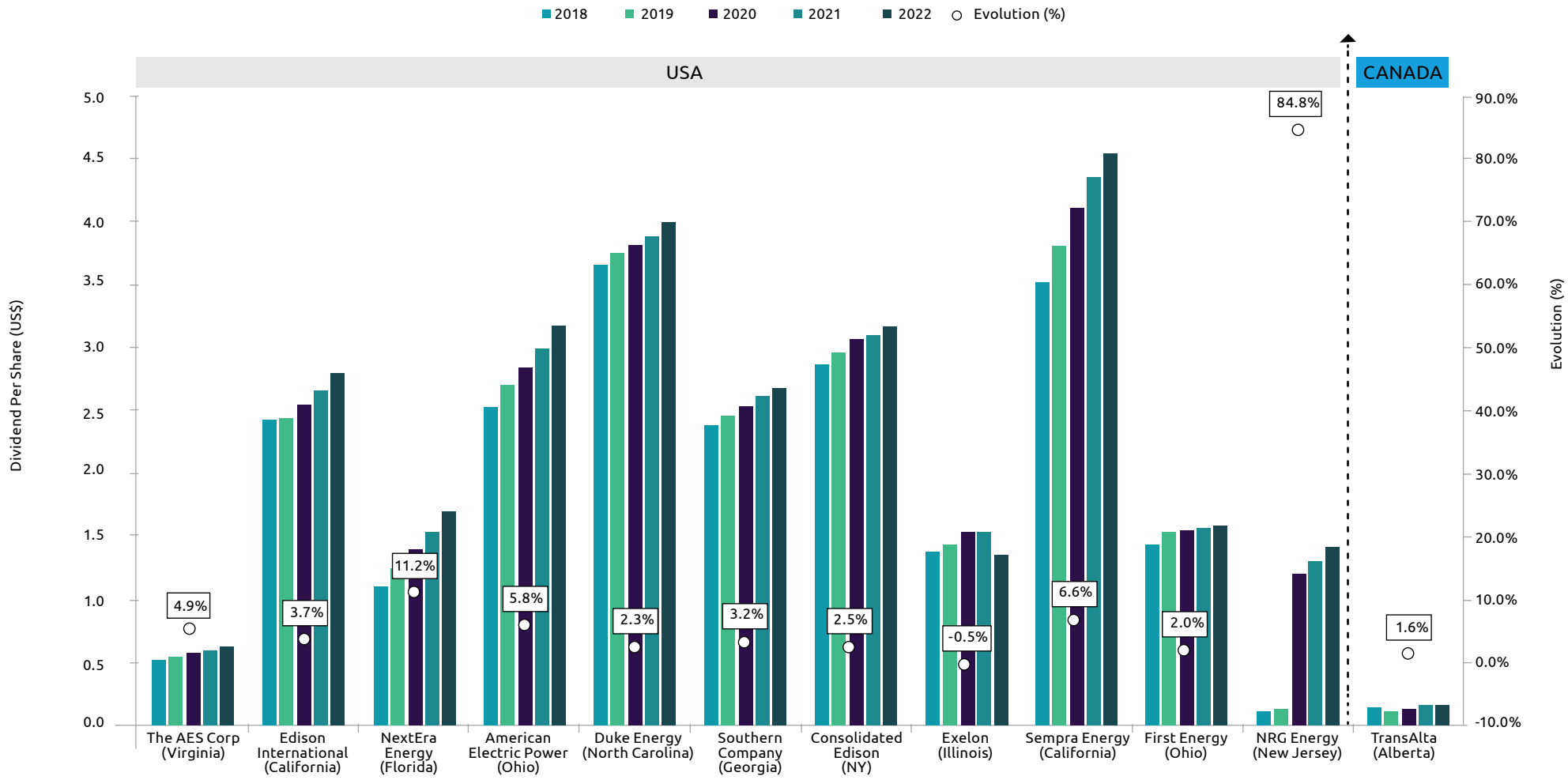
- Edison International declared a dividend of $ 2.80 per share in 2022, which is an increase of around 6% as compared to 2021.
  - In December 2022, Edison International declared a 5% increase to the annual dividend rate from $2.80 per share to $2.95 per share.
  - Edison International states that timing and amount of future dividends are dependent on several other factors including the company's requirements to fund other obligations and capital expenditures, and its ability to access the capital markets and generate operating cash flows and earnings.
- Sempra Energy declared a dividend of $ 4.54 per share in 2022, which is an increase of around 4% as compared to 2021.
  - Sempra Energy states that they have achieved strong financial results in 2022, while continuing to support a growing dividend.
  - The company also states that Sempra's ability to pay dividends largely depends on cash flows from their subsidiaries and equity method investments.
- Duke Energy declared a dividend of $3.98 per share in 2022.
  - Duke Energy increased the dividend by approximately 2% annually in both 2022 and 2021, and the company remains committed to continued dividend growth.
  - Additionally, the company aims for a dividend pay-out ratio of between 65% and 75%, based on the adjusted EPS.
- TransAlta declared a dividend of $0.16 per share in 2022, an increase of 7% over 2021.
  - The company attributes the increase in dividend to a solid financial position with over $1.6 billion in liquidity.
  - TransAlta increased their annual dividend by 10%, starting in January 2023, which represents their fourth consecutive annual increase.

Majority of the energy utilities reported impressive earnings for 2022 and reaffirmed their growth outlooks. There is a forecast of 6% average annual EPS and dividend growth for U.S. utilities during the next three years, according to a report by Morningstar, Inc.. This steady growth along with dividend yields that have stuck near 3.5% suggests attractive total returns for most utilities.

The report also states that it is unlikely that energy utilities stocks will finish 2023 with a performance like 2022 when they outperformed the market by 21 percentage points. However, an 8% total return from utilities, including dividends, should make investors happy after three years of mostly flat returns.

FIGURE 7

U.S. and Canada: Dividend per share (USD $) and 2018-2022 evolution



AUSTRALIAN PLAYERS - PRIORITIES, INVESTMENTS AND FINANCIAL RESULTS

VINNIE NAIR, AUSTRALIA

GAUTAM GANDHA, AUSTRALIA

The electricity market is changing

The National Electricity Market (NEM) in Australia is undergoing significant and unprecedented change. Since 2016, market participation has quadrupled and by 2024 a further increase of 40% is expected, bringing the total number of participants to over 500.

However, it is not so much the number of participants which is a cause for scrutiny, but rather the type of participants drawn to the market.

As incumbent large-scale generators diminish, small generation aggregators are becoming much more influential. This is largely driven by an uptick in distributed energy resource usage, aggressive emissions targets, societal inertia, and opportunities. As a result, we are approaching an age of wholesale change. In this environment, utilities will be required to determine how small generation aggregators survive and how they can thrive.

So, who is in the market now?

