SMART ENERGY DECISIONS RESEARCH

STATE OF DISTRIBUTED ENERGY RESOURCES STUDY

NOVEMBER 2021

SPONSORED BY nrg



A Note from NRG

Interest in distributed energy resources (DERs) — which include a growing variety of hardware technology and software services deployed on the customer's side of the meter — continues to rise for a multitude of reasons. As we see it at NRG, where investment in these services was once driven primarily by the need to keep the lights on during blackouts, today DERs are multiplying thanks to their proliferating benefits, from cost savings and increased resilience to tracking and reducing emissions.

Yet achieving these benefits is a journey, one that involves an increasingly complex set of questions and judgments. You may start with a narrow focus, seeking simply to supply backup power or gas to a location. To do so, you might ask: Can your site use solar or wind, instead of — or to run alongside — a natural gas microturbine? Or, in evaluating demand reduction programs or time-of-day power pricing, you might ask: If we power down during peak pricing, could losses from disruptions be greater than energy cost savings?

Finding the optimal answer to such multifactor questions increasingly goes well beyond simple spreadsheets, demanding computational data analytics, operational acumen, and sophisticated financial modeling. Even as companies deepen their in-house energy and financial experts to better navigate these questions, the complexity can outrun the internal capabilities of all but the largest players.

For many, a trusted partner can help navigate this journey, and add value to the management of this mix of hardware, data, and modeling challenges. In picking a partner, look for an adaptable collaborator with proven experience across the technologies, markets, and risk profiles of your organization. The DER journey will be most effective for your company with the right guide.

Executive Summary

For each of the past three years, Smart Energy Decisions has conducted a survey of trends in Distributed Energy Resources (DERs). In 2021, sustainability goals have risen in importance to rival cost reduction, the perennial top priority, among the key reasons to invest in DER technologies and services. This reflects both the maturing market for DERs, marked by increasing accessibility as costs fall and options multiply, as well as the rising urgency to lower greenhouse gas (GHG) emissions economy-wide.

Leaders from both the customer and supplier sides of the energy industry are recognizing DERs as a potent tool in helping to achieve these goals. You'll see the following themes echoing throughout this report:

The promise of DERs is being fulfilled. Among those who have deployed DERs, when asked what benefits they have achieved, eight out of 10 cite a reduction in energy costs; more than half cite improved energy efficiency and progress towards emission reduction targets.

Interest in DERs remains strong, especially for resources that can deliver multiple benefits, including cost savings, decarbonization, and resilience. Energy storage can do all three and thus is emerging as "the next big thing." Though only a quarter of those surveyed have deployed this technology to date, 59% are actively considering energy storage.

Awareness of the financial risks of outages is rising. As fires, extreme weather, and aging infrastructure cause more blackouts, resilience is only growing more valuable. While most players recognize this trend, surprisingly few had assessed the dollar value or wider risks posed by outages. We expect this will change in coming years.

Sustainability targets are a strong driver. While cost-cutting is still respondents' top priority, making progress toward emissions reductions is cited by nearly two-thirds of those surveyed. Nearly nine out of 10 industrial respondents have set GHG targets; other sectors are likely to follow.

Partner preference is fragmenting. As DER demand rises, customers are working with a variety of partners in roughly equal measures, including utilities, energy services providers, and DER product and services providers. It is evident that a strong partner is increasingly vital to create and implement strategies in order to maximize the benefits of DER investments.

Methodology: Who Did We Talk To?

In June 2021, Smart Energy Decisions received 105 responses from an electronic survey we fielded to our readers, representing a diverse mix of organizations. Increased interest from the institutional sector resulted in this segment representing the largest share of respondents. In a year marked by multiplying incidents of blackouts, from West Coast wildfires to Texas cold snaps, this shift may indicate that hospitals, universities, and other institutions are newly prioritizing resiliency.

By annual spend on electricity, respondents split evenly, with 45% spending below $25m annually and 44% spending more. Under that amount, institutional and government entities were preponderant. A significant share (14%), dominated by commercial and industrial companies, reported spending over $200m. Overall, 73% of respondents expressed medium or high interest in DERs (see next page).

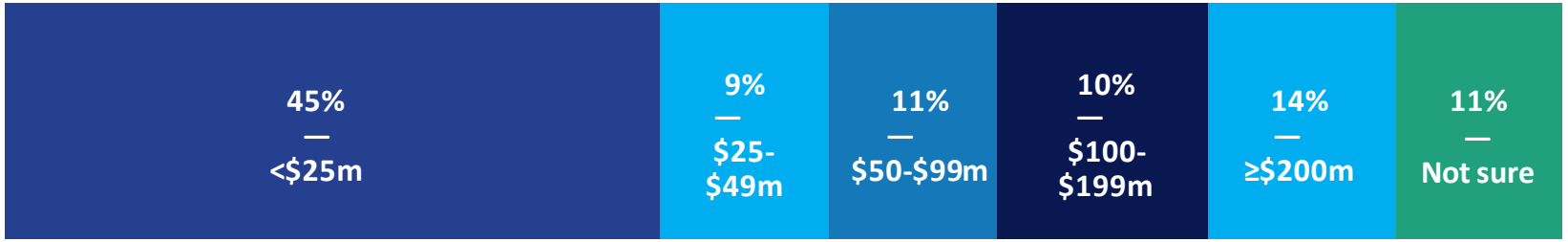
Q. *Which of the following best describes your type of company?*

