THE NEXT ERA OF ENERGY INNOVATION

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CHANGING WINDS

Innovation tailwinds have quickly turned to headwinds

- Wavering regulatory support and government funding
- Investor pressure for short-term financial returns
- Faltering market for startups due to fewer exit strategies for startups

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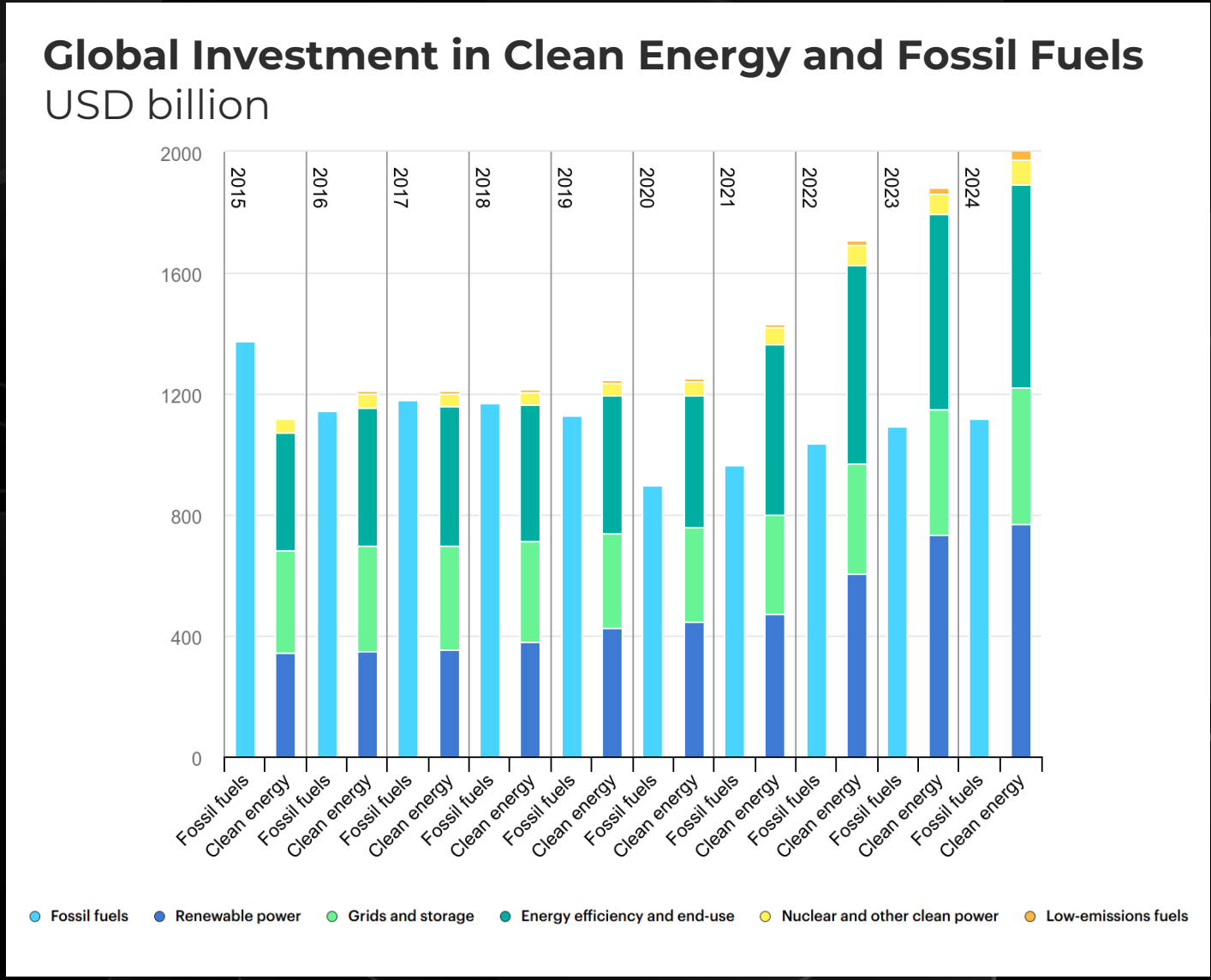
BUT YOU CAN'T AFFORD TO STOP

Investments in low-carbon technologies have outpaced investments in fossil fuels for a decade and the gap is growing.

You can't bank on policies that support fossil fuels long-term.



Source: IEA's World Energy Investment 2024

Innovation teams need to remain focused on the priorities of the organization

KEEPING INNOVATION FOCUSED

Innovation teams in the energy sector took too many large risks motivated by a fear of missing out.

Innovation teams should focus on opportunities with a clear sightline to the business.

