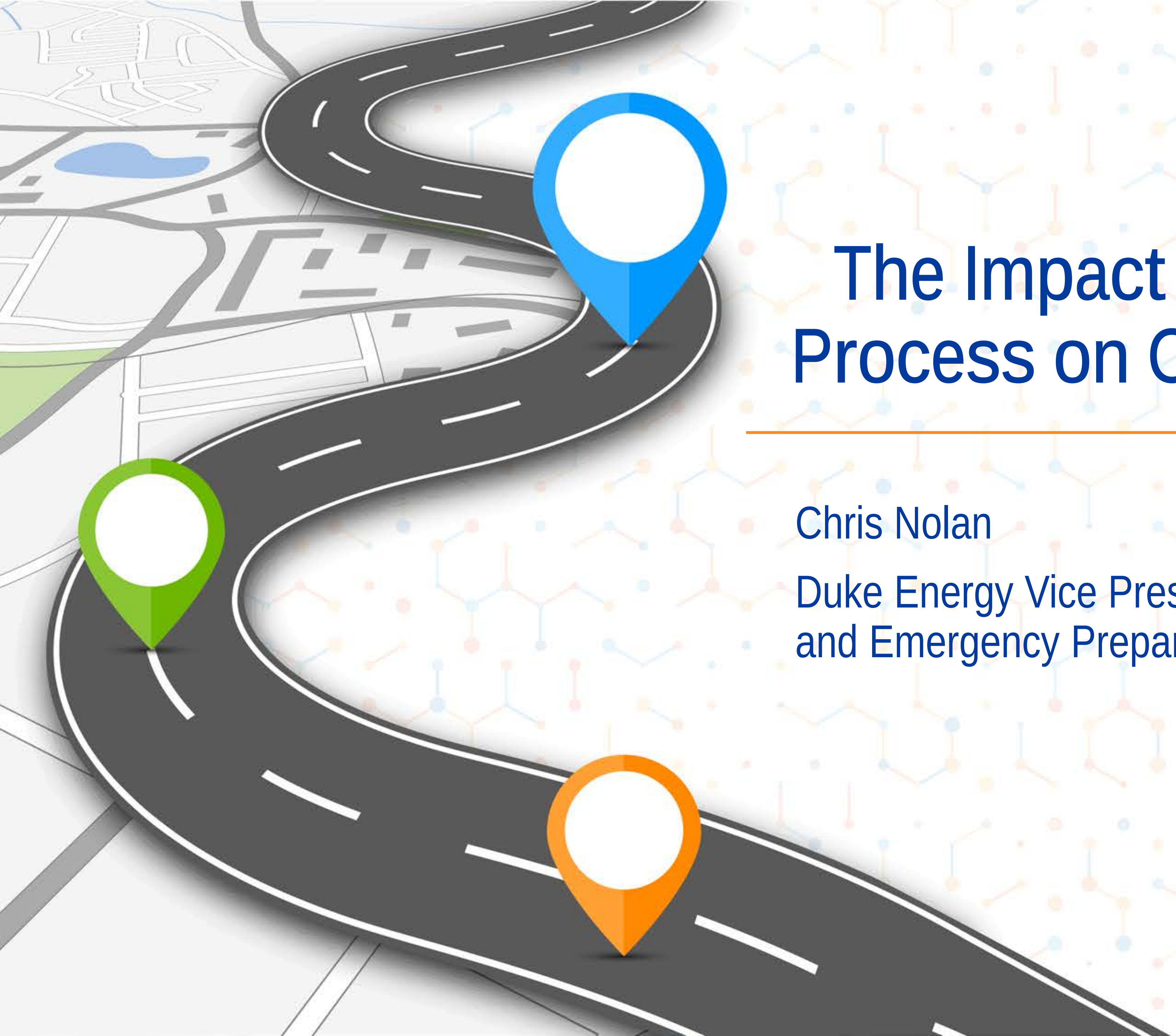


The Impact of the Regulatory Process on Overall Project Risk

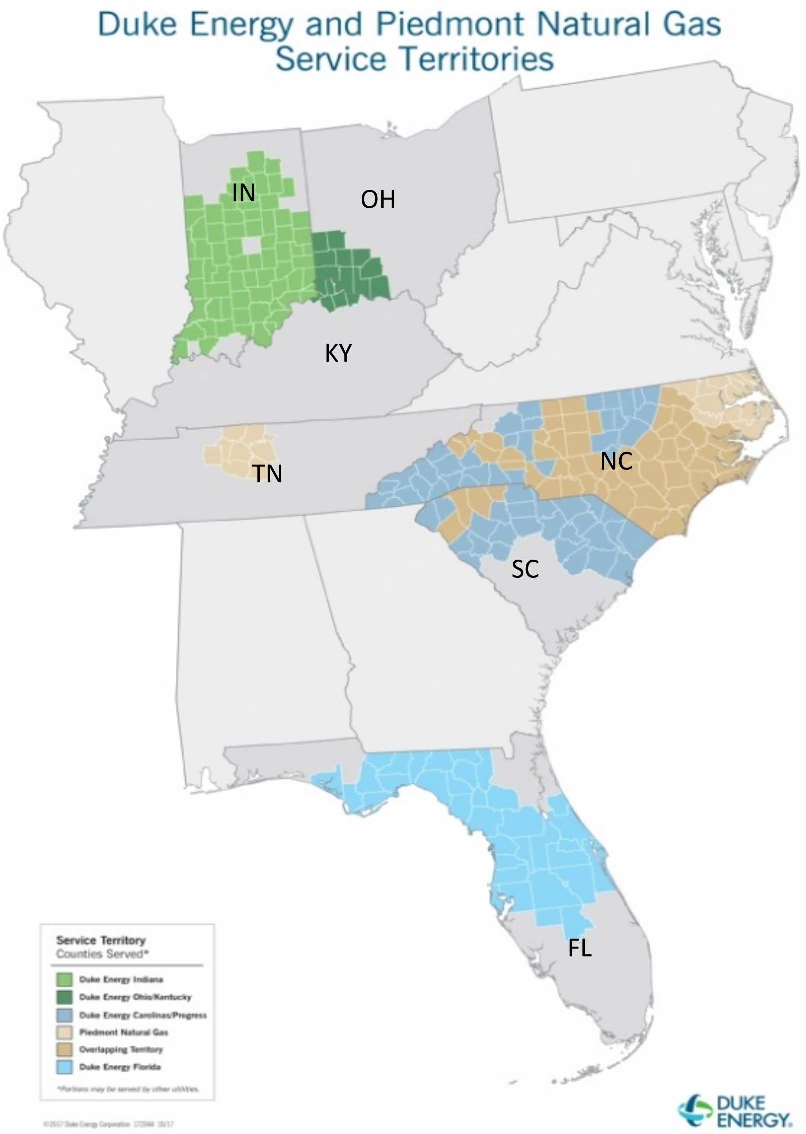
Chris Nolan

Duke Energy Vice President of Regulatory Affairs, Policy and Emergency Preparedness

GAIN Gateway for Accelerated Innovation in Nuclear

Duke Energy Service Territory

- **Regulated Utility** operations serves 7.8 million retail electric customers in 6 states – NC, SC, FL, IN, OH, KY
    - 51,000 megawatts total electric generation capacity
    - 31,000 miles of transmission lines
    - 280,000 miles of distribution lines
    - Service area – 91,000 square miles
- **Piedmont Natural Gas** serves more than 1.6 million natural gas customers in 5 states – NC, SC, OH, KY, TN
    - 33,000 miles of natural gas pipelines
- **Duke Energy Renewables** operates wind and solar power facilities in 14 states – AZ, CA, CO, FL, GA, HI, KS, NC, NY, OK, PA, TX, WI, WY
    - 3,000 megawatts electric generation capacity
- Approximately 29,000 employees