Q. *What is your company's annual electricity spend?*

TYPE OF COMPANY



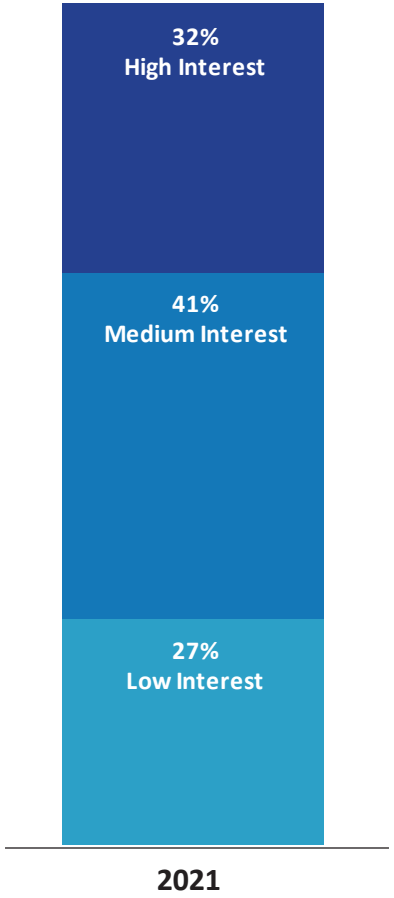
ANNUAL ELECTRICITY SPEND



Participants and Their Level of Interest in DERs

2Life Communities
Advance Auto Parts, Inc.
Alameda County
Albertsons Companies
Alectra
ASU
Avery Dennison Corp.
BASF
Bates College
Becton, Dickinson and Co.
Bee Maid Honey
Bekaert
Big Lots
Bluefield State College
Bristol-Myers Squibb Co.
Bucknell University
Buffalo Niagara Medical Campus
California State University, San Marcos
Canadian Urban Limited
CBRE
CentraCare
Chatham University
Cinemark USA
Cisco Systems, Inc.
Citrix
City of Asheville, NC
City of Berkeley, CA
City of Dover, DE
City of El Paso, TX
City of Kansas City, MO
City of Orlando, FL
City of Winston-Salem, NC
Clemson University
Comcast
Costco
Crown Metal Packaging Canada
Culver City
Cumberland Farms
Cummins, Inc.
Cushman & Wakefield, Inc.
Daimler Trucks NA
Dana-Farber Cancer Institute
DePauw University
Dollar Tree/Family Dollar
DR2 Solutions
DXC Technology
Eastman Chemical Co.
Emory University
Extreme Networks, Inc.
Ford Motor Co.
GCC Cemento
Genentech
General Mills
Georgia College & State University
Green Coast Enterprises
HARBEC
Harris Teeter
Hoag Memorial Hospital Presbyterian
Houston Methodist Hospital
Humber College
Intel Corp.
ITW
J.M. Huber Corp.
JLL Mexico
Kohler Co.
The Kroger Company
Liberty University
Lockheed Martin
Marengo Community High School
Material Sciences Corp.
Merck & Co., Inc.
Mercy Hospital
Michigan State University
Mohawk Industries
MOMs Organic Market
Montclair Kimberley Academy
Northbay Healthcare
Northern Virginia Community College
Northwell Health
NYC Community Board 9
Oakland Unified School District
Port of San Diego
Port of Seattle
Procter & Gamble
PSEG
Raley's
Schaeffler Aerospace USA Corp.
Stanford University
Staples
State of New Jersey
Suffolk County Community College
Target Corp.
Tennessee State Government
Texas Children's Hospital
Town of Norwood
TxDOT
University of Alabama at Birmingham
University of California, Davis
University of Connecticut
University of Minnesota
UT Health San Antonio
VFS LLC
VMware, Inc.
Weis Markets
Young Living Essential Oils