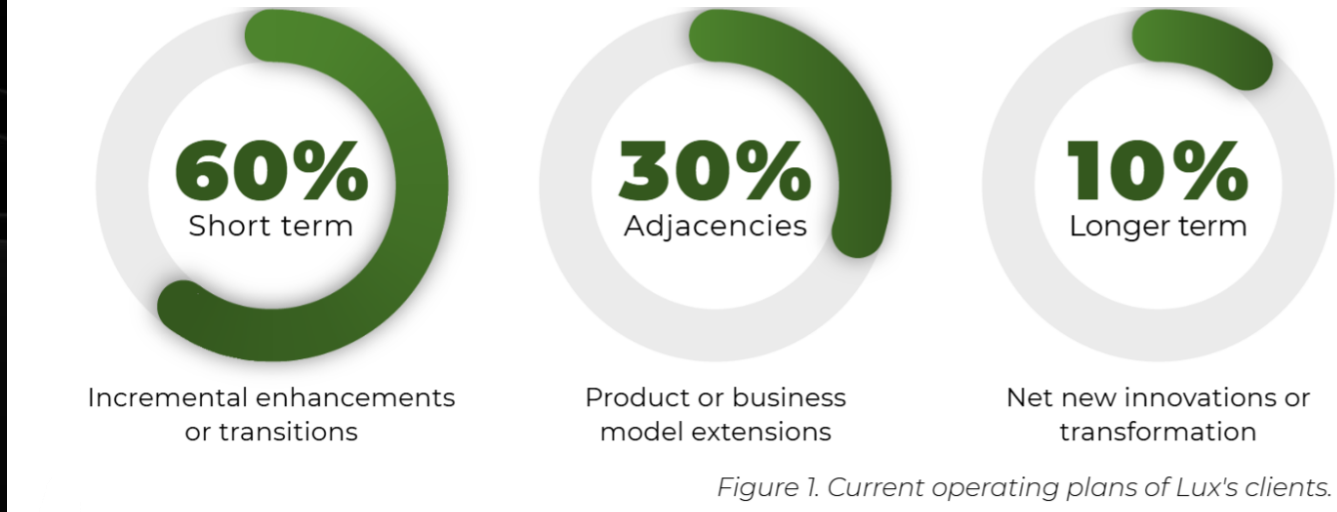
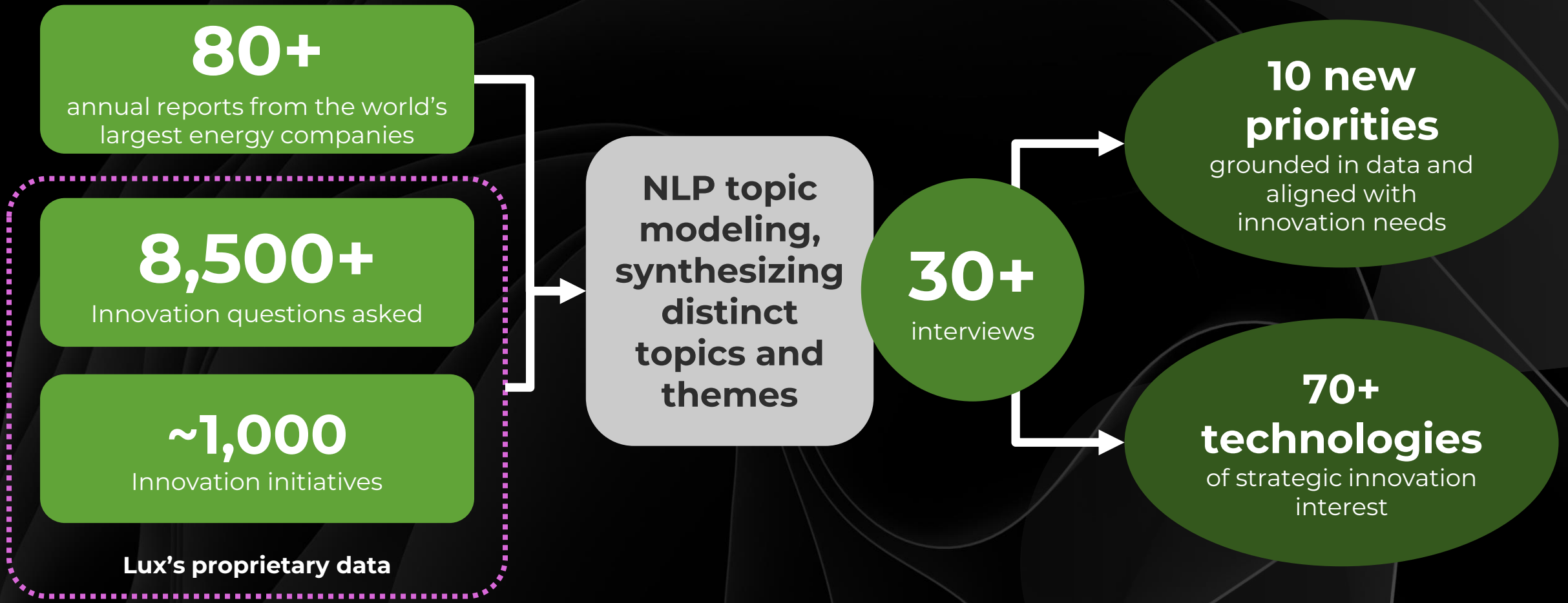


Figure 1. Current operating plans of Lux's clients.