Traditionally, participation in the NEM has been reasonably static. The way that the market operated was predictable and was dominated by incumbent players, both on the regulated and unregulated side. This is no longer the case, as smaller players are increasingly having a seat at the table, particularly to facilitate the energy transition.

In the past two years, six new participants have entered the NEM in the virtual power plant (VPP), battery, and demand response categories. Their flexibility, responsiveness, and inherent efficiencies from a cost perspective has enabled them to offer largely lower prices, encouraging traditional generators (such as black coal generators) to also drop prices. They can therefore compete when economically viable.

Additionally, service offerings such as Frequency Control Ancillary Services (FCAS) have attracted further investment from smaller businesses. These investments have displaced some gas and coal generation, with grid-scale batteries being the most common provider of these services.

The mix of supply is also increasingly being augmented by new entrants. Up from 1% between 2017–18, large scale solar now supplies approximately 5% of the NEM's electricity requirement. New South Wales (NSW) has now overtaken Queensland in output, with 6.4% generation from NSW's solar farms. The increase in large scale solar penetration is only expected to hasten, with another eight solar projects to be commissioned across the NEM sometime between 2022–23.

Despite the influx of new entrants, the majority of investment into the NEM is backed in some way by the government. As investors await more concrete examples of cost recovery, it seems as though confidence in investments is not purely market-led yet.

For instance, since 2020, the Clean Energy Finance Corporation (CEFC) has invested up to AUD $20 million to support Phase 3 of South Australia's VPP. The program is also supported by a AUD $5 million grant from the Australian Renewable Energy Agency (ARENA), a AUD $12 million equity contribution from VPP operator Tesla, and AUD $6 million from the South Australian Government's Grid Scale Storage Fund (GSSF). Below, we can see the investment profile of the government which helps speed up the implementation of clean energy technology. As further investment in the sector continues, Distributed Network Service Providers (DNSPs) will be forced to respond with their own investments to retain their position, and take advantage of opportunities.

How is the market behaving?

In addition to responding to investments made in the sector, market participants also need to be aware of other participant behavior which could be impactful.

The latest Australian Energy Market Operator (AEMO) report sheds light on participant activity in the market. Here are some key trends which we have observed:

- **Pricing pressure:** New entrants provide pricing pressure
- **Pricing manipulation:** Participants display behavior consistent with economic withholding
- **Physical withholding:** Participants are withdrawing capacity from the market entirely
- **Rebidding conduct:** Rebidding by participants is contributing to higher prices

Let's now look at the market from a retailer perspective.

In 2022, three large retailers, The Australian Gas Light Company (AGL), EnergyAustralia, and Origin, still held significant market share and continued to have considerable cost advantages over smaller retailers.

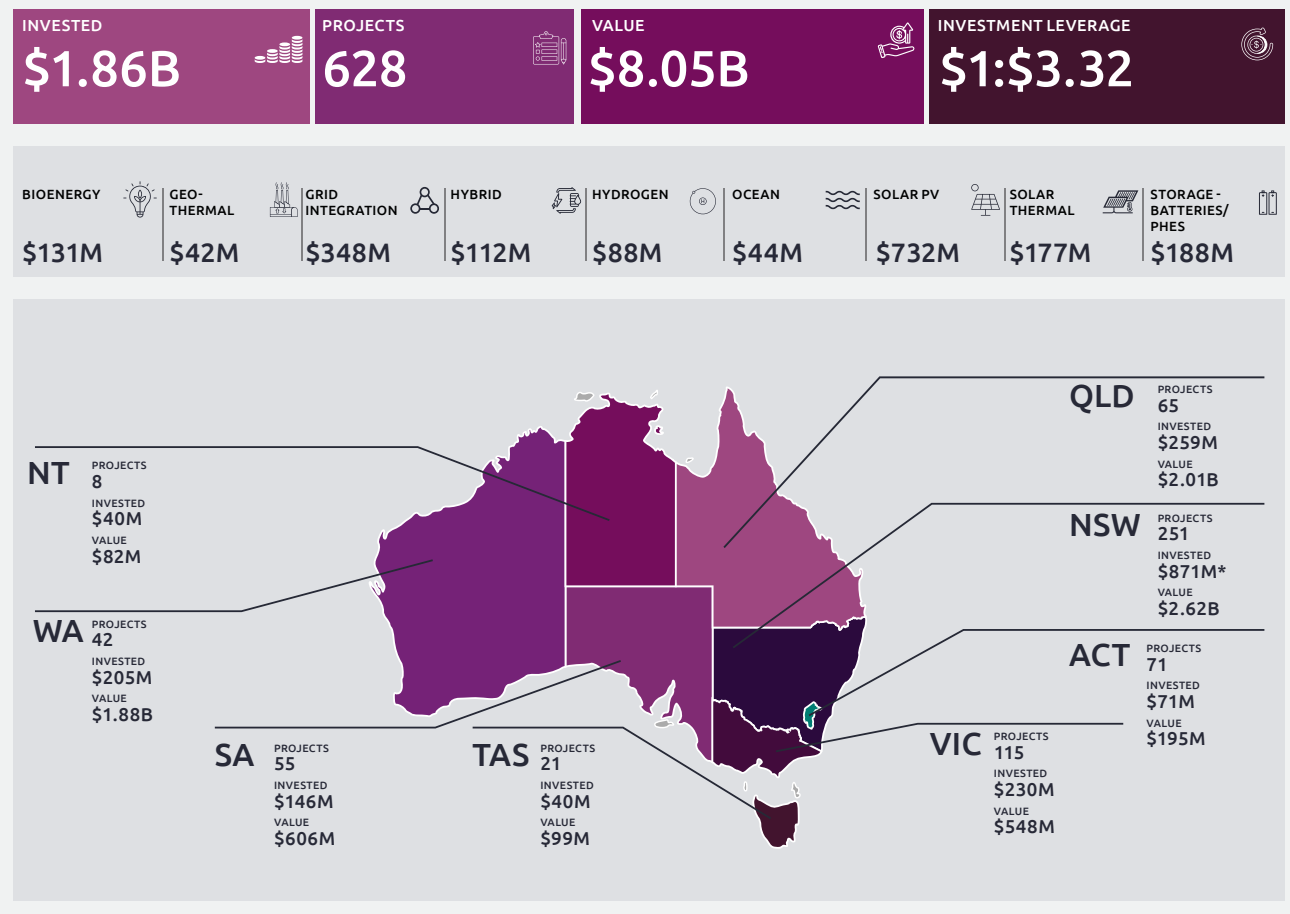
In the long run, high and volatile wholesale electricity spot prices (coupled with other financial headwinds) will cause prices to rise. This is because retailers will have limited ability to pass through increased costs, due to the price cap on standing offers or Default Market Offer (DMO).