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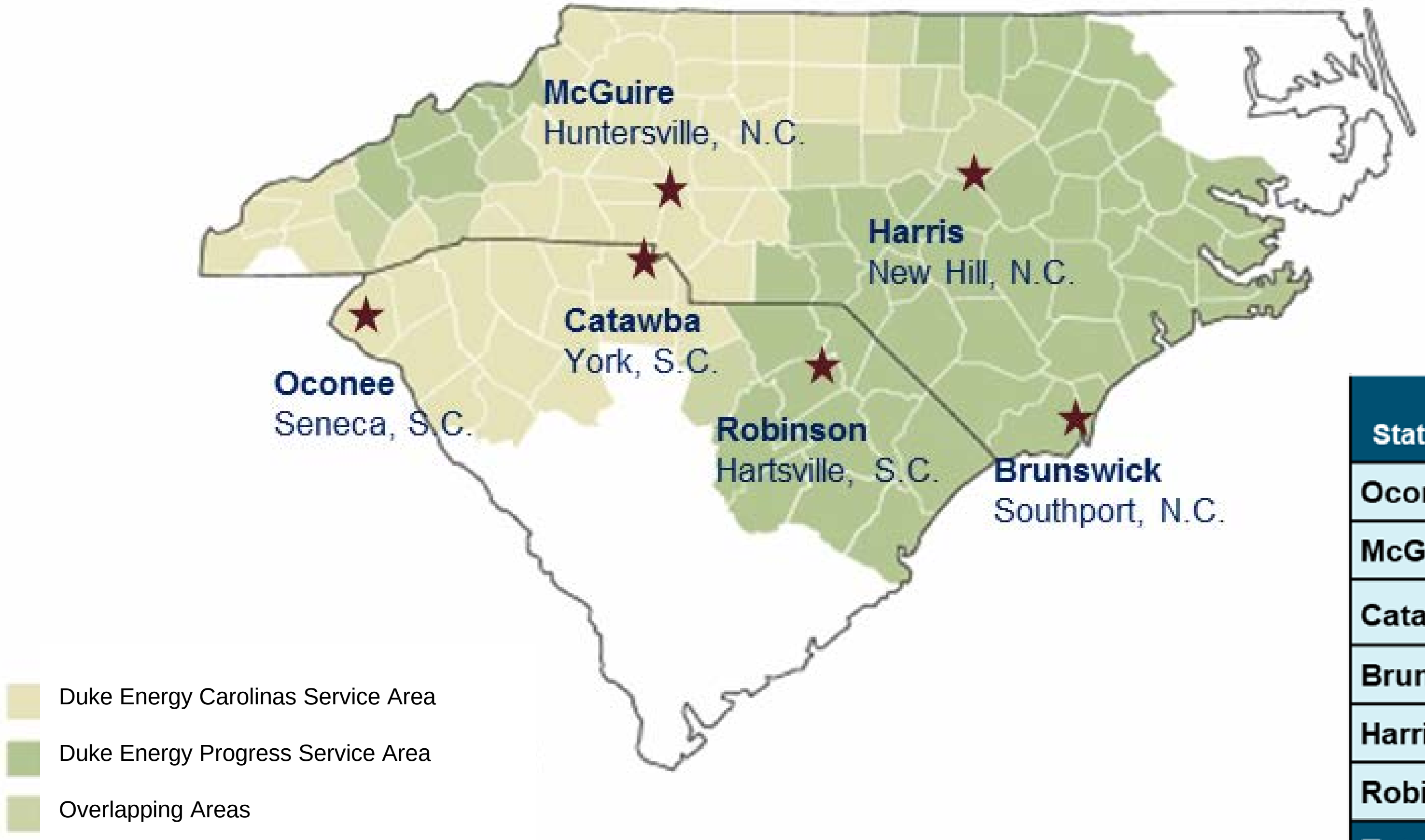
Duke Energy Nuclear Generation



Station	Capacity (MW)	Units	Commercial Operation	License Extension
Oconee	2,554	3 PWRs	1973	2033, 2034
McGuire	2,316	2 PWRs	1981	2041, 2043
Catawba*	2,310	2 PWRs	1985	2043
Brunswick	1,870	2 BWRs	1975	2034, 2036
Harris	964	1 PWR	1987	2046
Robinson	759	1 PWR	1971	2030
Total	10,773	11		

Duke Energy owns 100% of all units except the Catawba units.