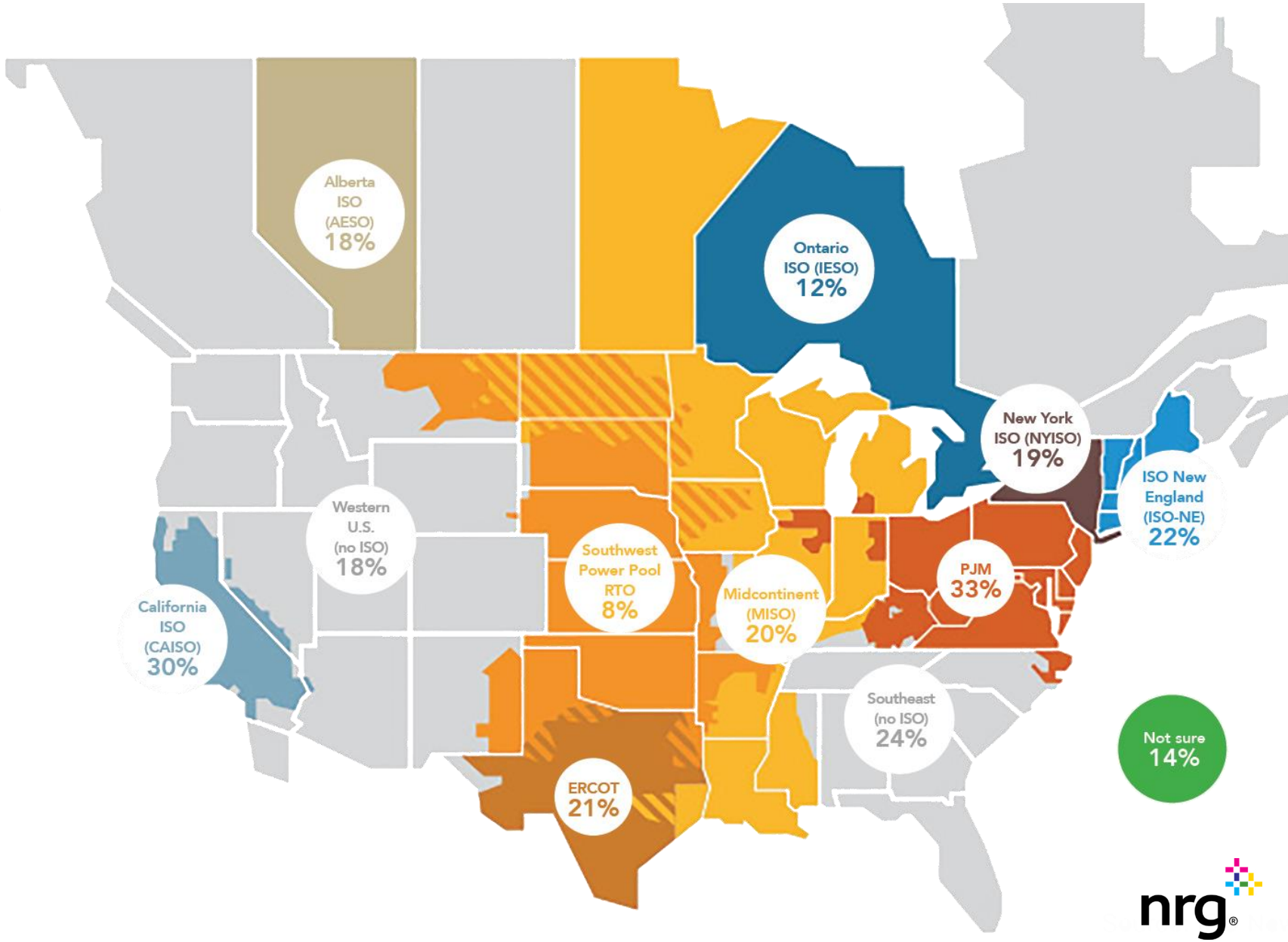
INTEREST LEVEL IN DEPLOYING DERS



ISOs and RTOs Represented

This survey captures perspectives from a wide distribution of regions and market types across the U.S. and Canada. Nearly a third of respondents reported a presence in both PJM (33%) and CAISO (30%), both of which have high energy costs and diverse grid modernization efforts.

Those with operations in multiple regions — 28% of total respondents — face greater challenges, from increased complexity managing suppliers in different markets to deploying advanced energy services, such as local backup power, efficiency upgrades, or onsite renewables. In these cases, a seasoned energy services partner with a national presence can offer greater insight and deeper resources to help optimize energy planning.