Six retailers have either exited the market or are no longer seeking new market growth. This has resulted in consumers moving from small and very small retailers, to large retailers. Subsequently, market concentration has increased.

In the last six months alone, the rising cost of capital and lack of liquidity in the market is hurting innovation, stifling the start-up ecosystem, and raising the bar for new entrants in the market in the long run. However, market participants must still pay attention to existing new entrants who are offering innovative services and keep a close eye on further disruptors.

FIGURE 1

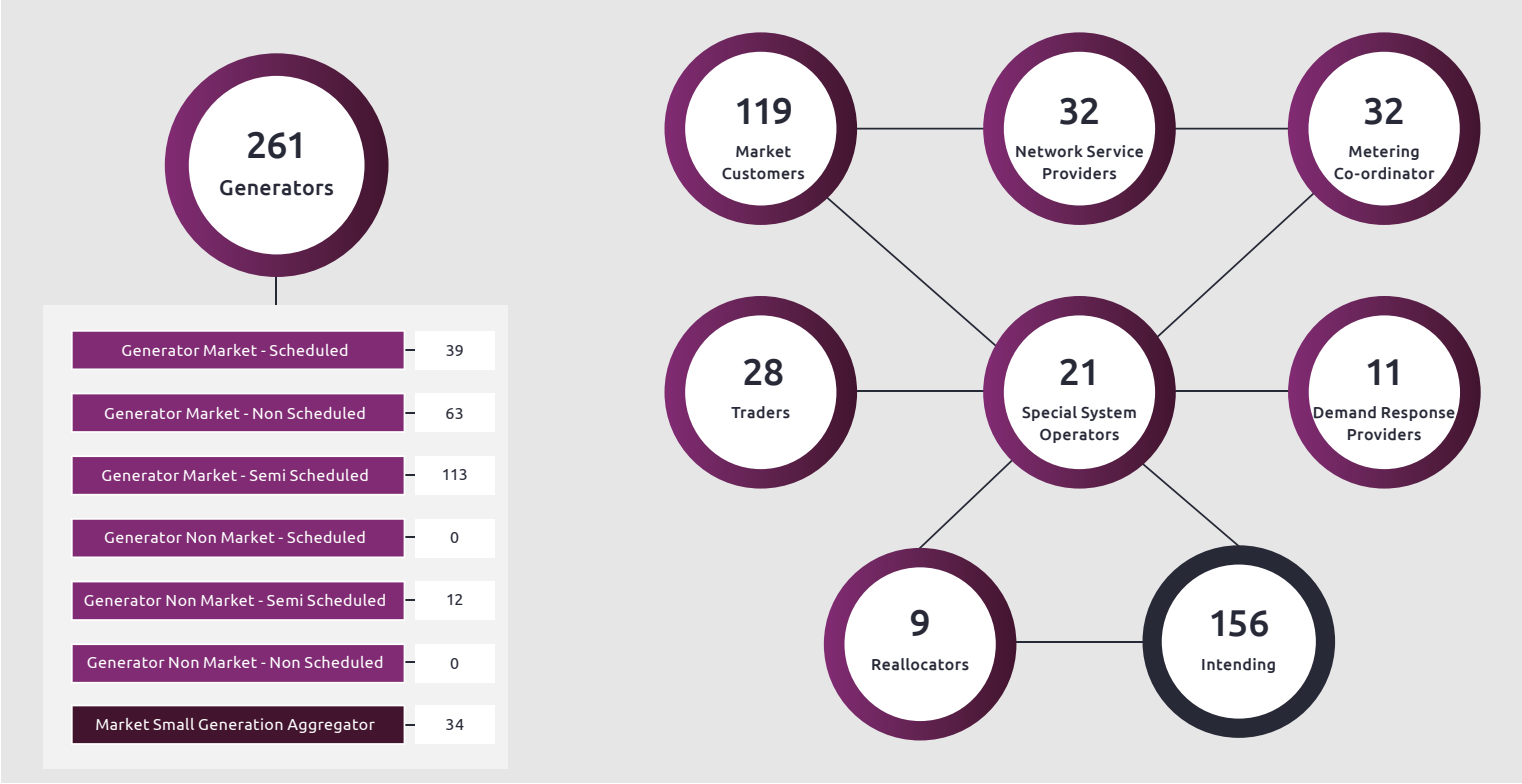
Investments in Australia



* Includes $567 million contributed to projects inherited by ARENA in 2012.

FIGURE 2

Participants in the NEM



Partnership opportunities

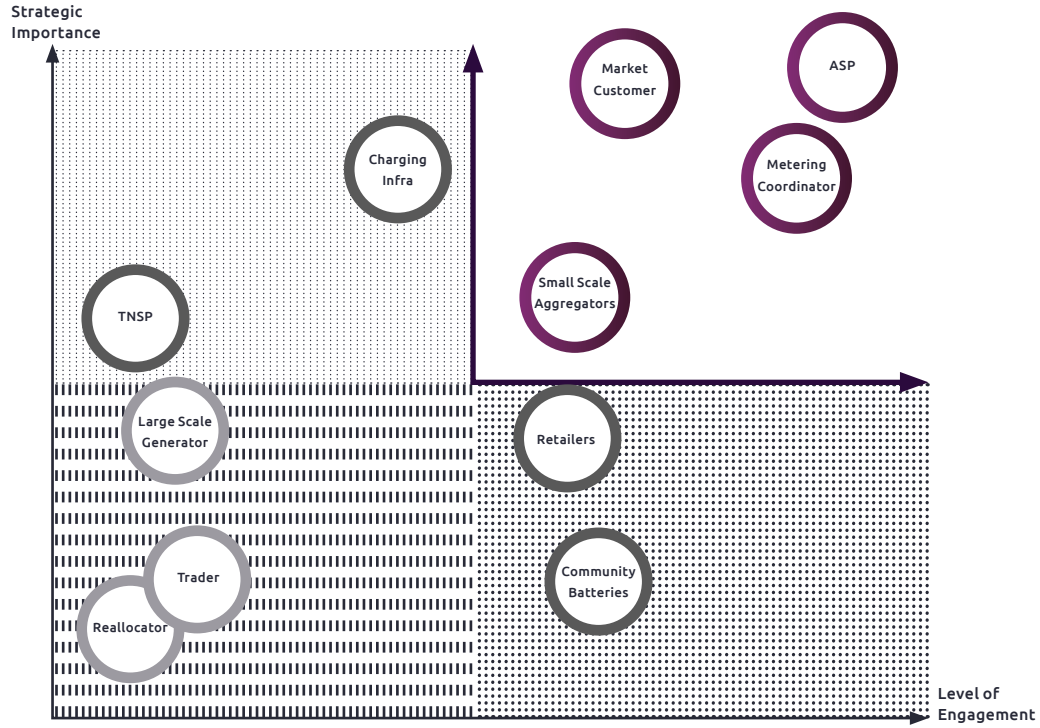
To combat the volatility in the market generated by increased investment and dynamic new entrants, Capgemini recommends that utilities should consider partnership opportunities and understand the types of partners that exist.