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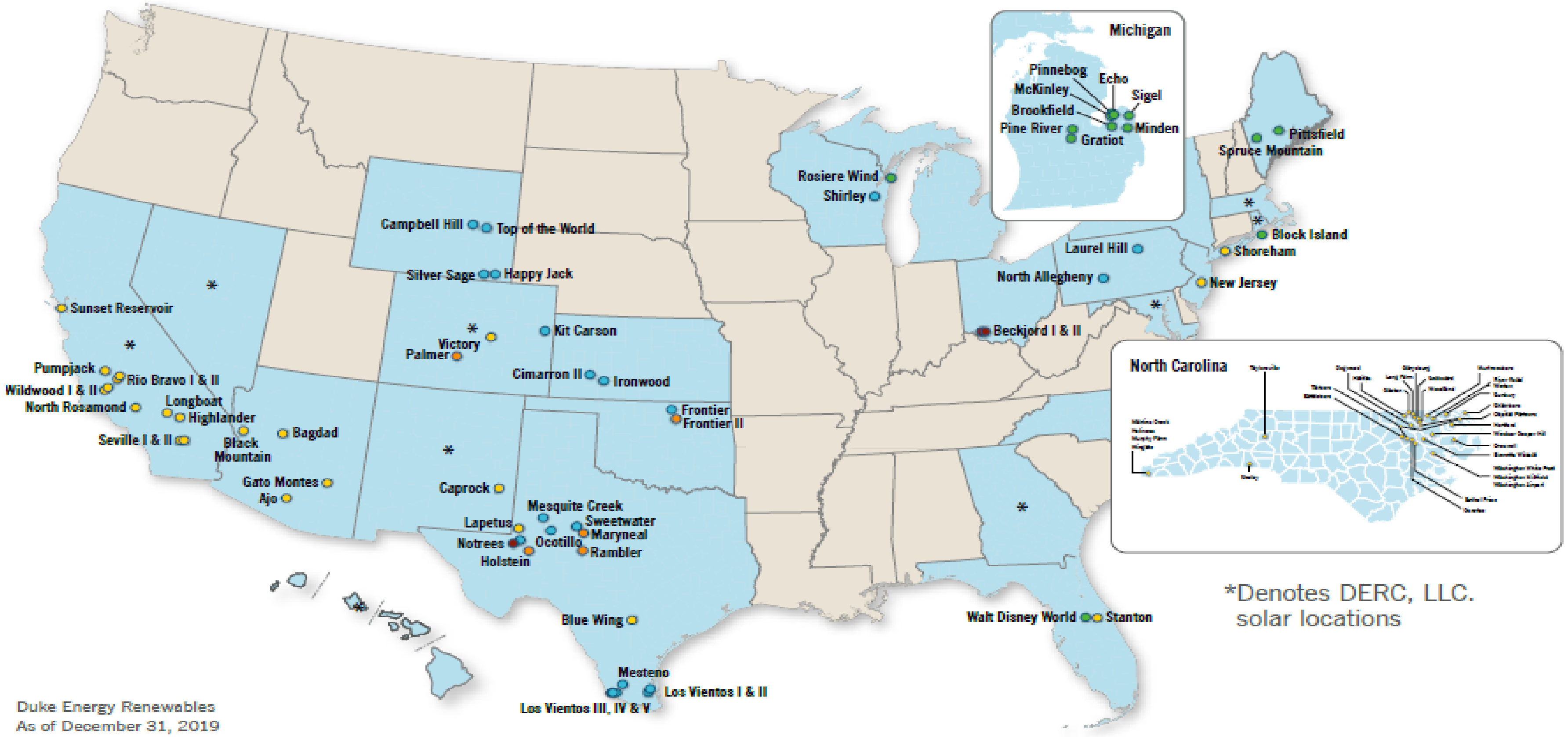
Duke Energy Wind and Solar Generation

Commercial and Regulated Renewable Projects

- Solar power projects
- Wind power projects
- Battery storage facilities
- Third-party customers
- Under construction



*Denotes DERC, LLC. solar locations

Climate Change

- President Biden’s Clean Energy Plan
  - Rejoined the 2016 Paris Agreement on climate change
  - Reform and extend certain tax incentives, like the production and investment tax credits for wind and solar projects
  - Use of renewables to produce carbon-free Hydrogen power
  - Significant investment in the research, development, and commercialization of Advanced Nuclear reactors
  - Achieve an economy-wide net-zero carbon emissions standard by 2050, and a 2035 target date for a carbon pollution-free American utility sector
- To meet these carbon reduction goals, nuclear must be included in the generation mix
- With continued addition of wind and solar facilities, nuclear power must adapt as a zero-emitting load following resource (ZELFR)
- ZELFRs can include advanced nuclear, energy storage, hydrogen firing turbines, etc.