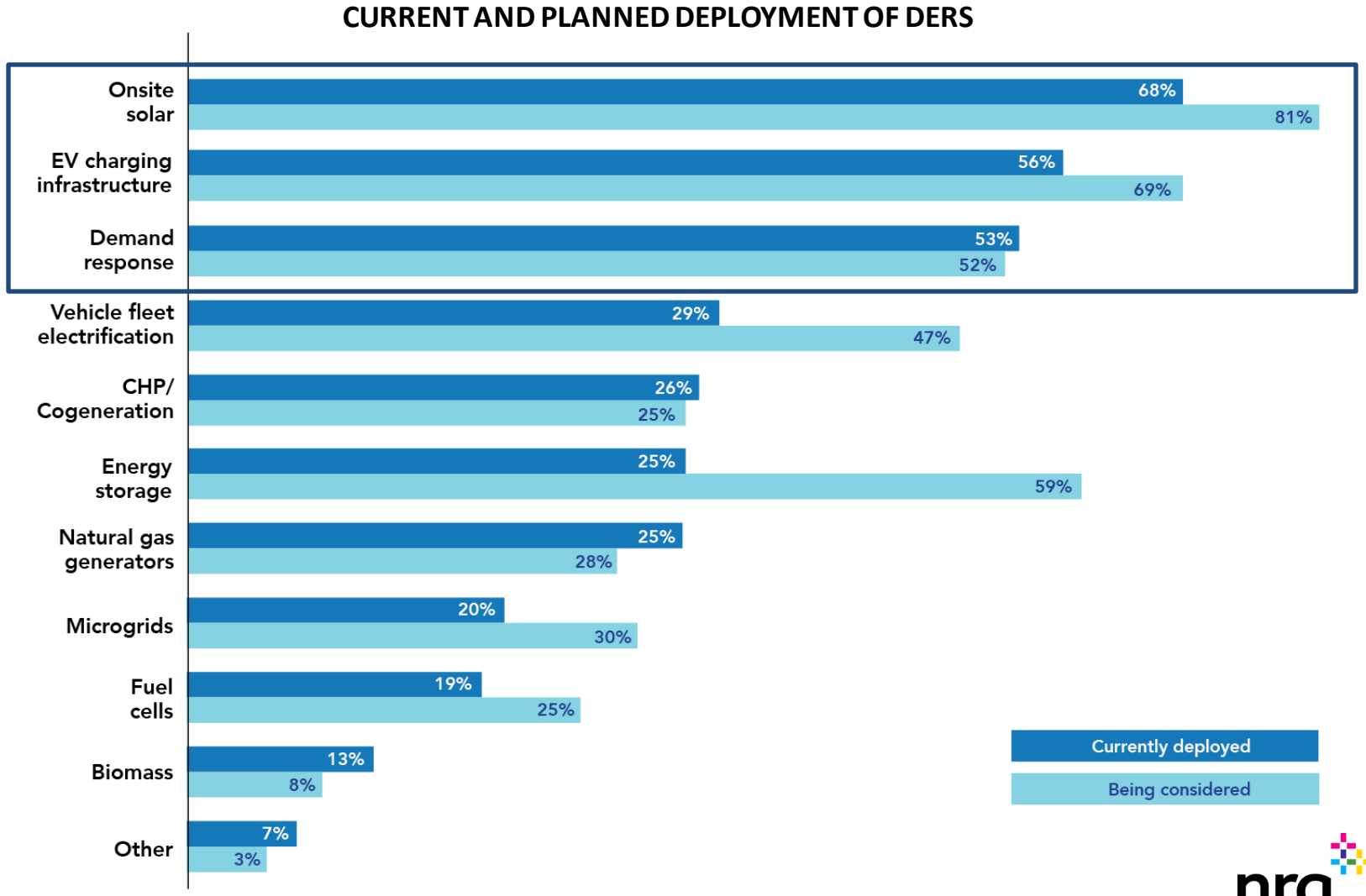
Q. *Under which regional transmission organization (RTO) or independent system operator (ISO) region(s) does your company operate in? (Select all that apply)*

DERs Today: Onsite Solar Rules

Among currently deployed DER technologies, three technologies were cited by more than half of respondents: solar, EV charging infrastructure, and demand response (DR). Solar continues to dominate as respondents' top choice both today and in future plans. The persistent strength of EV charging and demand response underscore the interplay of these top three technologies: by shaving load during peak periods, DR can prevent disruptions, and help solar satisfy onsite demand; EV charging, meanwhile, offers a great way to capture more solar energy during peak daytime output.

Notably, since last year's report, onsite solar's lead has shrunk. This may reflect a widening set of considerations among energy professionals, as they look beyond the primary challenge of deploying renewables to the benefits of complementary technologies such as onsite storage. A look at future plans, on the next page, highlights this trend.

Q. *Which of the following distributed energy resources are currently deployed/being considered by your company? (Select all that apply)*