- **Partners:** A utility may consider partnering with a company due to one or both parties not having sufficient capabilities, or the regulatory overhead being too great for one party to to compete the job on their own.
- **Frenemies:** A company might choose to partner with a utility to help them provide a service. For example, the company may be looking for a technology uplift at a reasonable cost base, which also allows the utility to quickly expand in areas such as the unregulated revenue space.
- **Friends:** A company could partner with a 'friend', whereby the two parties exist in some sort of a symbiotic relationship. The utility and the company in question would therefore work together in a mutually beneficial relationship.

Below are some helpful considerations for utilities when deciding how best to invest in opportunities:

- **Partners:** Mining giants suffering from high energy prices might want to take matters into their own hands to manage escalating energy costs. [1] Therefore, mining giants may want to partner directly with Transmission Network Service Providers or Distributed Network Service Providers (DNSPs).
- **Frenemies:** Partnering with a 'frenemy' gives aggregators an opportunity to scale up their customer base, as well as ramp up hardware (including IoT) and software sales. This can be achieved through value-add services (such as tariff arbitration), flexible exports, and locational demand response services. Australian Energy Regulator (AER) is undertaking a significant step forward with the network tariff reform. [2]

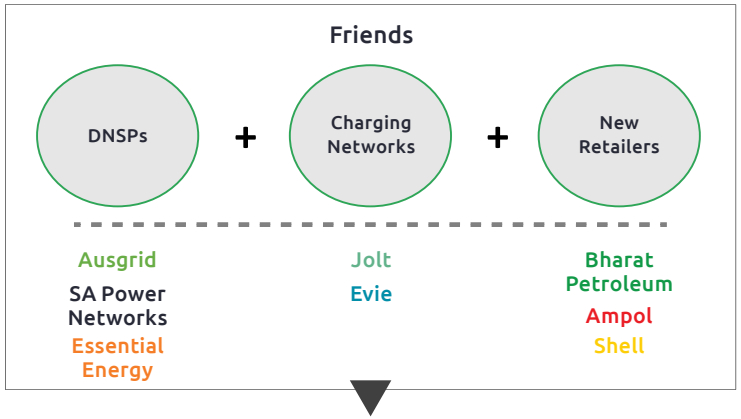
FIGURE 3



- **Friends:** There are also opportunities for DNSPs to form a three-way partnership, for example, between a fossil fuel operator, a DNSP, and an infrastructure charging operator. This is suitable for fossil fuel operators registering themselves as electricity retailers in the NEM. [3]

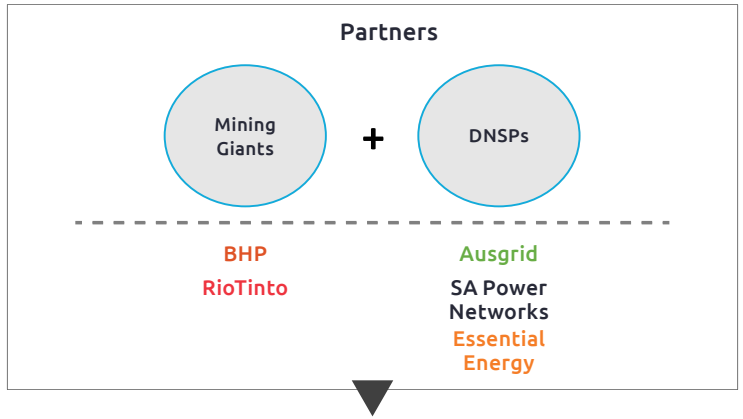
Investment opportunities

Utilities will need to make material investments in enabling technologies or in partnership options (as mentioned previously). This ensures they are equipped with the capabilities required to respond to an increasingly evolving market.



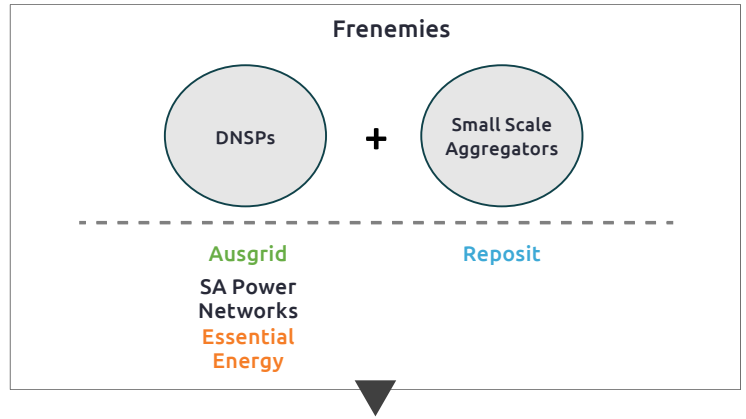
Cost of Doing Nothing

- To enable access to new services, DNSPs need to seriously consider partnerships with charging networks and new retailers.
- DNSPs are unable to secure retail licenses; in addition, tremendous capability exists in the market regarding charging networks. Failing to capitalize on these opportunities puts the onus on DNSPs to solve fundamental issues in isolation.



Cost of Doing Nothing

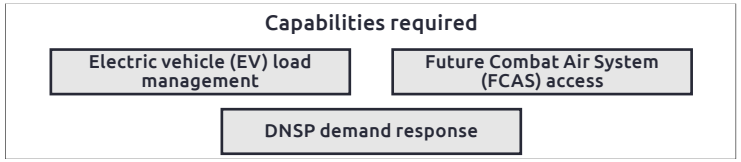
- Mining giants can go it alone in building private networks due to the sheer amount of capital at their disposal. However, energy networks expertise is hard to come by.
- By partnering with mining giants and helping to develop and manage their private networks, DNSPs will greatly improve their Regulatory Asset Base (RAB).

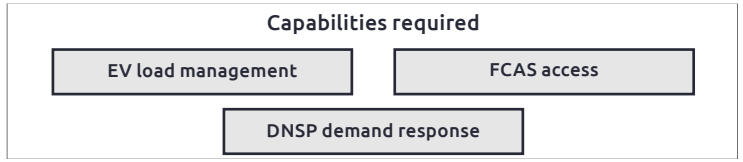


Cost of Doing Nothing

- DNSPs currently partner with aggregators or similar ancillary service providers to access capabilities and technologies which do not exist internally. Without these technologies and capabilities, responding to an increasingly volatile network and changing customer behaviors becomes difficult.
- However, DNSPs will need to decide whether these capabilities are better developed internally to increase revenue and safeguard against external risk.