See the report: Three Things Innovation Leaders Must Do in 2025

THIS WEBINAR WILL FOCUS ON TWO KEY PARTS OF THE ENERGY INDUSTRY

UNBIASED, CUSTOMER CENTRIC



LUX FOR INNOVATION LEADERS

Oil and Gas

Harnessing External Innovations

Future Chemicals

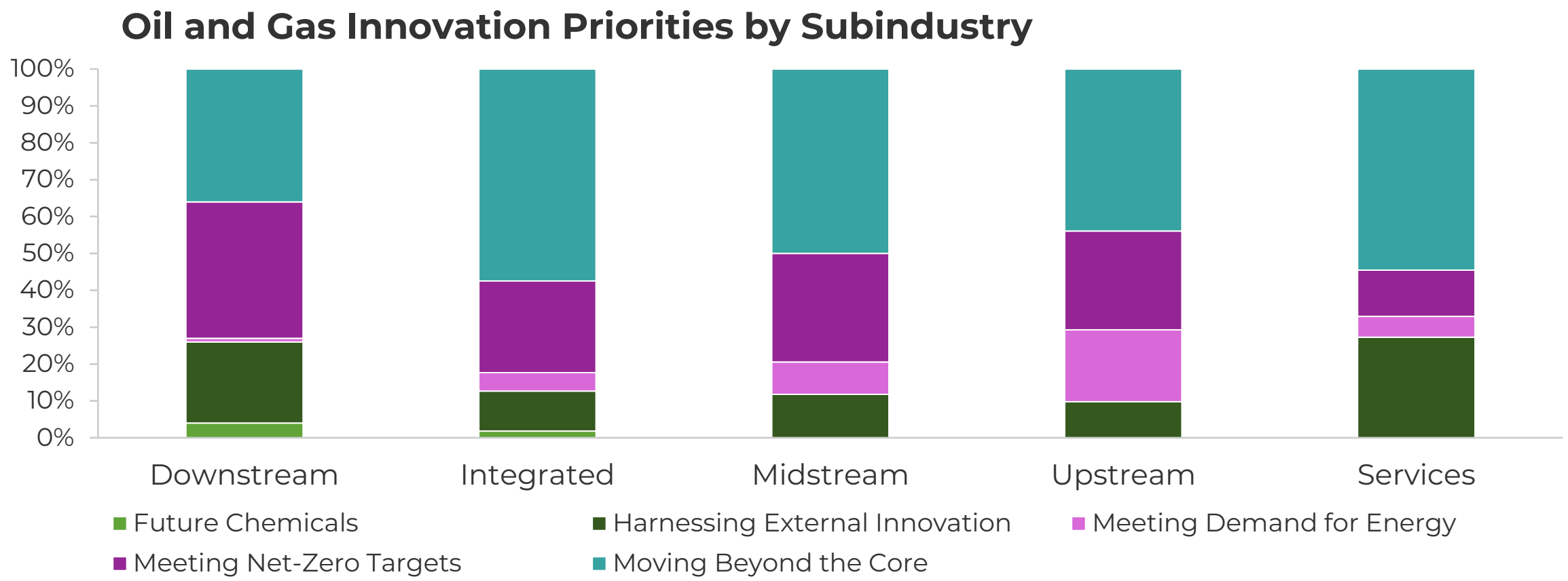
Moving Beyond the Core

Meeting Demand for Energy

Meeting Net-Zero Targets

Policy and Regulations

DISTINCT PRIORITIES IN SUBINDUSTRIES



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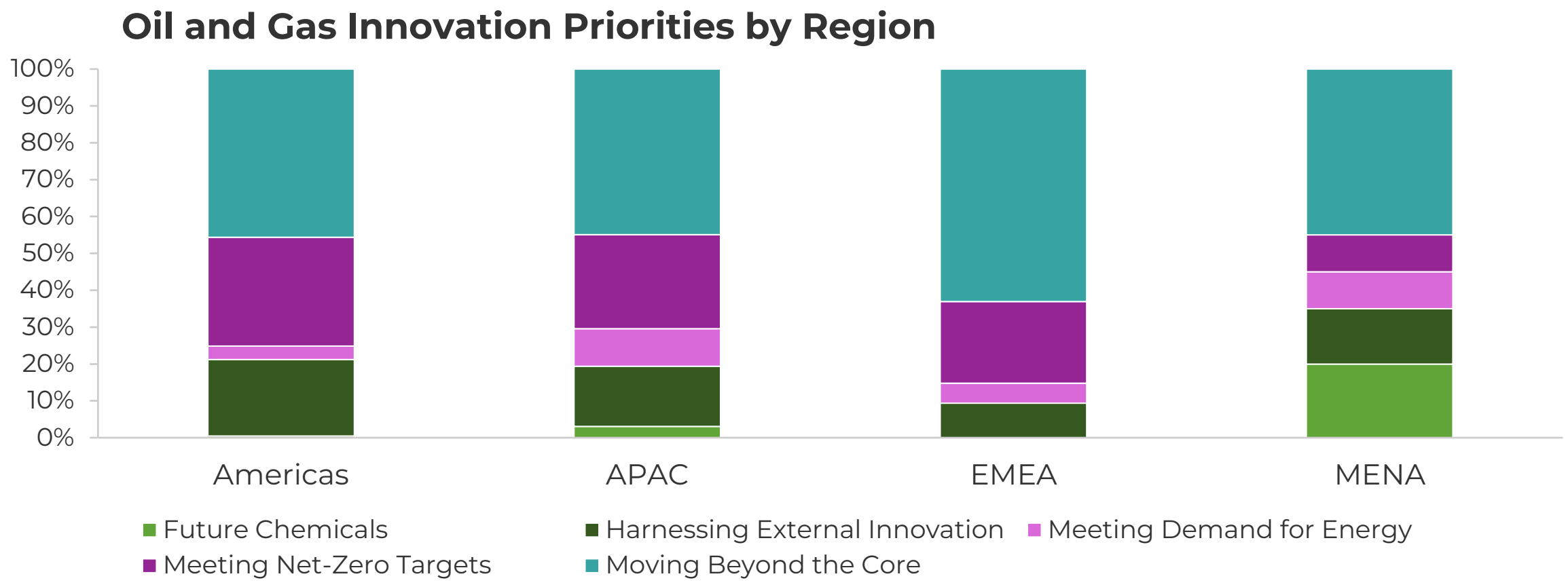
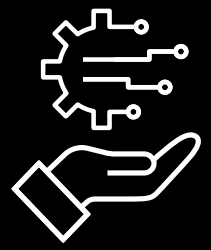




HARNESSING EXTERNAL INNOVATIONS

Leverage advances in materials science, AI, and other fields to innovate within existing operations and facilities.