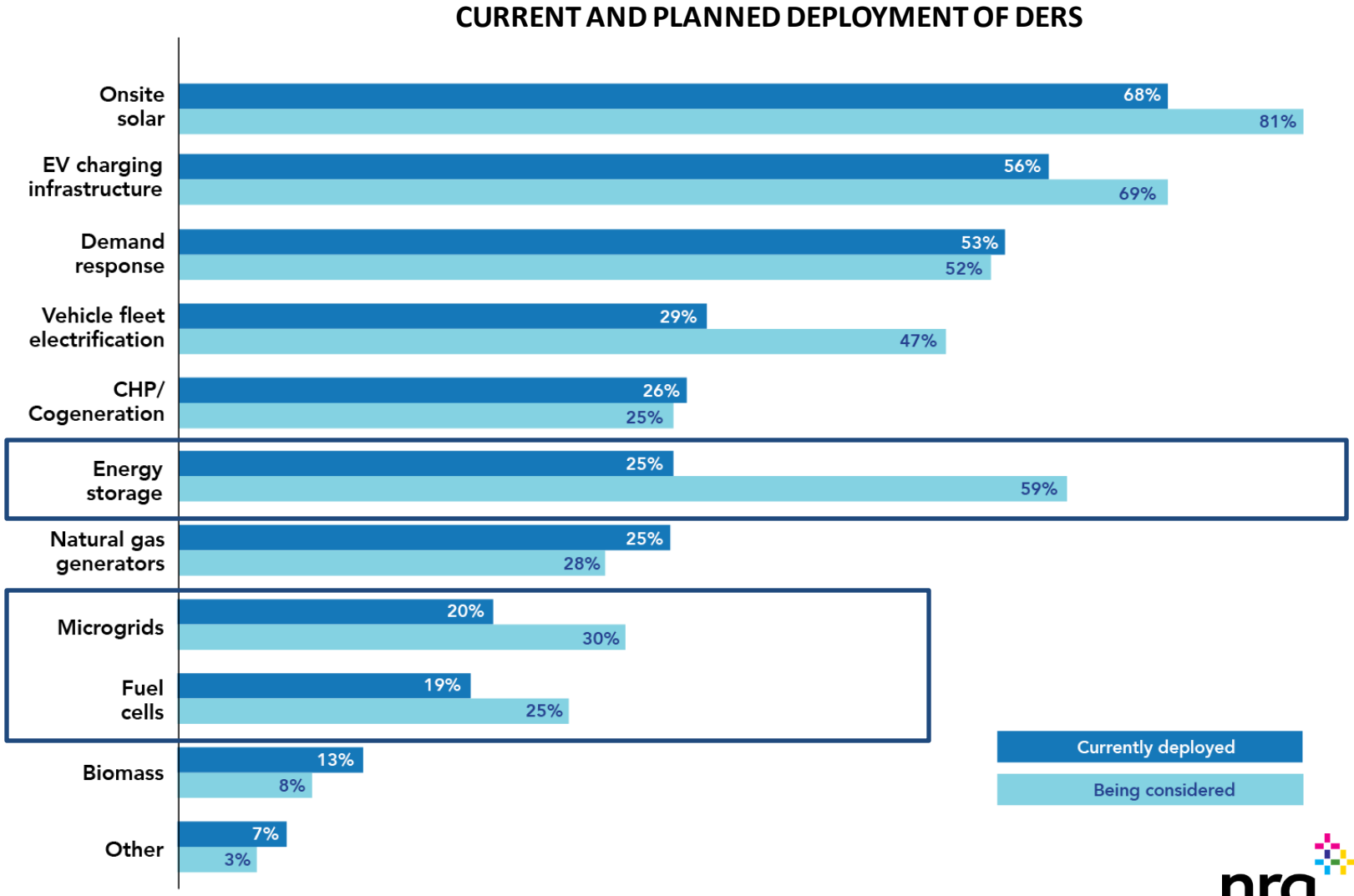
DERs Tomorrow: Storage Rising

Looking ahead, solar continues to dominate future consideration of DER priorities — an indication that its low costs and relative maturity have locked it into many long-term plans. Likewise, measured by interest in future deployment, electric vehicles (EVs) and demand response (DR) are also poised to continue growing.

Looking deeper into the stack of options, we see several newcomers poised to make big jumps. For instance, a quarter of respondents have deployed energy storage but well over half (59%) are considering adding more. This 34-point gap highlights a potential surge in DER-scale battery projects.

Two other complementary DER technologies, microgrids and fuel cells, also show positive gaps between deployment today and consideration for tomorrow, suggesting they're also poised for increased integration into DER plans. Only biomass shows a substantial negative gap.

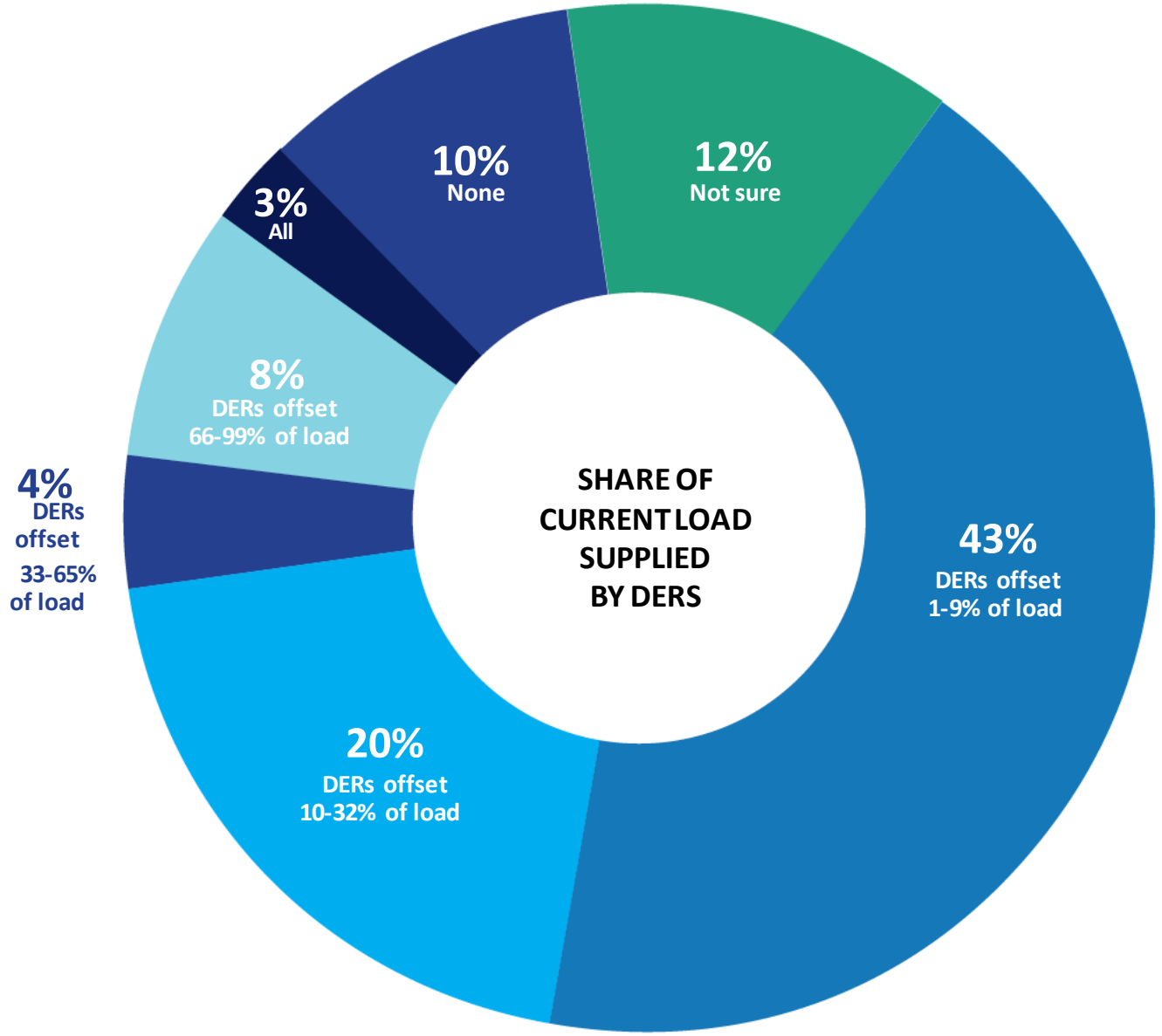
Q. *Which of the following distributed energy resources are currently deployed/being considered by your company? (Select all that apply)*