DNSPs require the capabilities below. The question will be whether we choose to incubate them or source them through partners and the market.





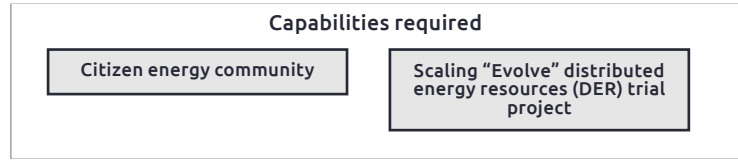
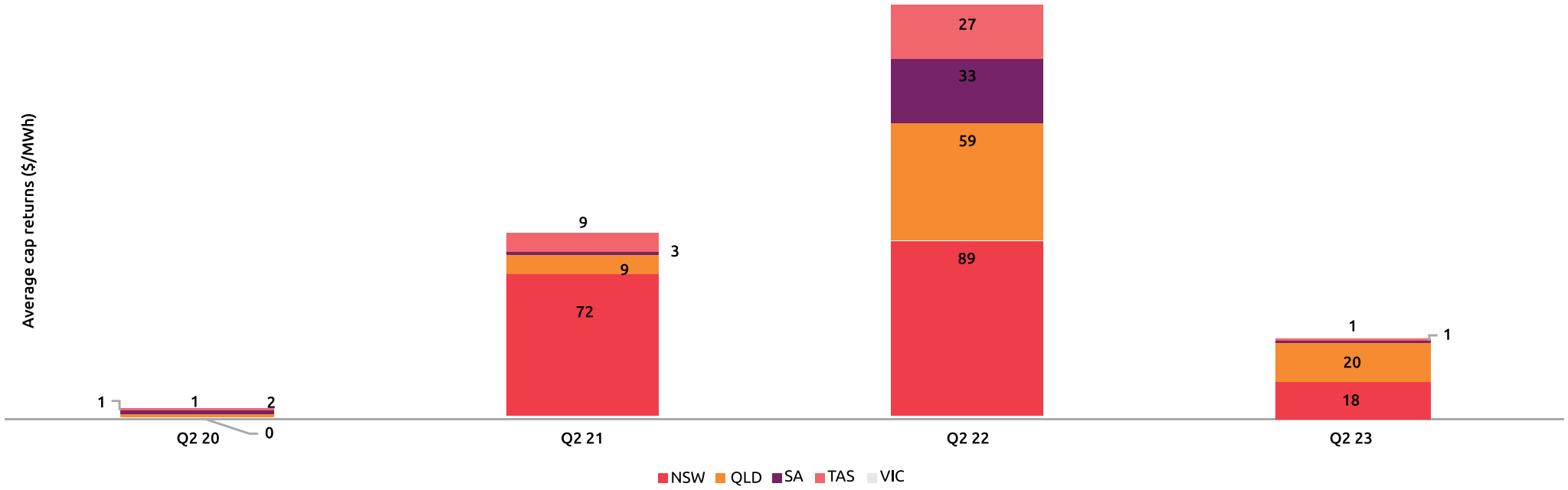


FIGURE 4

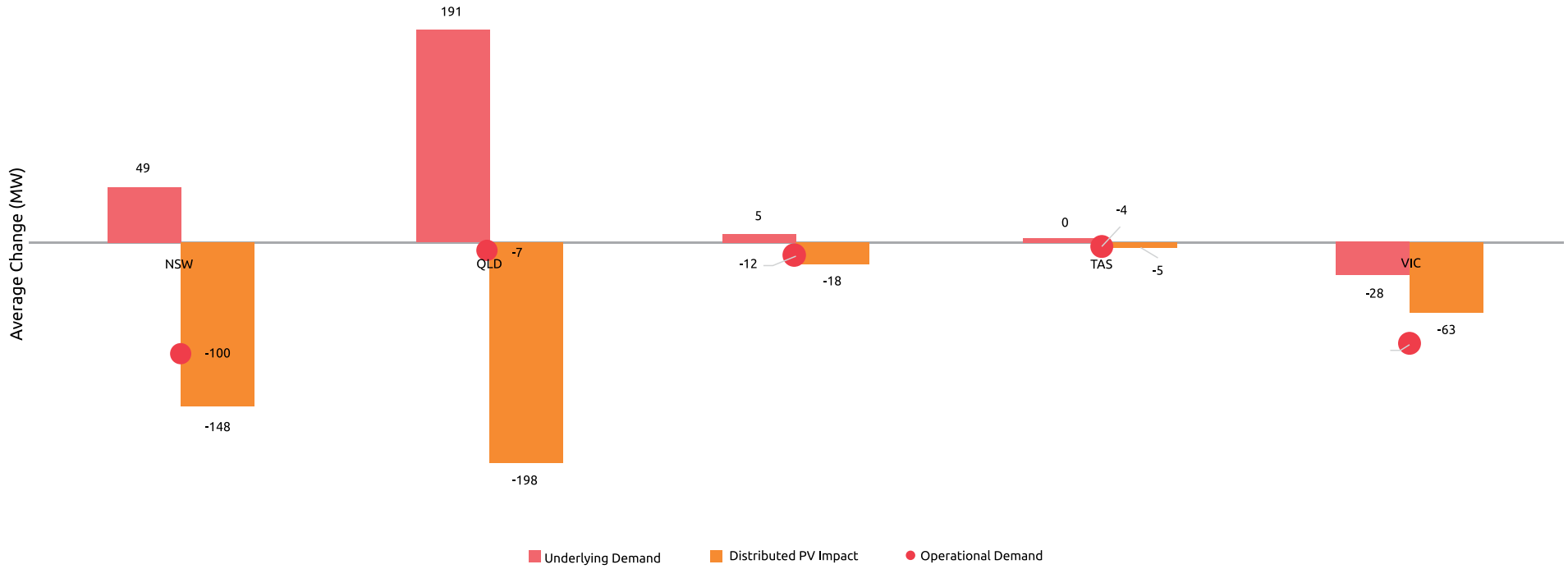
NEM average quarterly cap returns by region, Q2 2020 - Q2 2023



Source: AEMO: Quarterly Energy Dynamics Q2 2023
https://aemo.com.au/-/media/files/major-publications/qed/2023/qed-q2-2023-report.pdf?la=en&hash=719538BE6166CB79BE1BF6B9BE82A183

