Climate Scenario Analysis

Duke Energy

Report 2019

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Executive Summary
Duke Energy

This report by 2° Investing Initiative provides an assessment of **Duke Energy**'s power capacity by technology, its future alignment with climate transition pathways and evaluates its performance against other utilities in the North American market.

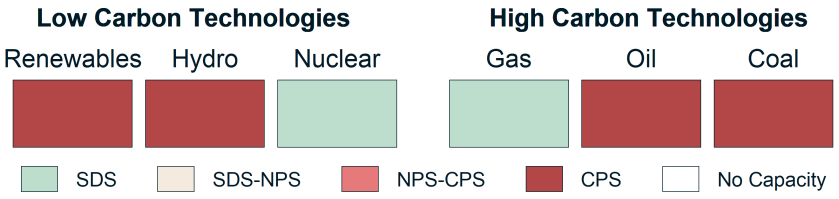
Installed Capacity 2019

Duke Energy has 61,375 MW of installed capacity with 27.7% coming from low carbon technologies. By 2024, it has no known plans for additional capacity.

	Renewables	Hydro	Nuclear	Gas	Oil	Coal
2019 Energy Mix (MW)	4,564	3,186	9,259	23,590	2,330	18,447
Planned Additions (MW) 2019-2024	611	0	0	202	-329	-714

Comparison of investment plans with transition scenarios

Duke Energy's planned capacity additions are compared to the different climate scenarios of the International Energy Agency (IEA) for each technology as described on page 4. The additional capacity planned by **Duke Energy** aligns it with the SDS for Nuclear and Gas capacity and with the CPS for Hydro, Renewable, Coal and Oil capacity.



Changes in Capacity required to align with the SDS by 2024

In order to align with the Sustainable Development Scenario (SDS) by 2024, **Duke Energy** would require the following changes in capacity by technology to its current plans by 2024:

	Renewables	Hydro	Nuclear	Gas	Oil	Coal
2024 Planned Energy Mix (MW)	5,175	3,186	9,259	23,791	2,001	17,733
Required Changes (MW)	6,394	360	-489	572	-399	-2,665

Introduction

Key Questions

This climate scenario report addresses five key questions regarding **Duke Energy**'s climate strategy:

1. How does the company's current capacity mix compare to the power market's capacity mix? (Page 6)
2. How do the company's investment plans compare to different climate transition scenarios? (Page 7)
3. How does the company's planned capacity mix by 2024 compare to the scenario-aligned market? (Page 9)
4. How can the company adjust its investment plans to align with the SDS by 2024? (Page 10)
5. How does the company's climate alignment compare to other utilities? (Page 11)

This document solely presents the results of the above analyses. For more information on the methodology, scenarios, underlying data, and limitations, please refer to "A Guide to Company Scenario Analysis" available at www.transitionmonitor.com.

Why is scenario analysis important?

Scenario analysis is highlighted within by the Task Force for Climate-related Financial Disclosures (TCFD) as a recommended tool for understanding the resilience of organization's strategies under different climate related scenarios. It supports both companies and investors in developing action plans as a response to the Paris Agreement.

How does this scenario analysis work?

This scenario analysis is an assessment of the physical assets owned by **Duke Energy** and its investment plans in new capacity, based on third party data. The share of responsibility, defined by climate scenarios that outline possible transition pathways, has been allocated to the company according to the regional distribution of its power capacity. Further analyses allow us to understand how **Duke Energy** is currently, and in the future, exposed to climate transition risks and opportunities.

How can it be used?

For **Companies**, this analysis provides a comparison of its performance relative to peers, and an understanding of how climate change responses differ. It also provides an overview of how planned capacity changes compare to the climate scenarios developed by the International Energy Agency (IEA). It highlights potential areas for action by companies.

For **Investors**, this report may be used to inform their decision making by highlighting the alignment of the trajectories of companies in their portfolio with different climate scenarios and therefore their potential exposure to transition risks. The information provided in this report can support engagement activities with companies and may provide data for reporting requirements.

For **other stakeholders**, such as policy makers or NGOs, this may support the development of guidelines for reporting or research.

What this report doesn't do: this report is not a financial analysis of the company and should not be taken as investment advice.

Data used in this report is based on third party data from GlobalData (effective as of 12/2018) and may vary from what is announced by the company in annual reports; the data in this report reflects an aggregation of the known subsidiaries of **Duke Energy** aggregated under the equity share principle. Details regarding the data sources and processing can be found on page 14. Companies are invited to review the data and provide feedback to assist in improving the underlying data sets by emailing 2dii at transitionmonitor@2degrees-investing.org.

Reading the Report

Report Contents

This report consists of three elements:

1. **Company profile:** information about the current installed capacity of the company, its technology mix and its global capacity distribution.
2. **Scenario Analysis:** results of the comparison of the company investment plans to different scenarios and the market.
3. **Peer Comparison:** a comparison of the scenario analysis results to peer companies operating in the same market.

Key Concepts

To understand the results presented in this report, some of the key concepts are summarised below. For detailed information about the methodology, scenarios and underlying data, please refer to "A Guide to Company Scenario Analysis" available at www.transitionmonitor.com.

Low carbon technologies: This report treats renewables, hydro and nuclear as low carbon technologies, and gas, oil and coal capacity as high carbon technologies. Renewable technologies include solar, wind and biomass. While acknowledging other sustainability issues linked to different technologies, the analysis in this report focuses on the low carbon versus high carbon split.

Capacity build out: Refers to the investment plans of the company in new power capacity.

Capacity vs Generation: This report uses capacity (MW) rather than generation (MWh) as a metric. The generation of electricity from each technology differs by a capacity factor that varies due to a multitude of factors.

Capacity mix: The distribution of the power capacity of **Duke Energy** is used as an indicator. This refers to the share of installed capacity that **Duke Energy** has in each technology.

Market: The market referred to in this report is designated based on the country of domicile of **Duke Energy**. The market therefore includes all North American utilities.

Aligned with a scenario: To be aligned with a scenario implies that the capacity build out of the company matches what is expected based on the roadmaps developed by the IEA.