Duke Energy Clean Energy Goals

Companywide CO_2 Emissions Reduction Goals

BY 2030

Cut CO_2 emissions by **at least 50%**

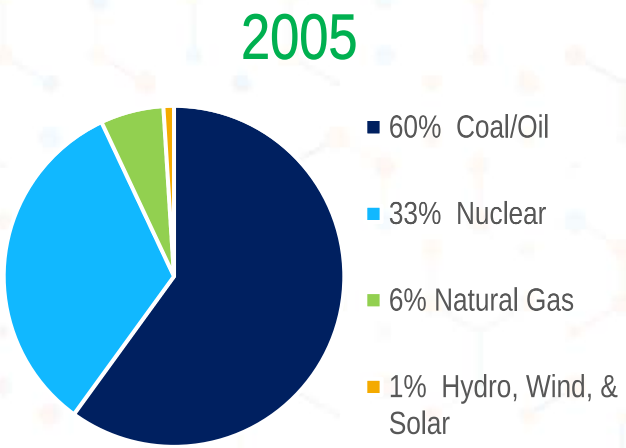
BY 2050

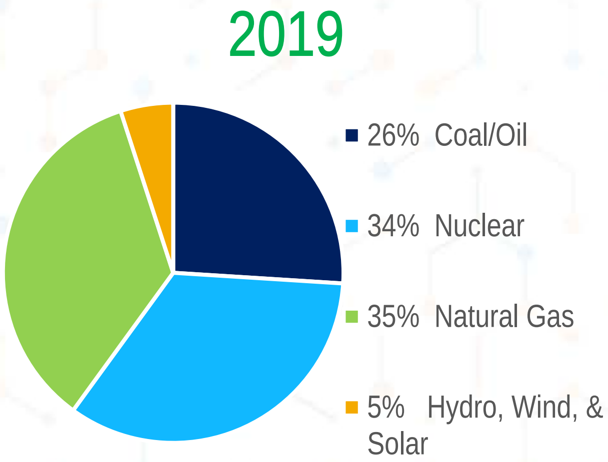
Attain **net-zero** CO_2 emissions

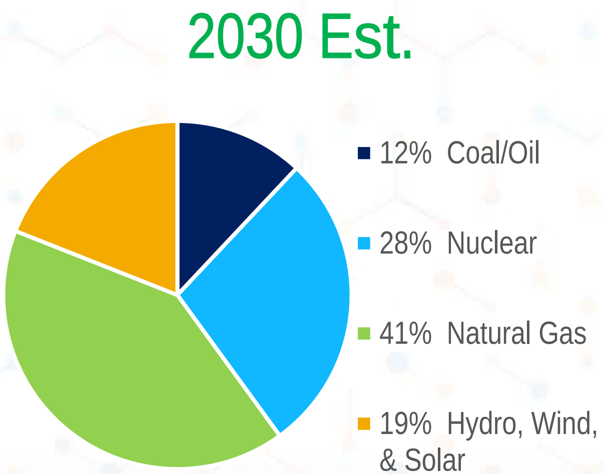
Duke Energy's Path to a Low-Carbon Future

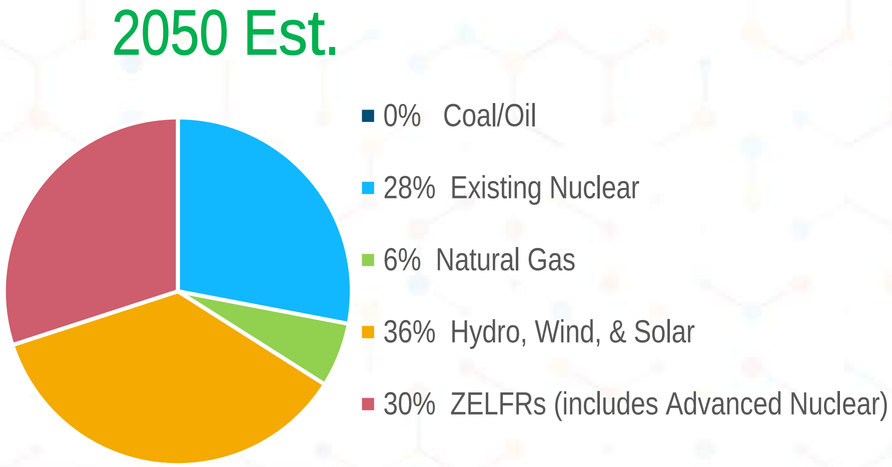
- Collaborate and align with our states and stakeholders as we transform
- Accelerate our transition to cleaner energy
- Continue to operate our existing carbon-free technologies, including nuclear and renewables
- Modernize our electric grid
- Advocate for sound public policy that advances technology and innovation
- Base load generation - carbon free, load following