FIGURE 5

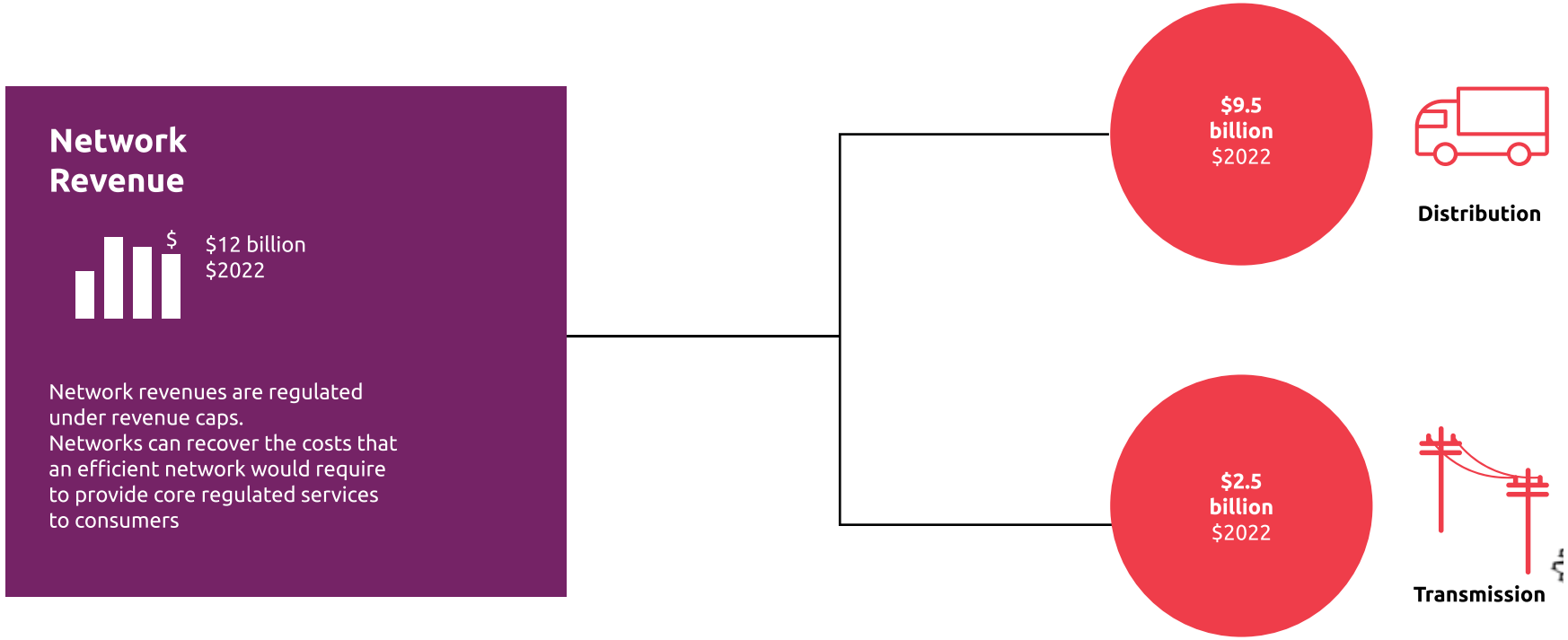
Changes in average demand components by region Q2 2023 vs Q2 2022



Source: AEMO: Quarterly Energy Dynamics Q2 2023
https://aemo.com.au/-/media/files/major-publications/qed/2023/qed-q2-2023-report.pdf?la=en&hash=719538BE6166CB79BE1BF6B9BE82A183

FIGURE 6

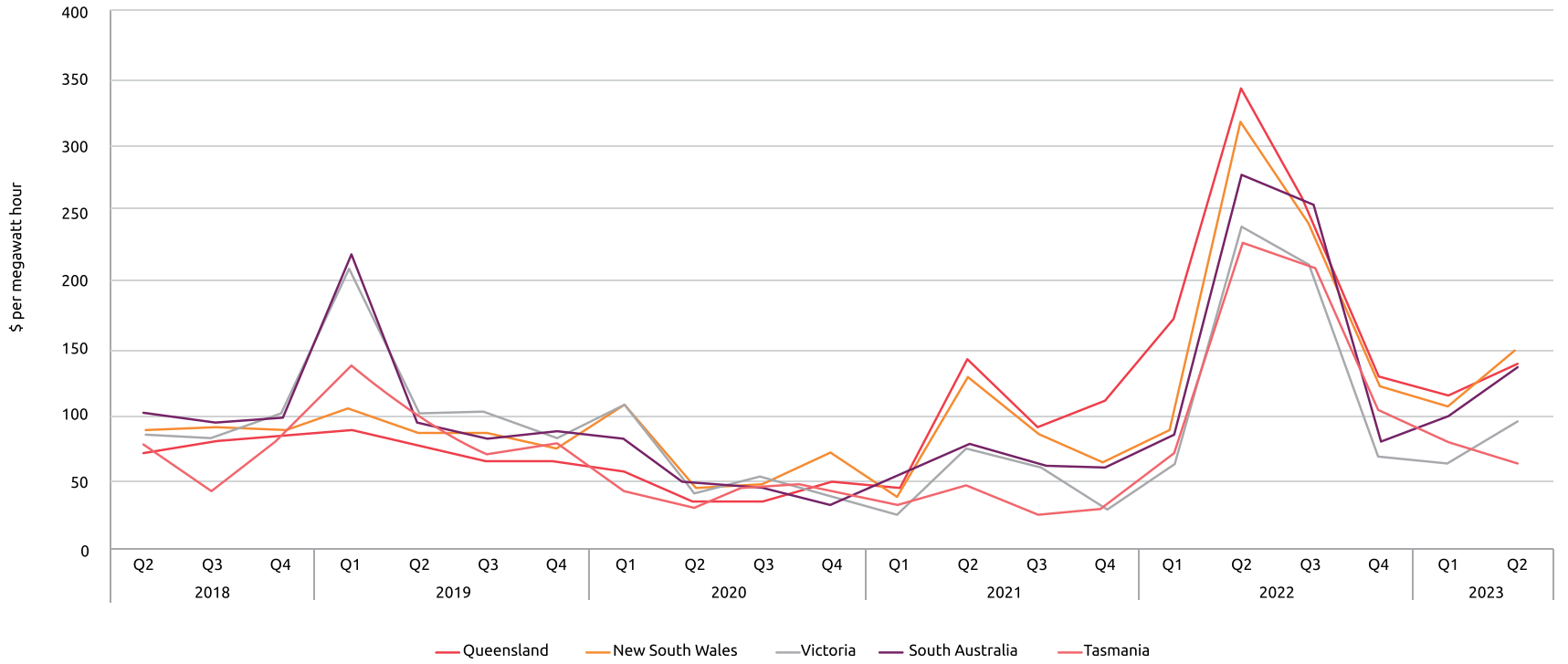
Electricity Networks performance in 2022



Source: AEMO: Quarterly Energy Dynamics Q2 2023
https://www.aer.gov.au/system/files/2023-Electricity-network-performance-report.pdf
https://www.aer.gov.au/system/files/AER%20-%20Infographics%20%202023%20Electricity%20network%20performance%20report_0.pdf