Scenarios: Four IEA scenarios are included in this report's analysis: three are sourced from the World Energy Outlook 2018 (WEO 2018) and one from the Energy Technology Perspectives 2017 (ETP 2017) and are detailed in Table 1. These have been chosen due to their regional and technological granularity. The SDS is used as the benchmark scenario. The scenarios consist of technology roadmaps that outline the technological changes required in each designated region globally. These roadmaps have been applied to each asset to calculate the change that would be required by asset. This is aggregated to the region and then the company to determine the overall expected change required.

Table 1: Overview of the IEA scenarios used in the analysis.

Scenario Full Name	Abbreviation	Estimated temperature increase by 2100*	Source
Beyond 2° Scenario	B2DS	1.75°C	ETP 2017
Sustainable Development Scenario	SDS	1.7-1.8°C	WEO 2019
New Policy Scenario	NPS	2.7°C	WEO 2019
Current Policy Scenario	CPS	3.3°C	WEO 2019

*The temperature rise estimates for the B2DS, SDS and NPS are specified by the IEA. The CPS estimate is taken from Climate Action Tracker's 2018 Warming Projections Global Update.

Company Profile

This section outlines the current and future capacity mix of **Duke Energy**. Figure 1.1 shows the changes in capacity in each technology between 2019 and 2024. From this, one may be able to extrapolate whether the company's transition risks increase or decrease. Figure 1.2 and 1.3 show the geographical distribution of power generation assets by capacity and capacity mix.

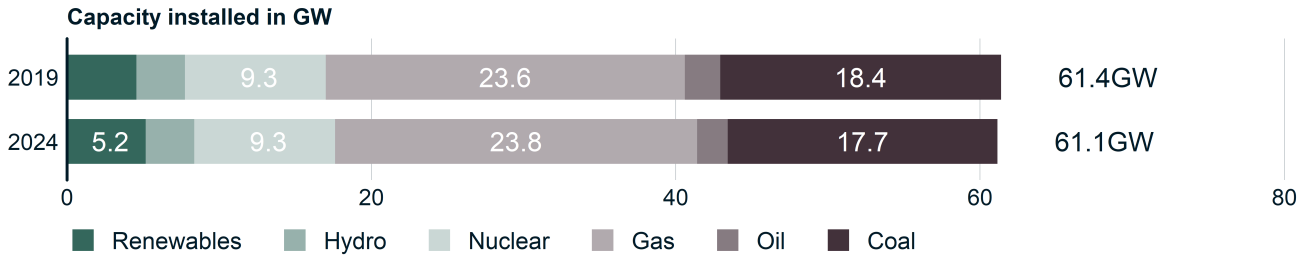


Figure 1.1: Company capacity mix in 2019 and 2024.

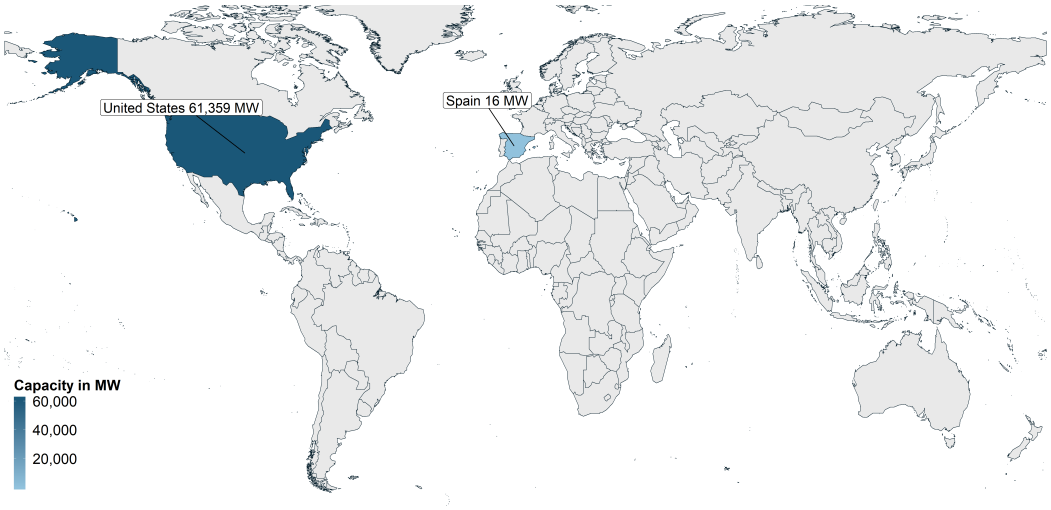


Figure 1.2: Geographical distribution of the company's power generating assets in 2019.

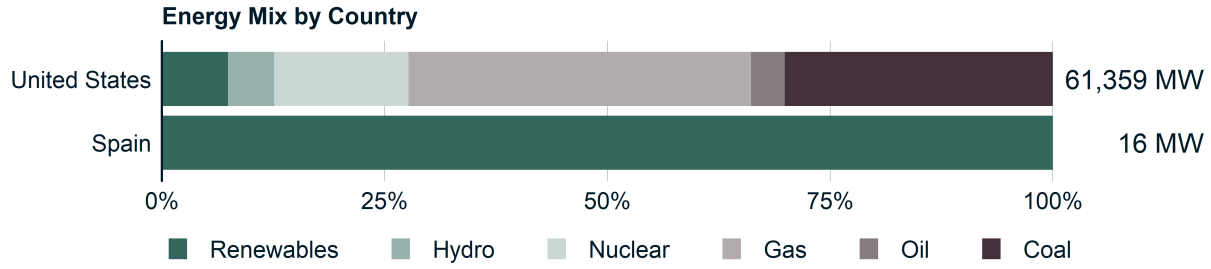


Figure 1.3: Overview of the company's capacity mix and total capacity in the largest countries by total capacity in 2019.

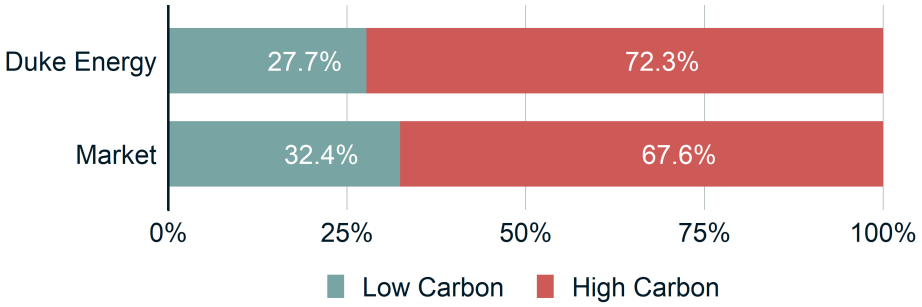
Current Alignment

How does the current capacity mix of Duke Energy compare to the market?