Opportunity Exists to Expand Impact of DERs

Among respondents, DERs are widely deployed, but rarely account for a large share of demand. A majority (78%) report that DERs can currently meet some share of load, but only 15% report that they can supply more than a third. For the largest group (43%), DERs provide under 10% of their load.

A small but notable share, around 3%, can meet their entire electricity demand with DERs. And among heavy users, relying on DERs to supply two-thirds or more of their power, the mix of DER systems is typically higher, at 5.3 types, versus an average of 3.3 for all respondents. This reflects the compounding benefits delivered by DER technologies. For example, on its own, a battery backup can help avoid outages. But tied into onsite solar, that battery can also help capture and use more solar power.



Q. *What percent of your load is currently offset by distributed energy resources?*

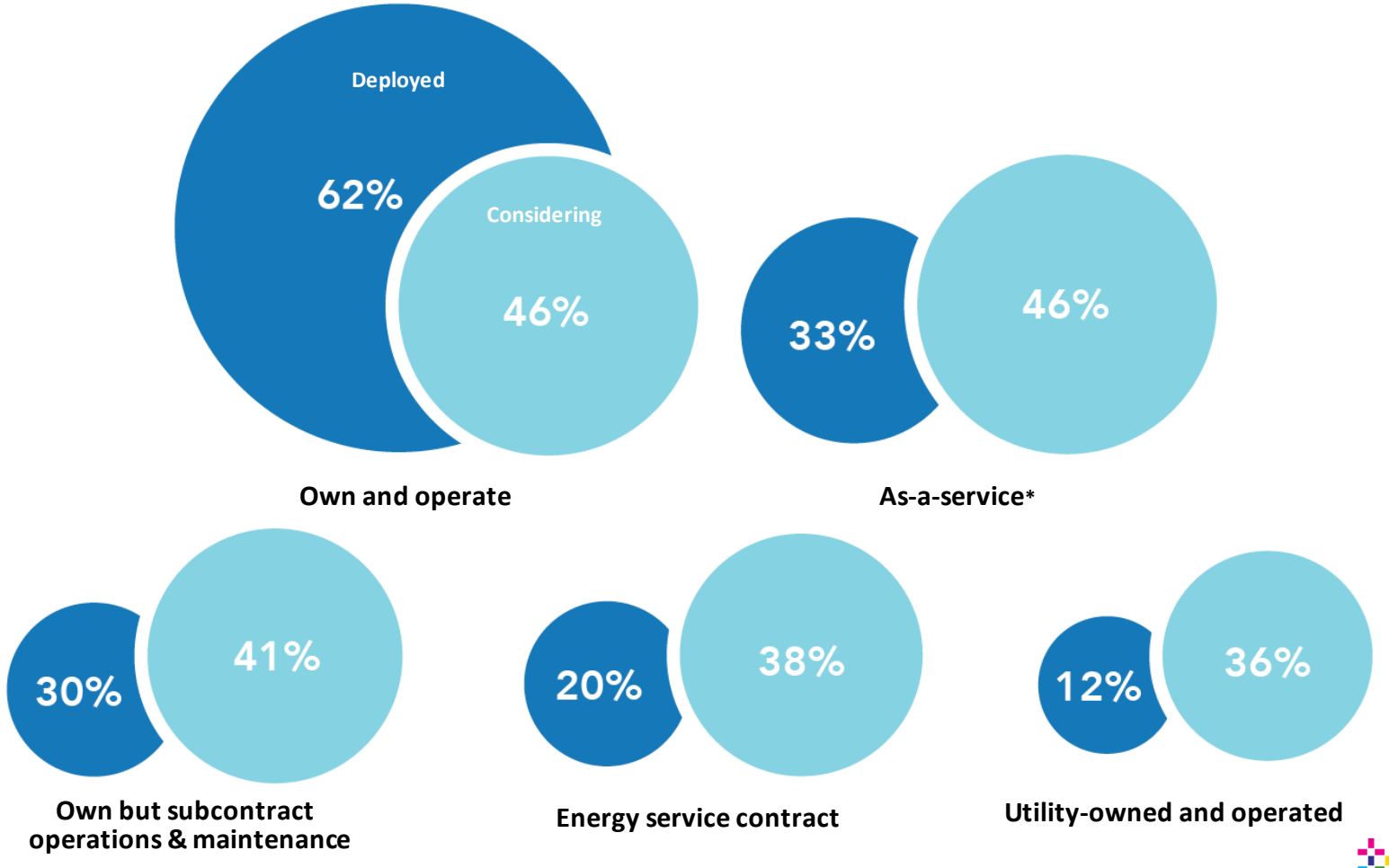
Alternative Deployment Models Are Maturing