Moving Toward a Cleaner Generation Fleet and Increased Fuel Diversity at Duke Energy









Project Risks

- Siting Risks
  - Environmental impact
  - Federal and state interactions and opposition
  - Potential intervenor litigation
- Technical Risks
  - First-of-a-kind (FOAK) reactor technology
  - Design certification delay, especially with using Part 52 pathway
  - Number of changes to a design after a combined operating license (COL) approved under Part 52
- Regulatory Risks
  - Lack of clarity in existing regulatory framework for advanced nuclear (e.g., licensing basis events, categorizing systems, structures and components or SSCs, radiological limits, etc.)
  - Number of exemption requests required and number of requests for additional information
  - Regulatory decision making – Approved, Not approved or Delayed

Early Site Permits (ESPs)

- Approves the site for nuclear deployment for up to 20 years, with a renewal option for an additional 10 to 20 years
- Using a Plant Parameter Envelope (PPE), the ESP can bound multiple technologies
- Allows a utility to make progress while technologies continue to advance (i.e., detailed design)
- Can be used with either the Part 50 or Part 52 licensing pathway
- A Limited Work Authorization (LWA) can allow site preparation activities to start while the Operating License is under NRC review
- Includes an approved environmental impact statement
- Finality on site safety and environmental regulatory issues
    - Mitigates project risk
    - Preserves flexibility
    - Can allow an early start of field work

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Part 50 Licensing Process

- Two-step process
  - Construction Permit (CP) followed by application for Operating License (OL)
- Advantages
  - Allows field work, design and licensing to all occur in parallel (i.e., earlier start)
  - Could result in a sooner completion date since construction proceeds at risk
  - Provides flexibility in completing design and construction
- Disadvantages
  - Larger risks on the part of the utility as construction starts before a detailed reactor design is complete
  - The “design-as-you-build” approach introduces project risks in the regulatory arena since the NRC may impose additional requirements as a condition of receiving an OL
  - Provides less finality before making a significant financial investment in plant construction
  - Requires duplicative licensing and hearing requirements

Part 52 Licensing Process

- One-step process
  - Combined Construction Permit and Operating License
- Advantages
  - Incorporates a standard design certification (i.e., approved reactor design)
  - Allows early resolution of safety and environmental issues before field work begins
  - Offers more finality in that regulatory reviews regarding suitability of site or design of the plant (i.e., design certification) are not revisited prior to issuance of the COL
- Disadvantages
  - Less construction flexibility
  - Potential schedule risk if significant changes to reactor design are needed later
  - Later start on construction typically results in a later overall completion date

Advanced Nuclear Licensing Implications

- Small Modular Reactors (Light Water) and Advanced Reactors (Non-Light Water) present unique licensing challenges
  - Advanced nuclear plants will be coming on line when renewable generation will make up a more significant part of the U.S. generation mix
  - Advanced nuclear must have the ability to load follow to supplement when renewable generation is unavailable or when it's peaking
  - Operators may utilize advanced nuclear plants to produce hydrogen or process steam for commercial or industrial use
  - Licensing for First-of-a Kind designs may result in increased technical and financial risks
  - The NRC has recognized the uniqueness of advanced nuclear plants and is developing a new risk-informed, technology inclusive regulatory framework. The new Rule (i.e., Part 53) formalizing key parts of this framework will not be issued in time for First-of-a-Kind plants

QUESTIONS?

Images courtesy of GAIN and ThirdWay