Keeping up with pace of innovation in adjacent industries is challenging, but necessary, as novel innovations elsewhere can be applied to the energy industry. Innovations in novel materials and digital technologies, for example, have direct use-cases in the oil and gas industry.

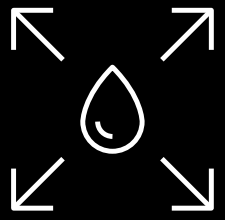
Companies must continually monitor for advances in these and other industries to avoid missing out on potentially transformative innovations.

Hot Topics

- Advanced coatings
- Industrial Robotics
- Quantum Technologies
- Metamaterials
- Advanced Membranes

Industry's pressing questions

- **Industrial robotics –** Which top companies developing legged robots should we be engaging with?
- **Quantum technologies –** Should an O&G company be paying attention to innovations in quantum computing? What problems might they solve?
- **Advanced Membranes –** Can membrane performance and cost improve enough to be competitive for carbon capture?



MOVING BEYOND THE CORE

Identify opportunities in new areas beyond conventional O&G opportunities to create new products and services.

The decline of demand for oil and gas products is a question of when, not if. As the industry retracts, companies will either need to acquire the competition or enter new markets to maintain market share. This could mean moving downstream into the chemicals industry, exploring critical minerals extraction, or pursuing opportunities in carbon management.

Smart companies won't abandon these strategies in the face of short-term financial pressures but instead will find lean ways to execute them.

Hot Topics

- Advanced Plastic Recycling
- Critical Minerals Extraction
- Electric Vehicle Charging
- Flow Batteries
- Water Electrolysis

Industry's pressing questions

- **Advanced Plastics Recycling –** What is the capacity outlook for advanced plastic recycling technologies?
- **Electric Vehicle Charging –** Can battery swapping viably compete with fast charging for passenger vehicles?
- **Critical Minerals Extraction –** What are the technical and operational challenges of minerals extraction technologies?

MEETING NET-ZERO TARGETS

Understand which technologies you should deploy to meet interim emissions-reduction goals.

With near-term decarbonization targets looming large, oil and gas companies must find ways to reduce Scope 1 and 2 emissions. They also must balance other priorities like investor pressure and the pursuit of other innovation projects.

Today, all companies need a clear roadmap to reduce emissions in their operations; leaders are already iterating on these plans, monitoring new innovations that can accelerate decarbonization or lower costs for compliance.

Hot Topics

- Blue Hydrogen
- Sustainable Aviation Fuel
- Point-Source Carbon Capture
- Thermal Energy Storage
- Carbon Sequestration

Industry's pressing questions

- **CO_2 Capture –** What innovations and novel developments can address the high costs of CO_2 capture?
- **Low-carbon heat –** What is the potential for electrifying process heat used at our facilities?
- **Sustainable aviation fuel –** What are the pros and cons of the different production pathways, and which regions are likely to adopt them?