Most respondents (62%) own and operate their DER facilities, up from 51% last year. This share grows higher still (to 73%) among institutions such as universities and hospitals, a tier of users characterized by in-house energy-system expertise, long-planning horizons, and a focus on cost-cutting.

And while the own-and-operate model shows strong future consideration (46%), interest in other options exceeds their level of current deployment. This suggests the arrival of a new tier of customers who may lack in-house expertise or capital access, but are drawn to the benefits of DERs. Models that let owners maintain control of the asset but minimize capital and technical demands — such as as-a-service, own but subcontract and energy service contract — all show substantial levels of potential growth. Considering that top barriers to DER deployment are ongoing and upfront costs (see page 15), it's no surprise operators are eyeing alternative models. In particular, commercial organizations are considering as-a-service, 55% vs. 46% among total respondents.

Q. *Which of the following models are being considered and/ or currently utilized to deploy distributed energy resources? (Select all that apply)*

DER DEPLOYMENT: MODELS IN USE AND UNDER CONSIDERATION



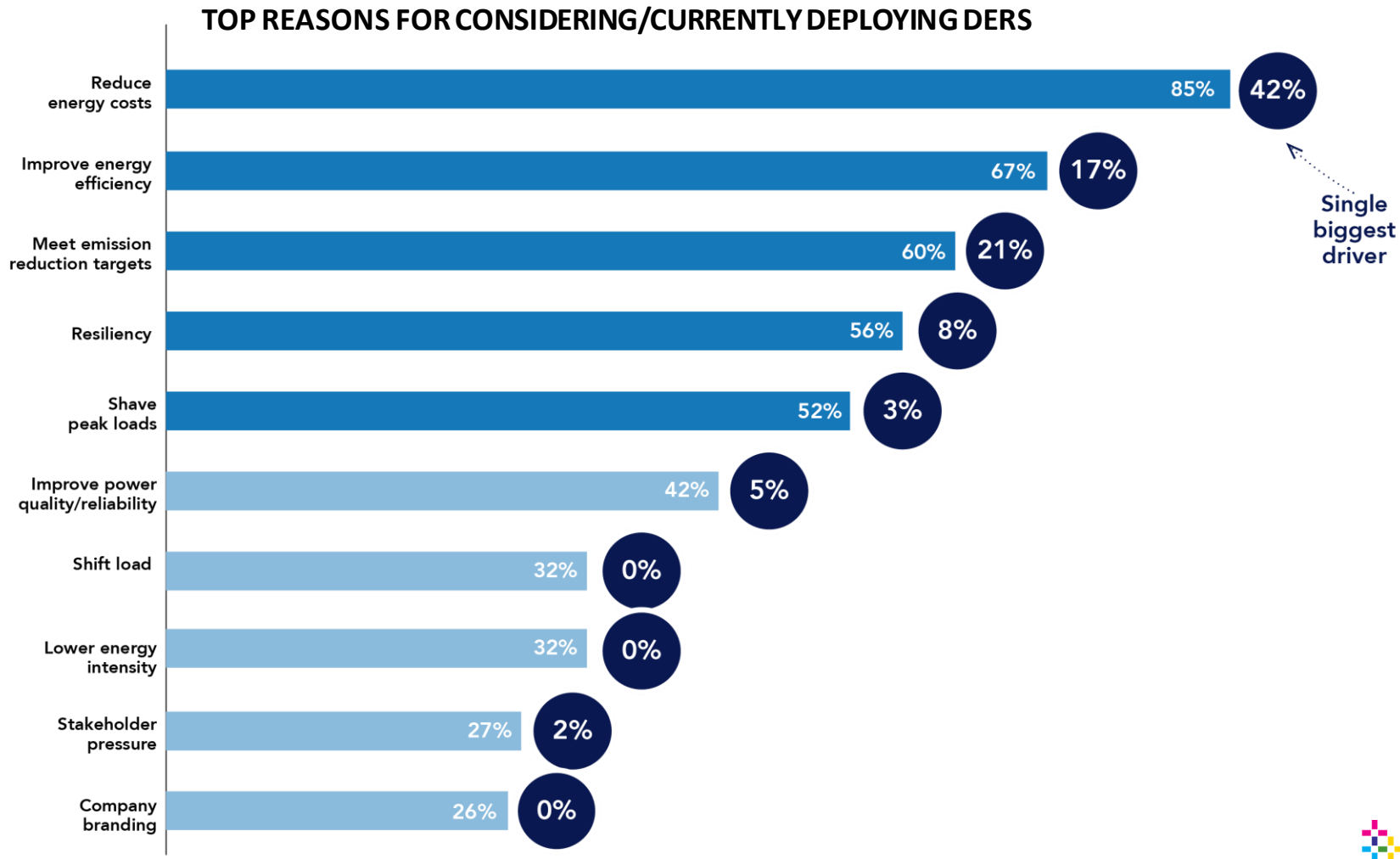
** with outside party supplier/ operator (eg. PPA, VPPA, lease, or other financial arrangement)*