FIGURE 7

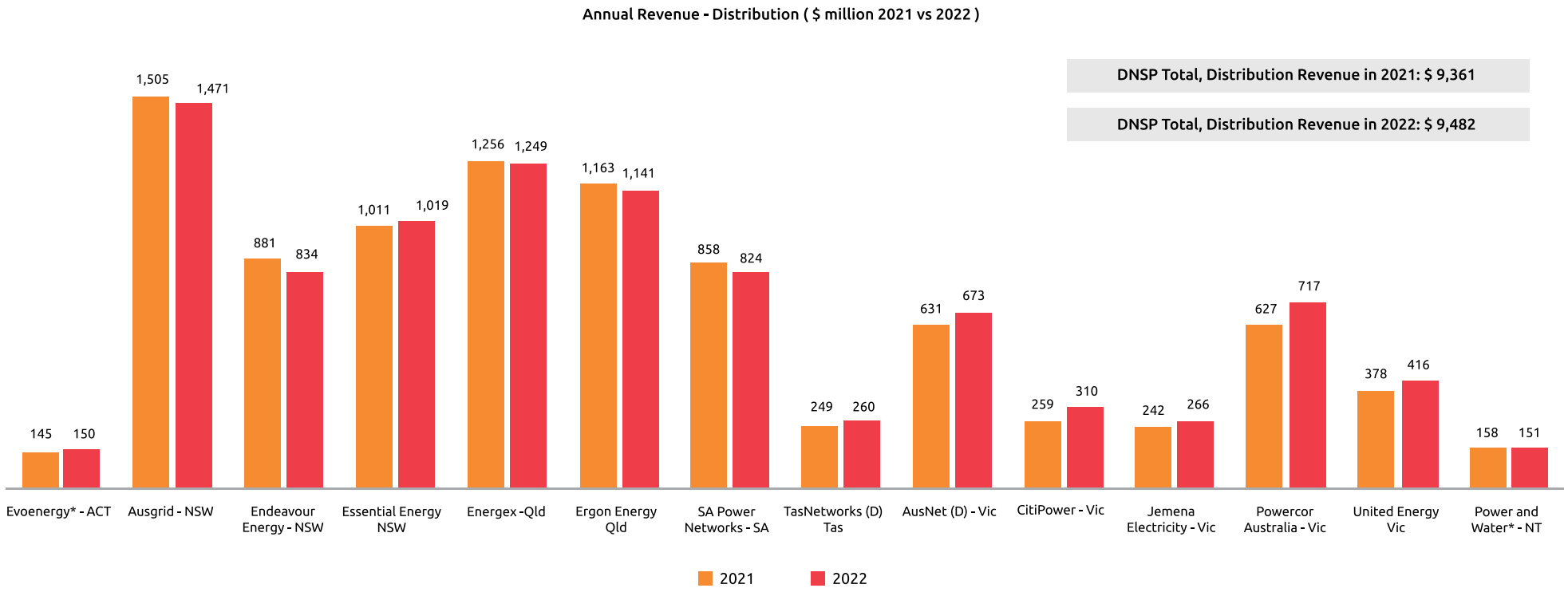
Quarterly wholesale spot prices across National Electricity Market regions, 2018 - 2023



Source: Australian Energy Regulator: Quarterly volume weighted average spot prices – regions
https://www.aer.gov.au/wholesale-markets/wholesale-statistics/quarterly-volume-weighted-average-spot-prices-regions

FIGURE 8

Distribution, Annual Revenue, $ million, (2021 vs 2022)



Source: AER - Electricity network performance report 2023
https://www.aer.gov.au/networks-pipelines/performance-reporting/electricity-network-performance-report-2023
https://www.aer.gov.au/system/files/AER%20-%20Electricity-DNSP-Operational%20performance%20data%202006-2022.xlsx

FIGURE 9

Distribution, Regulatory Asset Base, $ million, (2021 vs 2022)

Source: AER - Electricity network performance report 2023

https://www.aer.gov.au/networks-pipelines/performance-reporting/electricity-network-performance-report-2023

https://www.aer.gov.au/system/files/AER%20-%20Electricity-DNSP-Operational%20performance%20data%202006-2022.xlsx