This section provides an overview of the diversification of **Duke Energy**'s capacity across high and low carbon technologies. In order to meet the goals of the Paris Agreement, the IEA broadly signals that the share of "low carbon technologies" must increase while the share of "high carbon technologies" must decrease.

As such, the company's capacity mix is presented both in terms of the share of low carbon technologies of its total capacity, and the breakdown of its capacity by technology specifically. The market is representative of all utilities in the North American power market.

A) Low and high carbon capacity mix percentage



B) Capacity mix by technology percentage

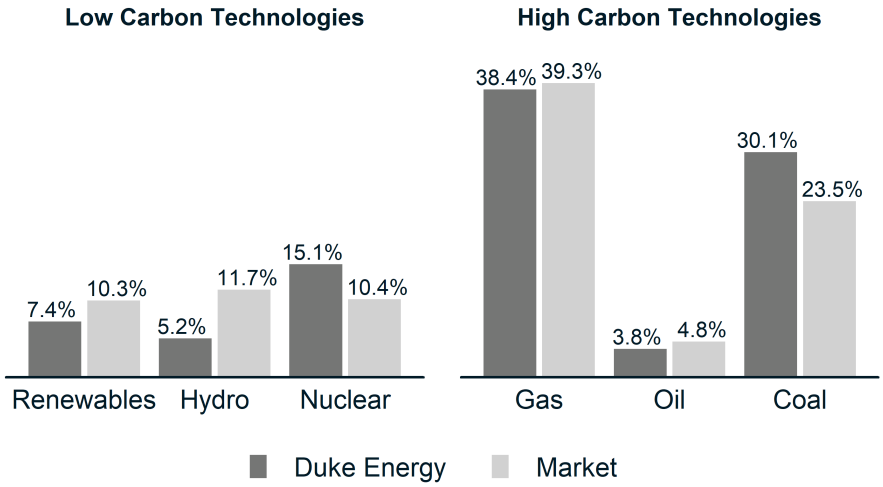


Figure 2.1: Comparison of the company's capacity mix to the market's capacity mix in 2019 by A) low carbon vs high carbon spilt and B) by technology.

Duke Energy has 27.7% of its power capacity in low carbon technologies compared to 32.4% in the market. Duke Energy has a higher share of Coal and Nuclear capacity than the market; it has a lower share of Gas, Hydro, Oil and Renewable than the market.

Trajectory

How do the capital expenditure plans for different technologies compare to the climate scenarios?

Plans to build or retire capacity over the next 5 years can be used to compare **Duke Energy**'s planned changes in capacity to different International Energy Agency (IEA) scenarios. These scenarios present possible transition pathways and the changes in capacity required if each company in the world were to align its capacity accordingly.

The expected change in capacity by technology as per the IEA scenarios has been applied to the power capacity of **Duke Energy** to calculate the changes required under each scenario. This report benchmarks the company against the Sustainable Development Scenario (SDS), though the following charts also show the Beyond 2 Degree Scenario (B2DS), the New Policy Scenario (NPS) and the Current Policy Scenario (CPS).

Alignment with climate scenarios may vary by technology. For each technology, figure 3.1 summarises the different IEA scenarios that **Duke Energy**'s investment plan aligns with. It is important to note that these charts are independent of the current exposure to each technology (except by determining the starting point in terms of capacity). The initial (2019) weighting of a technology within the company's capacity mix is not reflected in these charts.

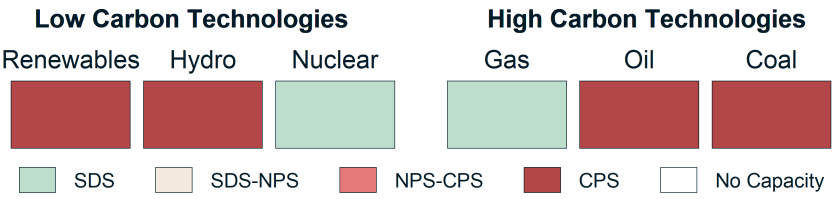
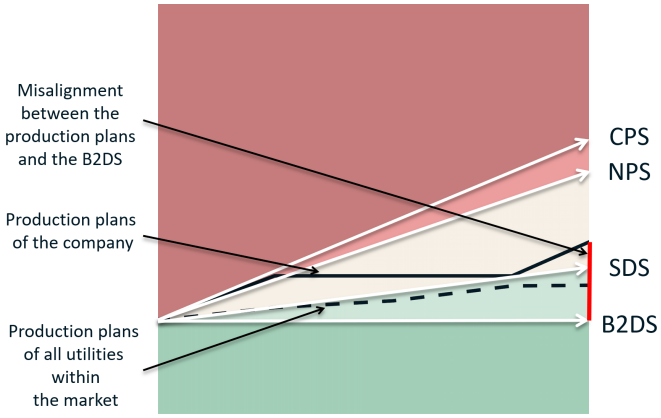


Figure 3.1: Scenario outcome of the build out plans for each technology by 2024. This summarises the results of the trajectory charts in 2024.

The additional capacity planned by Duke Energy aligns it with the SDS for Nuclear and Gas capacity and with the CPS for Hydro, Renewable, Coal and Oil capacity.

The charts on the following page (figure 3.2) provide additional details on how **Duke Energy**'s investment plans for each technology align with four IEA scenarios over the next five years. They also show the market's trajectory for context.

The background colours represent how the trajectory of a technology should progress under the relevant scenario based on the geographical exposure of the company's power capacity. The solid and dashed lines represent the production plans of the company and those of the utility market scaled to the starting point of the company. In the chart to the right, the company's investment plans for this technology lie between the SDS and NPS trajectories. The difference in 2024 between the company's production plan and the end point for a specific scenario indicates the change in capacity that would be required for alignment. The market capacity can be compared to the company plans as a relative indicator only, as the scenarios are specific to the company. In this case, the company is building out more of this technology than the market.