LUX FOR INNOVATION LEADERS

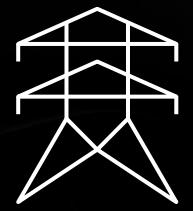
Utilities

Innovating at the Grid Edge

Asset Management

Low-Carbon Electrons

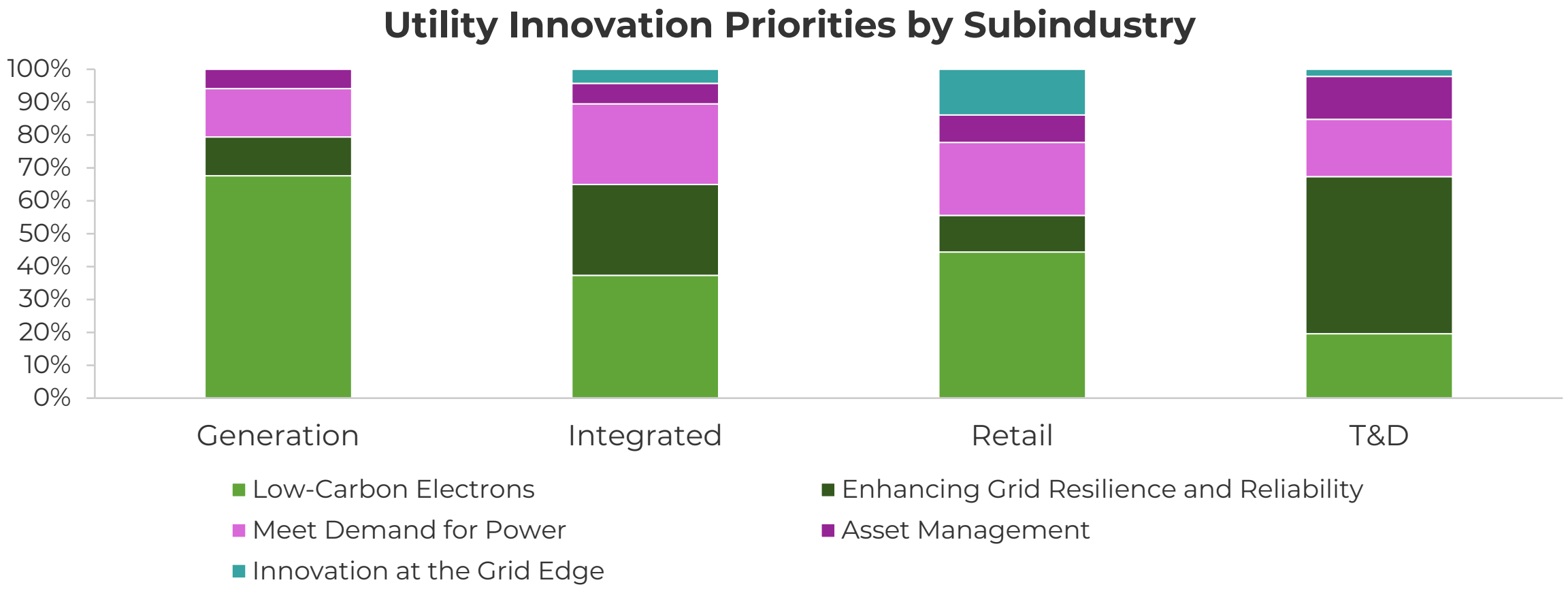
Meeting Demand for Power



Enhancing Resilience & Reliability

Policy and Regulations

DISTINCT PRIORITIES IN SUBINDUSTRIES



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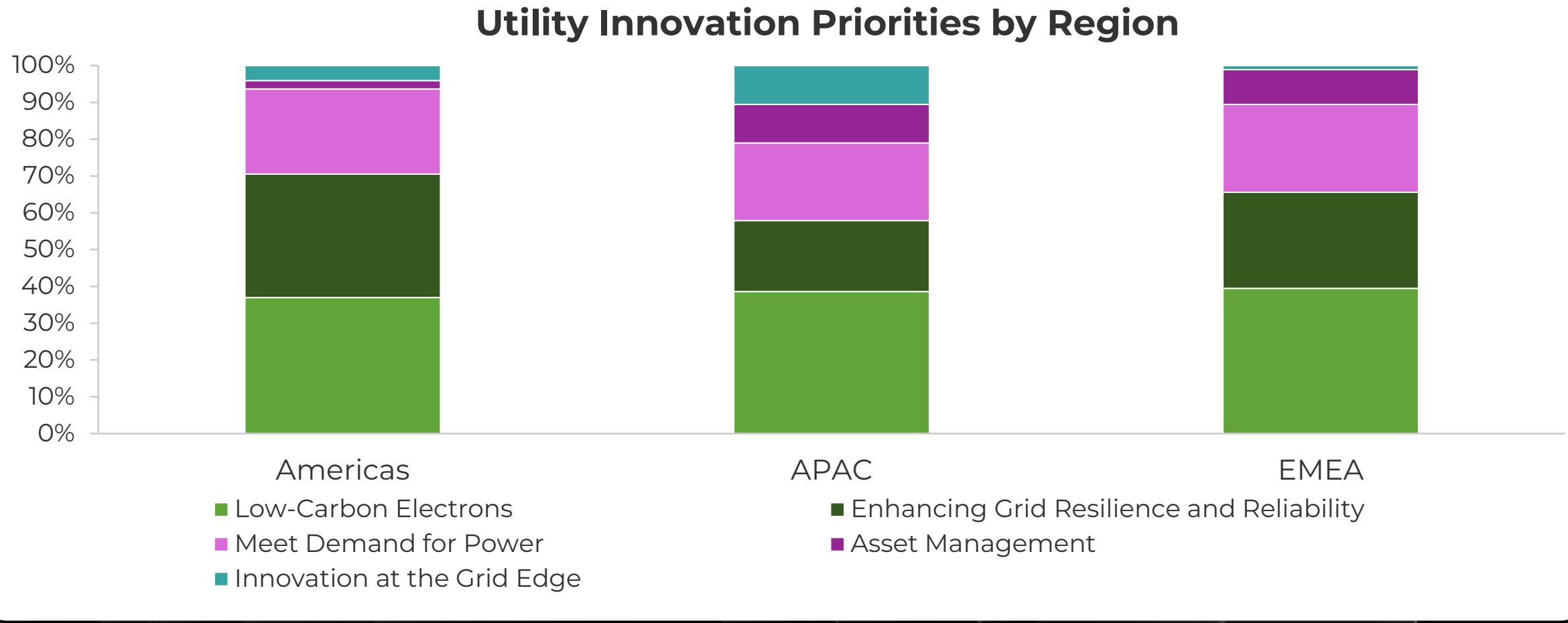


INNOVATING AT THE GRID EDGE

Developing solutions to manage and optimize power at the grid edge, by managing distributed energy resources.

The number of assets at the grid edge — such as **electric vehicles**, **solar panels**, or **energy storage** — is rising dramatically.

Novel business models are emerging, along with regulations, to allow utilities to tap into these new sources of flexibility.