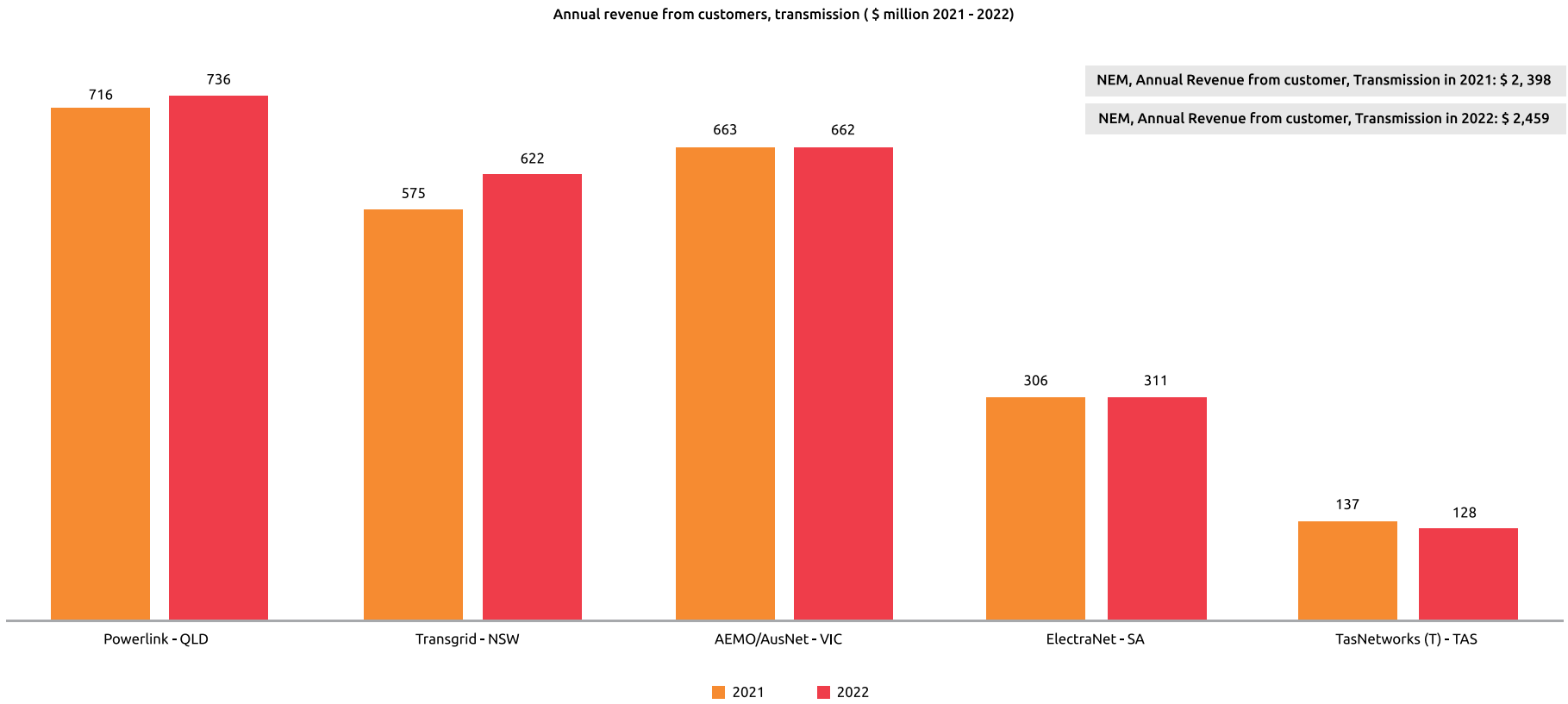
FIGURE 10

Distribution, Operating expenditure, $ million, (2021 vs 2022)

Source: AER - Electricity network performance report 2023
https://www.aer.gov.au/networks-pipelines/performance-reporting/electricity-network-performance-report-2023
https://www.aer.gov.au/system/files/AER%20-%20Electricity-DNSP-Operational%20performance%20data%202006-2022.xlsx

FIGURE 11

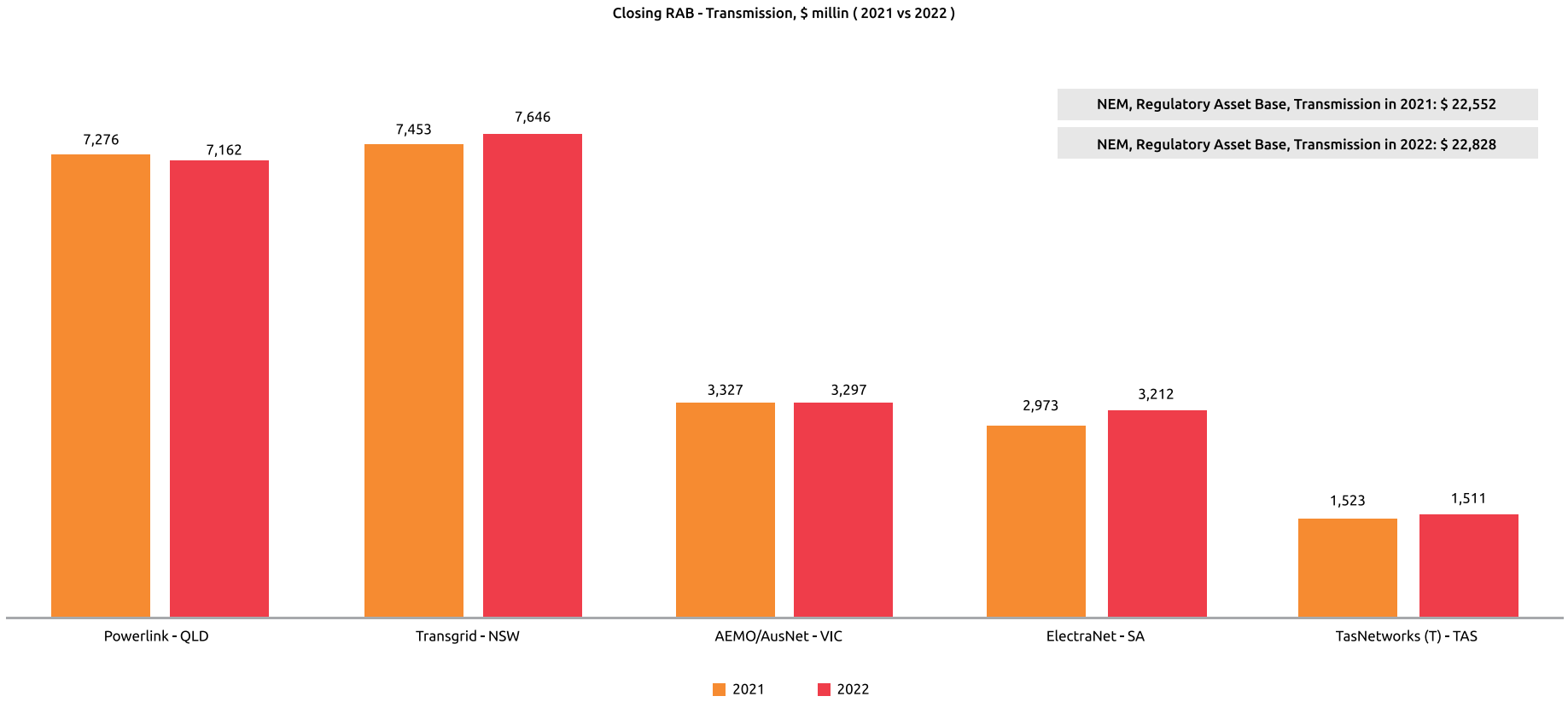
Transmission, Annual Revenue, $ million, (2021 vs 2022)



Source: AER - Electricity network performance report 2023
https://www.aer.gov.au/networks-pipelines/performance-reporting/electricity-network-performance-report-2023
https://www.aer.gov.au/system/files/AER%20-%20Electricity-DNSP-Operational%20performance%20data%202006-2022.xlsx

FIGURE 12

Transmission, Regulatory Asset Base, $ million, (2021 vs 2022)



Source: AER - Electricity network performance report 2023
https://www.aer.gov.au/networks-pipelines/performance-reporting/electricity-network-performance-report-2023
https://www.aer.gov.au/system/files/AER%20-%20Electricity-DNSP-Operational%20performance%20data%202006-2022.xlsx

FIGURE 13

Transmission, Operating expenditure, $ million, (2021 vs 2022)

Source: AER - Electricity network performance report 2022
https://www.aer.gov.au/networks-pipelines/electricity-network-performance-report-2022

Conclusion

There are significant changes happening in the Australian energy market. This can be seen in the activity of investment, the behaviour of certain participants, and the investments required by DNSPs to maintain relevancy.

What is certain are the capabilities required to maintain relevancy, most notably:

- EV load management
- FCAS access
- Demand response
- Citizen-driven energy community management
- DER project trials

However, DNSPs will have to grapple with how they acquire these specific capabilities, whether they develop them in house, or they choose a partnership model with other participants in the NEM. This is a difficult and fundamental question, which ultimately depends on where the DNSP chooses to focus their efforts; scaling revenue in their unregulated businesses or focusing on their core mission statement of a reliable supply and steady return to investors.

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Capgemini is a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided every day by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of nearly 350,000 team members in more than 50 countries. With its strong 55-year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fueled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering, and platforms. The Group reported in 2022 global revenues of €22 billion

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