Trajectory

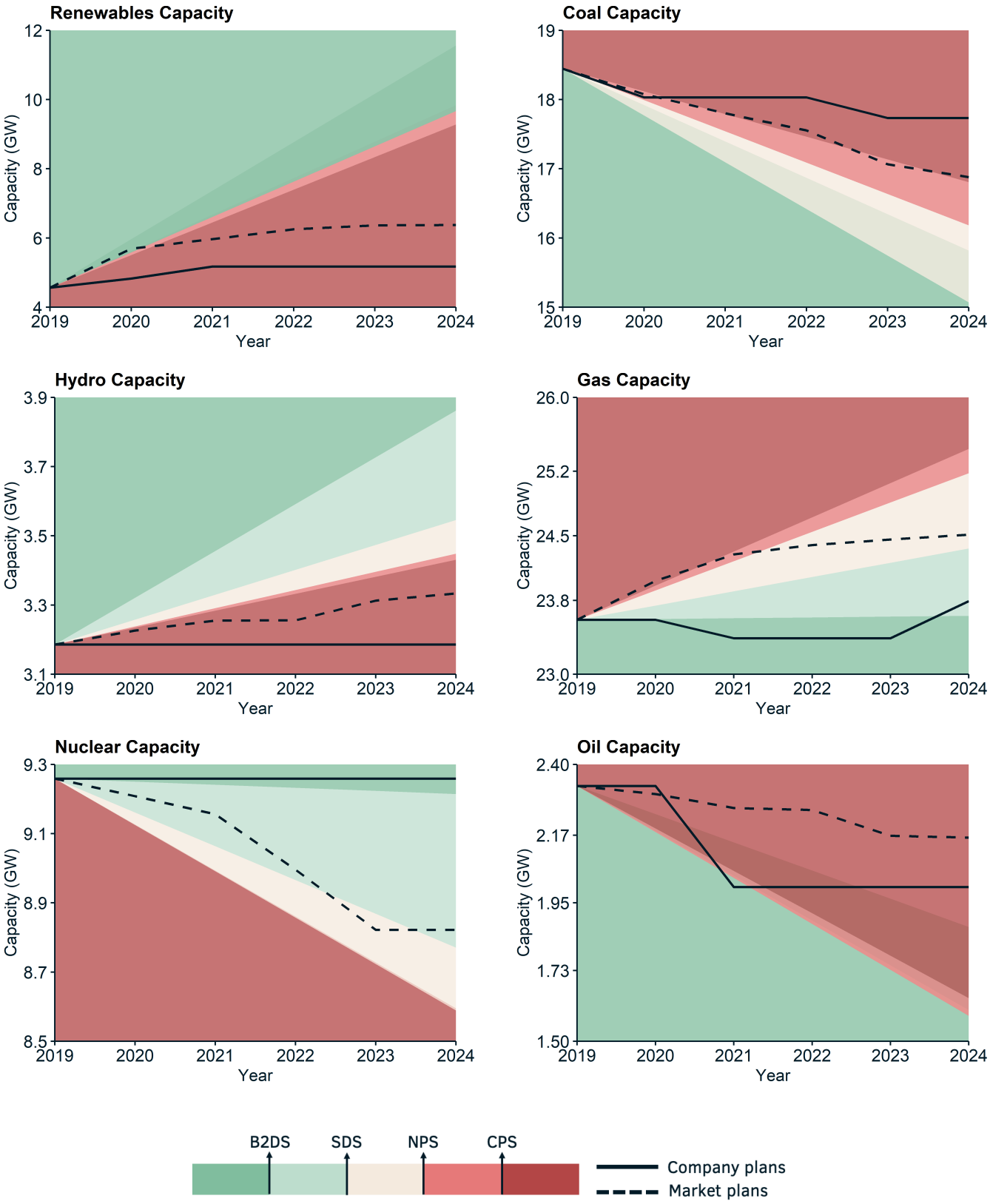


Figure 3.2: illustrates how **Duke Energy**'s planned capacity changes in each technology compare to different IEA transition pathways and the market.

Future Alignment

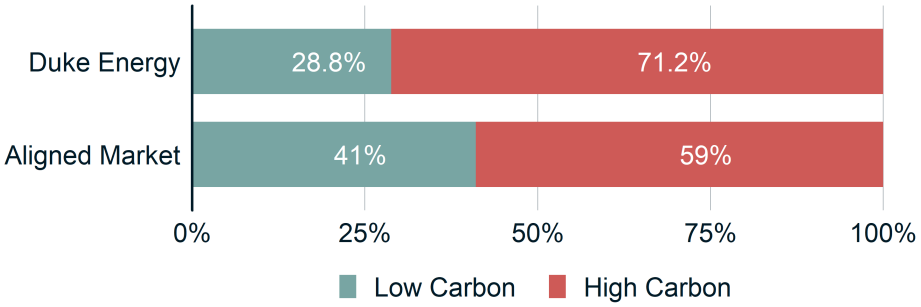
How will the planned capacity mix of Duke Energy compare to a North American utility market aligned with the SDS in 2024?

The capacity mix of **Duke Energy** in 2024 is based on its capacity mix in 2019 plus planned capacity changes between 2019 and 2024. The aligned market capacity mix shows what would be expected if the current North American power market were to develop over the next five years in accordance with the SDS.

If the company has a lower amount of low carbon technologies than the theoretical aligned market, it may be exposed to higher transition risks based on the technological trajectories outlined by the IEA.

Figure 4 shows that **Duke Energy** has an capacity mix in 2024 which has 12.2% percentage points or 29.7% less low carbon capacity than an aligned market.