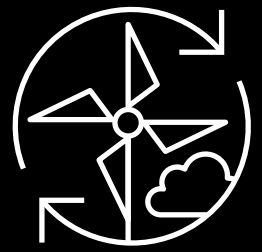
Utilities that can effectively manage power at the grid edge can deliver more reliable power at a lower cost compared to conventional centralized management.

Hot Topics

- Electric Vehicle Infrastructure
- Generative AI Impacts
- Distributed Energy Resource Management Systems (DERMS)
- Microgrids

Industry's pressing questions

- **Generative AI Impacts –** What are the most promising use cases for generative AI within a utility? Are other types of AI more promising?
- **Microgrids –** Which assets are best suited to different applications of microgrids?
- **EV Infrastructure –** What are the most promising applications for bidirectional electric vehicle charging?



LOW-CARBON ELECTRONS

Identify sources of low-carbon power generation or consider concepts like carbon capture that can mitigate emissions from existing power plants.

Many industries are **decarbonizing by electrifying** operations, but need a stable and low-cost supply of low-carbon electricity. While solar and wind will be the backbone of the energy transition, the pace of innovation is rising in **low-carbon dispatchable** power sources to complement intermittent and variable sources like solar.

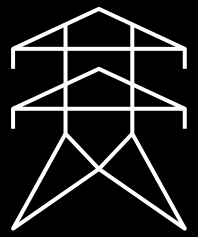
Utilities should focus innovation efforts **beyond conventional wind and solar**, and evaluate generation technologies based on their costs and potential impacts to system reliability.

Hot Topics

- Novel Nuclear Power Generation
- Point-Source Carbon Capture
- Novel Solar and Wind
- Low-Carbon Hydrogen
- Geothermal

Industry's pressing questions

- **Novel Nuclear –** Will small modular reactors be able to compete on costs with conventional reactors?
- **Point-Source Carbon Capture –** Which developers of carbon capture solutions are most promising to pair with natural gas generation?
- **Low-Carbon Hydrogen –** Is low-carbon hydrogen as a fuel a promising decarbonization pathway?



ENHANCING RESILIENCE AND RELIABILITY

Identify solutions which can allow the grid to maintain operations in stressful conditions.

A shift to intermittent and variable power necessitates **energy storage solutions** to balance supply and demand. At the same time, increasing **extreme weather events** such as wildfires, hurricanes and typhoons, and blizzards are posing physical threats to the grid.

Transmission capacity needs to grow, but is challenging to build, incentivizing solutions to get more from existing rights of way such as **dynamic line ratings** or **reconductoring**.

Hot Topics

- Flow Batteries
- Hydrogen Storage and Transport
- Novel Electricity Transmission
- Advanced Composites

Industry's pressing questions

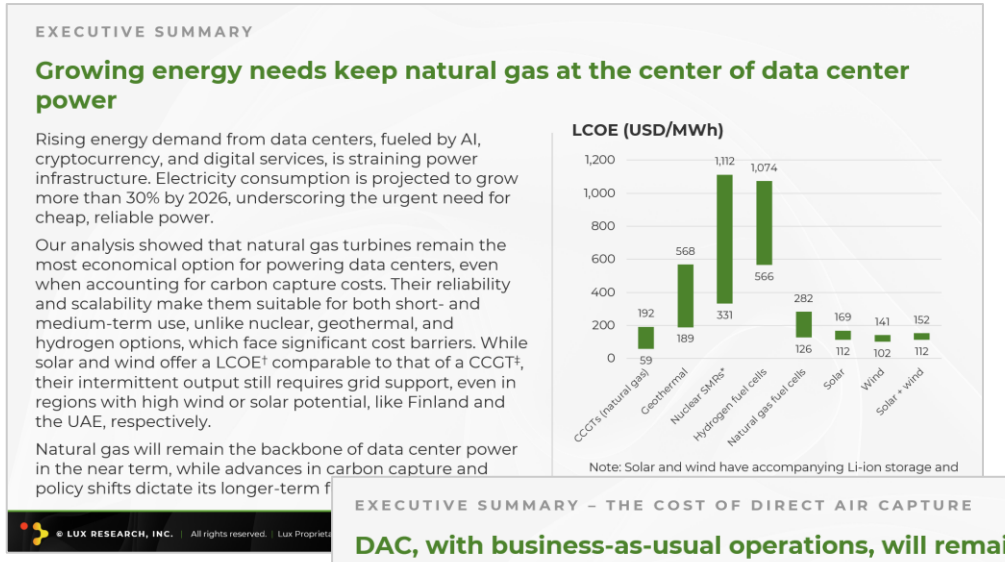
- **Long-duration energy storage –** Which forms of energy storage are lowest cost beyond Li-ion at durations of 10 hours or more?
- **Novel transmission –** What solutions are available to deploy that enable greater use of existing transmission capacity?
- **Grid hardening –** What technologies are available to prepare for extreme weather events? Should I be concerned about them?