A) Low and high carbon capacity mix percentage



B) capacity mix by technology percentage

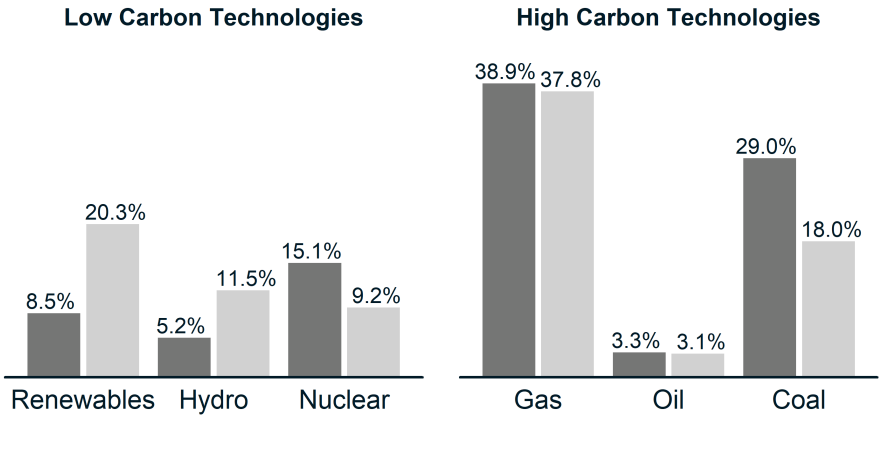


Figure 4.1: Comparison of the company capacity mix to the market capacity mix in 2024.

By 2024 Duke Energy has a higher share of Coal, Gas, Nuclear and Oil capacity than the market aligned to the SDS; it has a lower share of Hydro and Renewable capacity than the market aligned to the SDS.

Achieving Alignment

What changes in capacity are required by Duke Energy to align itself with the SDS?

For **Duke Energy** to align itself with the SDS by 2024 based on the company's current capacity, the following capacity changes by technology are required.

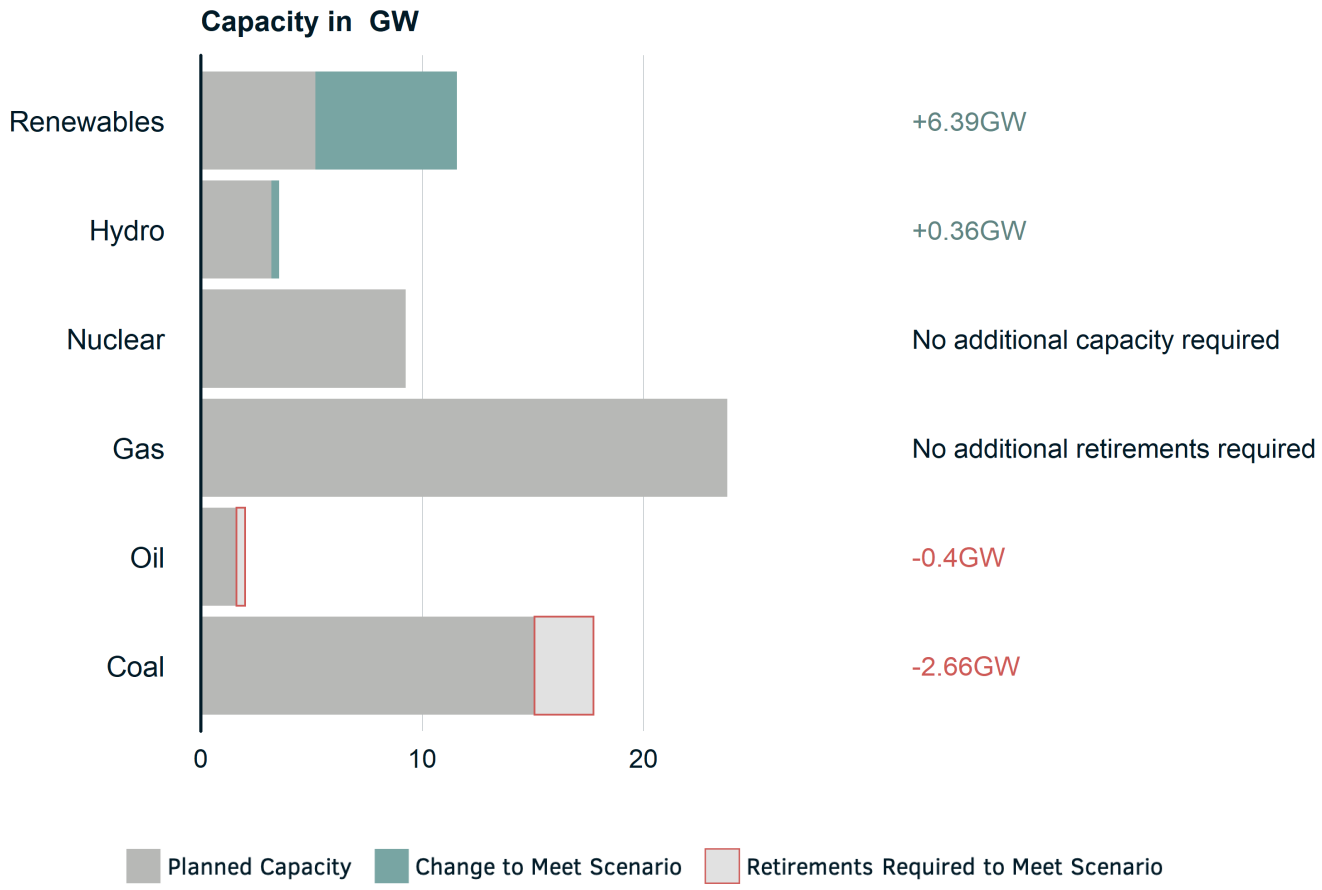


Figure 5: Changes in capacity required to align with the SDS.

By 2024, Duke Energy requires additional investment in Hydro and Renewable capacity to be aligned with the SDS, as well as retirements of Coal and Oil.

In some cases, the company's investment plans may outperform the capacity required to align with the SDS. If the company's investment plan for low carbon technologies exceeds scenario targets, no retirements are specified. Similarly, no additions are specified if the company's plans already meet the transition pathways for high carbon technologies.

Comparison Between Utilities

How does the current capacity and future planned capacity of Duke Energy for low carbon technologies compare to other utilities in the North American market?

In this section, we represent the current capacity mix of **Duke Energy** relative to the other utilities in the North American market, as well as its investment plans. Figure 6 highlights:

- On the x-axis, the percentage of low carbon technologies within the capacity mix in 2019.
- On the y-axis, the percentage of planned additions by 2024 which are low carbon.
- The 2019 total power capacity of each company via the size of the circles. Each circle represents a separate utility.

Duke Energy is highlighted in black.

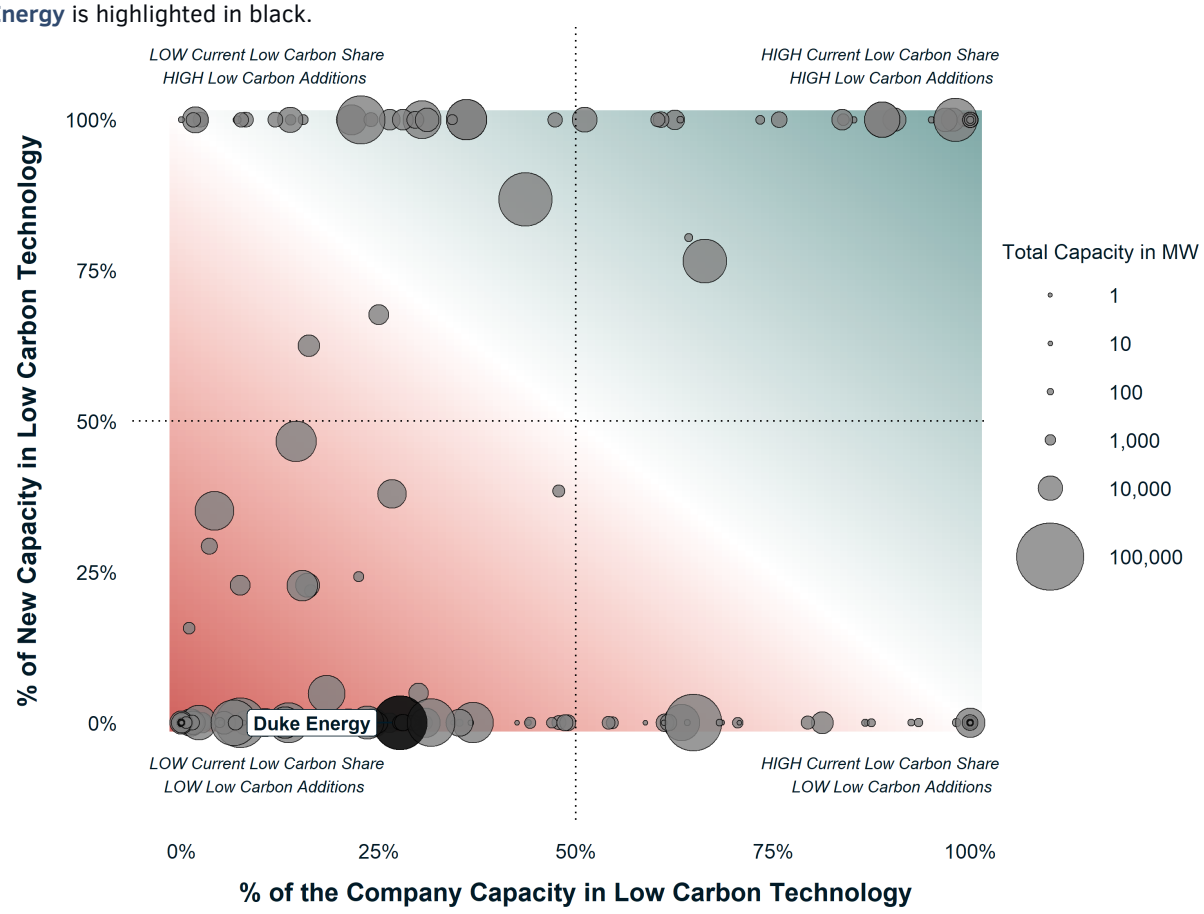


Figure 6: % planned future capacity in low carbon technologies vs % current capacity in low carbon technologies.

Companies fall into one of four categories:

1. Upper Right: These companies are currently heavily invested in low carbon technologies as a share of the capacity mix, and have plans to expand investment in these technologies even further.
2. Lower Right: These companies are currently heavily invested in low carbon technologies as a share of the capacity mix. However, their planned capacity is either primarily high carbon, or they have no planned capacity additions.
3. Upper Left: These companies are not currently heavily invested in low carbon technologies, as a share of the capacity mix. However, their planned capacity additions are primarily low carbon.
4. Lower Left: These companies are neither currently heavily invested in low carbon technologies as a share of the capacity mix, nor have plans to build these out in the future.

Comparison Between Utilities

How do the investment plans in new capacity of Duke Energy compare to other utilities?

This section displays the investment plans by technology of all companies in the North American market. It highlights the distribution of the global capacity build out of these companies, in renewable and coal capacity.

Figure 7 shows the planned capacity changes between 2019 and 2024. The width of each bar represents the capacity of the build out of each company in the market: i.e. a company with 5 times as much capacity build out will be 5 times as wide as another company. This represents the cumulative additional capacity only and does not reflect net retirements.

16.3% of companies in the North American market have plans to invest in renewables (151.9% of new capacity) while 0.5% of companies have plans to invest in new coal capacity (-101.84% of new capacity).

The chart shows the build out volume of renewables and coal capacity for each company.