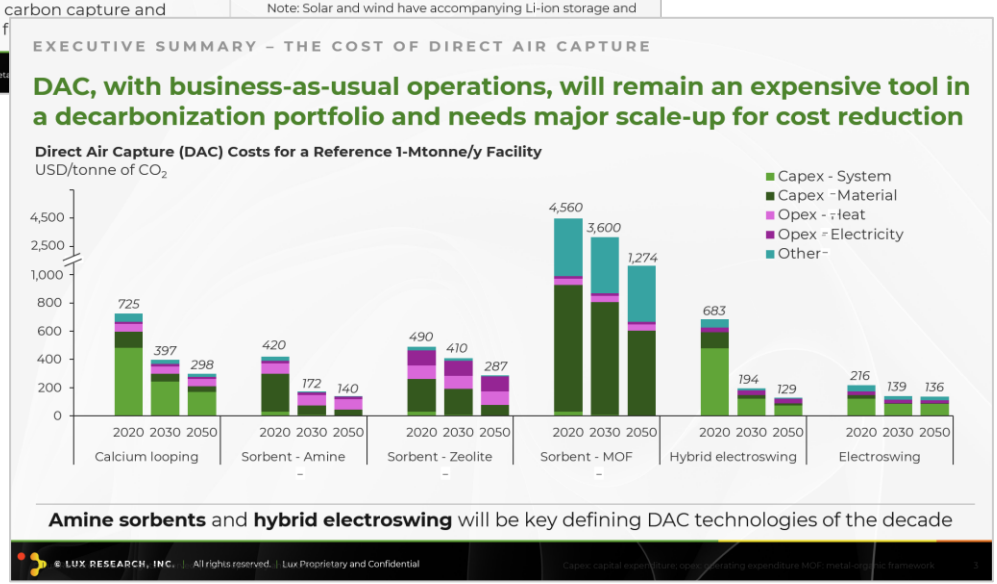
CATALYZING GROWTH IN THE NEXT ERA OF ENERGY INNOVATION

In times of uncertainty and chaos, focus on the fundamentals of your innovation process

DATA-DRIVEN INNOVATION

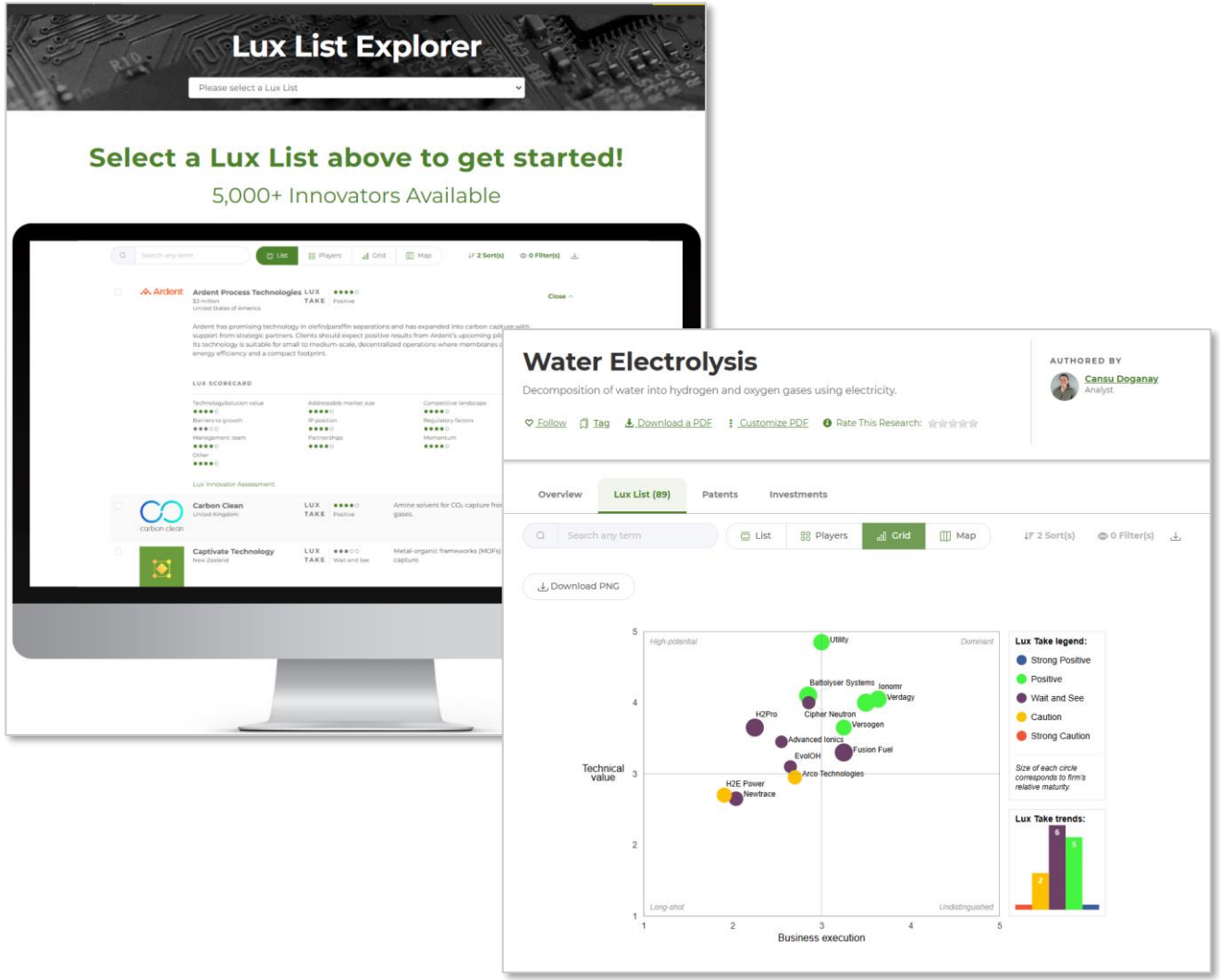
Use techno-economic to understand tipping points and dial-in the **timing** and **size** of investments; monitor those tipping points frequently.