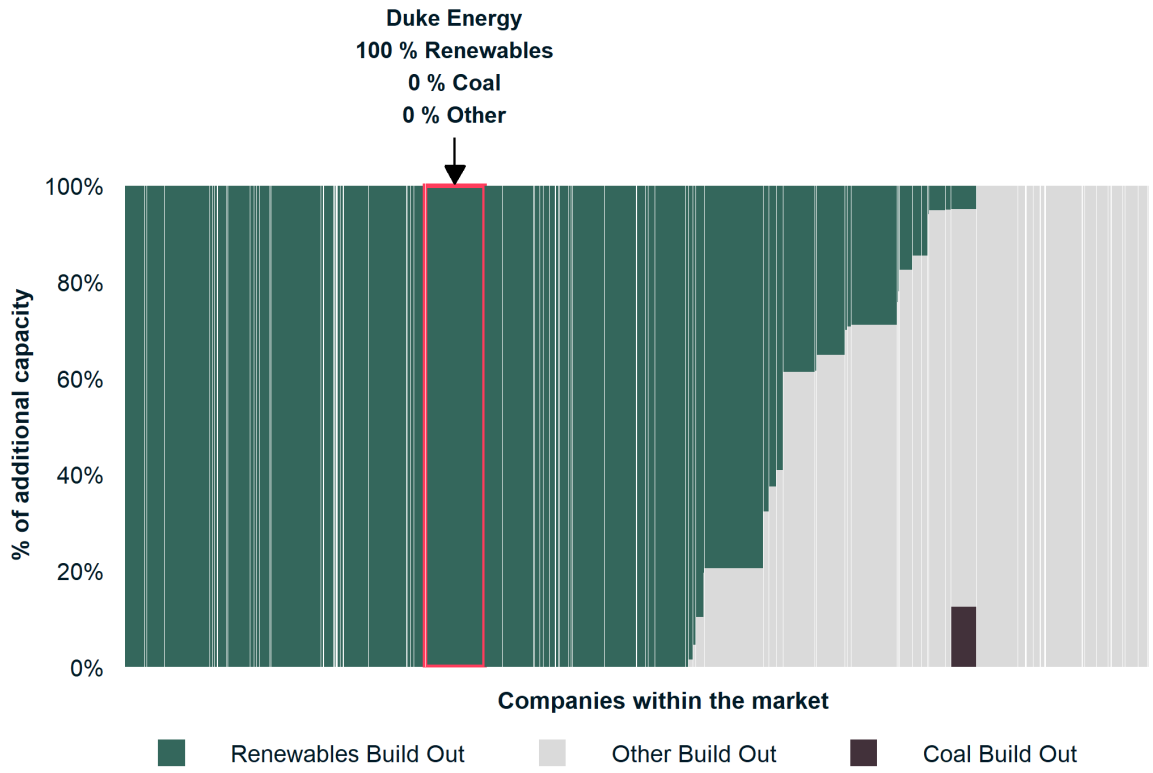


Figure 7: Breakdown of new power capacity by technology with a focus on Renewable and Coal power. The width of each bar represents the capacity of the build out of each company within the market.

Market Share

How does Duke Energy's market share of each power technology evolve between 2019 and 2024?

This section shows how **Duke Energy**'s market share in key technologies is expected to develop between 2019 and 2024 and what the company's future positioning relative to the market will be.

Figure 8 shows changes in the company's renewable and total power capacity market share, defined as the % of total capacity in each technology over the entire North American power capacity in each technology.

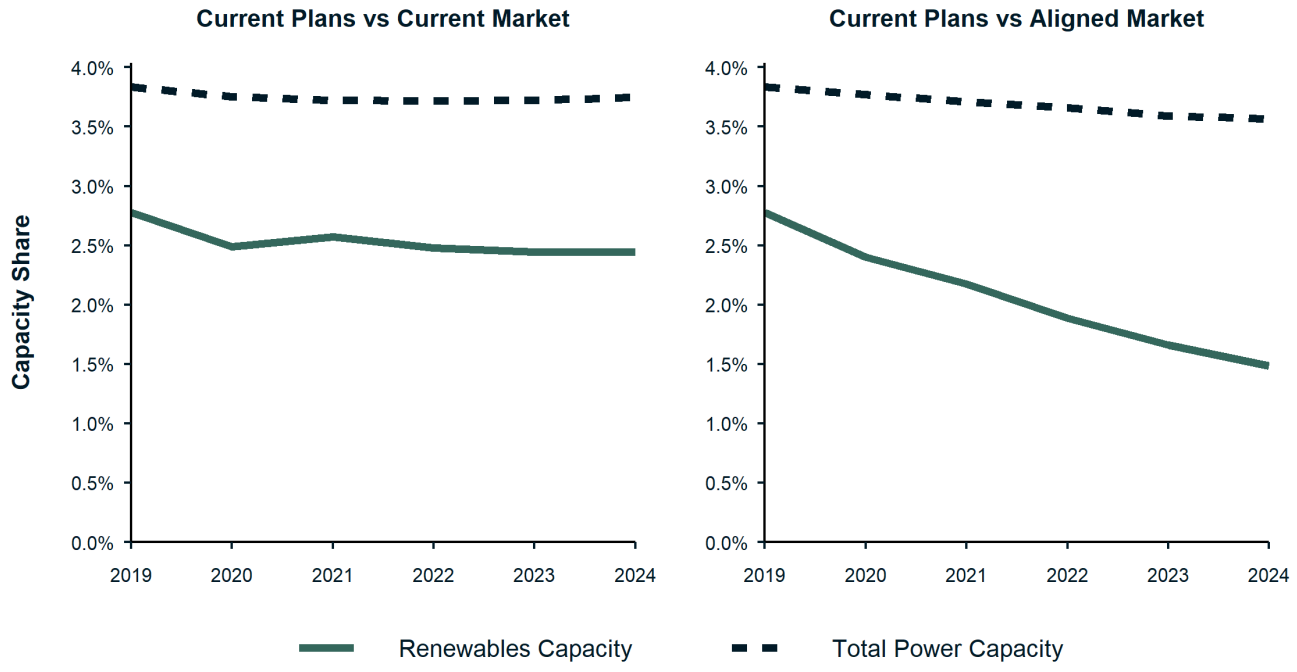


Figure 8: The above charts show how **Duke Energy**'s market share of the North American market develops for renewable and total power capacity. The chart on the left provides a comparison to the North American utility market given current plans, and the chart on the right shows how this would develop if the market were aligned with the SDS.

The total market share of Duke Energy is set to decrease given the actual plans of the market as well as the market under the SDS by 2024. Its market share of renewable capacity is set to decrease given the actual plans of the market and the market under the SDS by 2024.

The market share for each technology represents the company's capacity as a percentage of the capacity of all utilities in the market (actual and aligned) including current announced plans. If the company's renewables market share is decreasing over the next 5 years, this suggests that **Duke Energy** plans to build out renewables capacity at a lower rate than the utilities market as a whole.

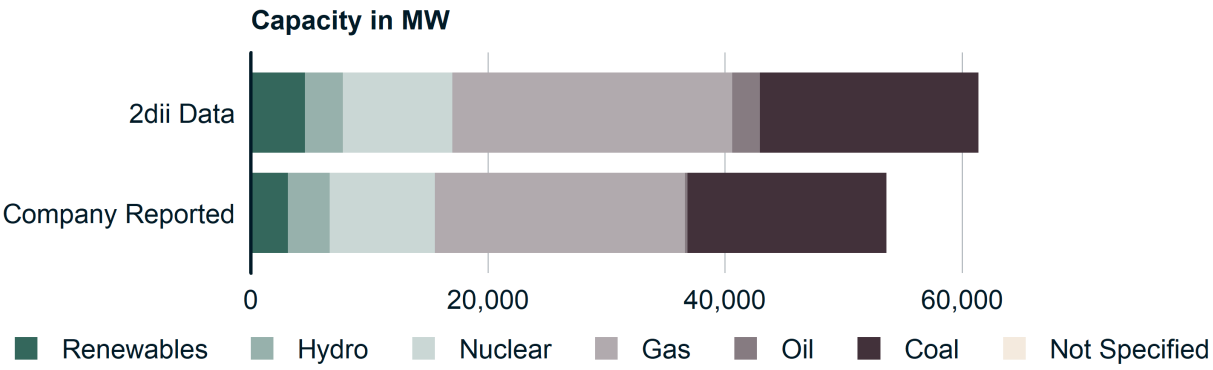
Data Sources

2dii scenario analysis is based on forward-looking power asset data from GlobalData paired with company ownership information from Bloomberg. GlobalData provides highly granular information on individual power plants, including plant ownership, technology employed, location as well as active and pipeline capacity values. The company's current capacity mix was calculated by aggregating capacities across active plants where the company is listed as owner, weighted by an ownership stake. 5-year investment plans were calculated by aggregating capacities from plants with years online between 2019 and 2024. Power capacity was allocated from subsidiary companies to the company based on company ownership data sourced primarily from Bloomberg. The result is a forward-looking capacity mix for **Duke Energy** that serves as starting point and basis for comparison for scenario analysis. It does not include electricity sourced under power purchasing agreements.

Self-reported capacity mix data was taken from the company's website or annual report and compared to the capacity mix used in this report. The comparison revealed a discrepancy of 12.6% (see figure 9). Reasons for discrepancy fall into three categories:

1. We take asset data and ownership information from two major data providers: GlobalData and Bloomberg. The data we receive from these sources may in some cases be incomplete or contain errors. Errors may include missing assets, missing or inaccurate parent-subsidiary information, and missing or inaccurate asset ownership data.
2. We allocate capacity from subsidiaries to parent companies according to the following rules: If a subsidiary company is private/unlisted, 100% of its capacity is allocated to the parent company holding the controlling stake. If a subsidiary is public/listed, the non-free float portion of its capacity is allocated to the parent company holding the controlling stake. No power capacity is allocated to parent companies holding non-controlling stakes.
3. Data sourced from GlobalData is effective as of June 2019, and data from Bloomberg is effective as of 2018 Q4. This may differ from the effective dates of company reported data.

The capacity mix data is still undergoing quality review. As part of the quality review process, 2dii reached out to all companies included in the reports to seek edits and clarifications to the underlying data. Please review the legal disclaimer for further information about the limitations of the data.



Data Type	Units	Renewables	Hydro	Nuclear	Gas	Oil	Coal	Total
2dii Data	MW	4,564	3,186	9,259	23,590	2,330	18,447	61,375
	%	7.4	5.2	15.1	38.4	3.8	30.1	
Company Reported	MW	3,136	3,520	8,858	21,113	223	16,764	53,614
	%	5.8	6.6	16.5	39.4	0.4	31.3	

Effective date of company-reported data: 31/12/2018

Figure 9: Comparison between the power capacity provided in the company reports published by the company to the aggregation of data completed by 2dii.

Company Statement

Companies were given the opportunity to respond to a draft of this report, to comment on both the data used and other qualitative elements of their sustainability policies that may not be captured in the analysis above. As a company, if you would like to make a similar comment or edit the content of this text, please be in contact with us at transitionmonitor@2degrees-investing.org.

Company Statement:

$ Climate change is an important issue for Duke Energy, our shareholders and stakeholders. We have reduced our carbon emissions by 31
% from 2005 levels and have adopted a goal to reduce our emissions by 40
% from 2005 levels by 2030. Beyond 2030, the company's long-term strategy will continue to drive carbon out of our system.$ $ We appreciate the opportunity to provide company information to stakeholders reviewing 2dii's climate scenario report, especially since the third-party data being used in this report is not accurate for Duke Energy. For example, we divested our international generation assets in 2016, yet the third-party data being used in this report indicates we still owned them in 2018. Another inaccuracy is that we have zero renewables additions planned. In fact, we have already announced 915 megawatts (MW) of additional renewables by 2020, and will continue to announce new projects going forward. $ $ In 2018, Duke Energy published a Climate Report to Shareholders, which details our approach to managing climate risk, including physical, policy and economic risks. The report is organized to align with the TCFD framework and provides clear descriptions of our carbon dioxide emissions reduction strategies. Our report also includes an analysis of a scenario under which we would reduce emissions consistent with a target intended to limit overall global average temperature increase to two degrees Celsius. $ $ We also disclose our progress toward our carbon and other sustainability goals on an annual basis in our Sustainability Report. The following Sustainability Report articles include information related to our transition to a low-carbon future that is omitted from 2dii's climate scenario report: $ $ -The company is on track for its renewable energy goal of owning or purchasing 8,000 MW of wind, solar and biomass capacity by 2020. $ $ -Battery storage is showing signs of being a major factor in the future energy mix, and Duke Energy is one of the leading companies pushing its development.$ $ -The company has more than 2,000 MW of pumped storage hydro power and plans to increase the capacity at its Bad Creek facility by more than 300 MW. $ $ -In 2018, the company retired 766 MW of coal-fired capacity and is planning 1,240 MW in additional coal retirements by 2024. $ $ -Duke Energy is moving toward a cleaner generation fleet. By 2030, we project our generation mix (in terms of megawatt-hour output) will be 30
% nuclear, 14
% renewables, 41
% natural gas and 15
% coal/oil.$ $ -The company continues to expand its portfolio of energy efficiency programs and is helping build public electric vehicle infrastructure. $ $ -We are modernizing the grid to support the two-way power flow needed to effectively integrate rooftop solar and other distributed technologies. $ $ Looking ahead, the specific path forward to a low-carbon energy future will depend on a number of factors, including market forces, public policy, technology innovation and commercialization and customer demand. Duke Energy will continue to work collaboratively with our regulators, policymakers and other stakeholders to chart a course that meets our obligation to provide safe, reliable, affordable and increasingly clean energy.$ $ $