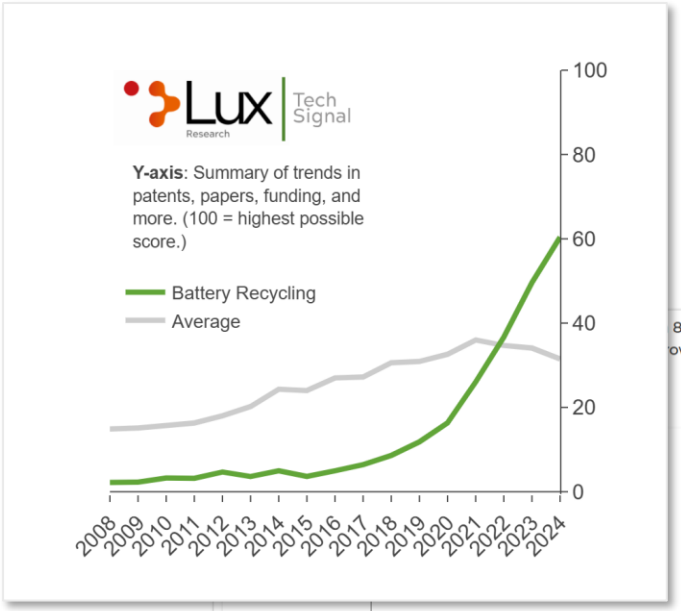
IDENTIFYING KEY PLAYERS

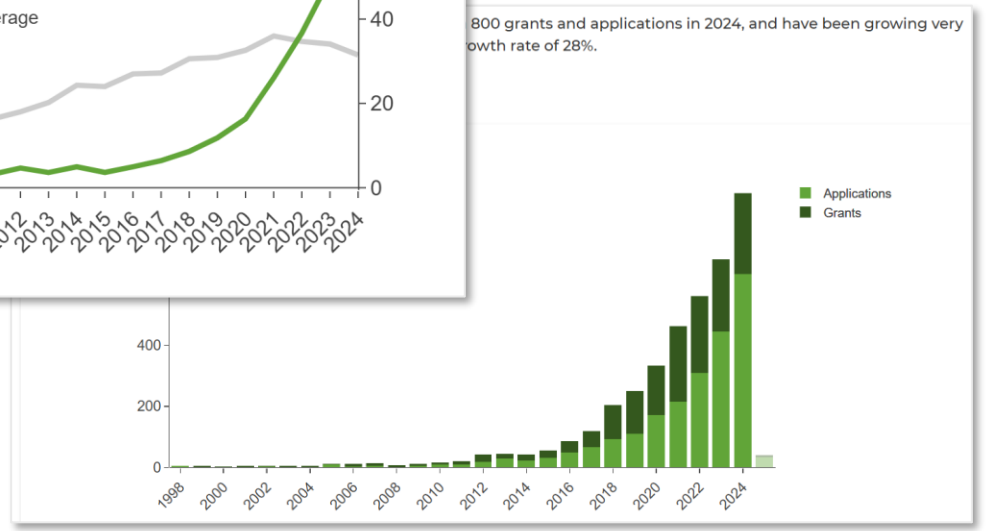
Identify leaders and potential partnerships with **thorough** understandings of key players.



WATCH FOR CHANGE

Stay at the forefront of innovation activities, understanding changes with Lux's tech signal.





CONSIDER CONSUMER SENTIMENT

Stay tapped into consumer sentiment to avoid your “Kodak Moment.”

JOBS TO BE DONE SUMMARY

#	Job
1	I want to avoid excessive costs associated with owning an EV.
2	I want to drive long distances.
3	I want to have convenient access to EV charging stations.
4	I want to enjoy EV software that enhances, not detracts from, my driving experience.
5	I want to get reliable battery life during cold winter days.
6	I want to have an easy-to-use infotainment system.
7	I want to have access to helpful, frictionless customer serv
8	I want to charge my EV quickly.

WHAT IS A JOB-TO-BE-DONE?

A job-to-be-done is the task or goal that a consumer "hires" a product to complete. This framework is based on the idea that people purchase products and services to achieve specific outcomes they cannot otherwise achieve.

KEY TAKEAWAYS

1

Innovation teams are navigating turbulent times.

The policy, financial, and social environment is changing rapidly.

2

Innovation teams are being pressured to look more near term.

Identify near-term opportunities with shorter paths to revenue generation.

3

Don’t chase hype; stick to innovation fundamentals.

Keep a structured approach to evaluating opportunities, tied closely to solving business challenges.

THANK YOU

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ABOUT LUX

Our mission is to advise leaders about commercially viable science and technology to enable sustainable innovation. We deliver research and advisory services to inspire, illuminate, and ignite innovative thinking that reshapes and grows businesses. Using quality data derived from primary research, fact-based analysis, and opinions that challenge traditional thinking, our experts focus on finding truly disruptive innovations that are also realistic and make good business sense.

The "Lux Take" is trusted by innovation leaders around the world, many of whom seek our advice directly before placing a bet on a startup or partner — our clients rely on Lux insights to make decisions that generate fantastic business outcomes. We pride ourselves on taking a rigorous, scientific approach to avoid the hype and generate unique perspectives and insights that innovation leaders can't live without.

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