Top Reasons for DERs: Cost Savings, Climate Targets

For 85% of our respondents, energy costs savings remain the champion in the race of rationales guiding decisions to deploy DERs. Yet close behind are a cluster of reasons that reveal the tight interplay between technologies that enable cost savings and the rising urgency to reduce emissions, a factor which at 21% trails only cost savings (42%) as respondents' single most important driver.

When cost savings and emissions reductions coincide, companies are quicker to take the leap to DERs. For example, improving efficiency directly lowers energy consumption, as does shaving peak loads. And both also lower costs and reduce emissions. These co-benefits are leading many to re-evaluate their approach to energy more holistically: optimizing for both supply and demand can yield bigger improvements in costs, emissions, and reliability.

Q. *What are the top reasons/the single most important reason or driver for considering or deploying distributed energy resources?*

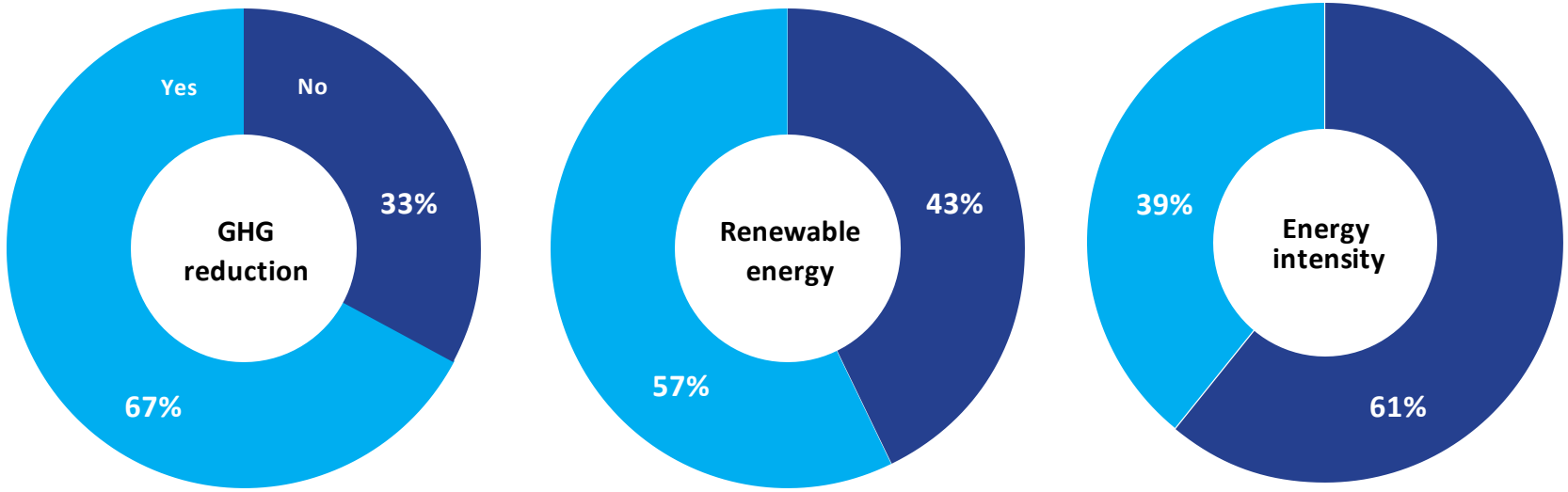


Rising Priority: Reducing Emissions

Energy professionals have evolved their priorities in recent years. As renewables have moved from the margin to the mainstream and fallen sharply in price, industry goals have advanced from renewables targets to broader ESG priorities. As part of this shift towards a more comprehensive evaluation of impact, GHG emissions reduction targets have emerged as a top priority.

This trend is reflected in our survey findings. Overall, 67% of respondents are targeting GHG reductions and 57% have set goals for renewable energy. Notably, respondents from the energy-intensive industrial sector lead this reprioritization: most (85%) have set GHG targets, while 73% have established renewable targets and 76% have defined energy intensity goals.

TARGETS SET FOR ENERGY AND EMISSIONS



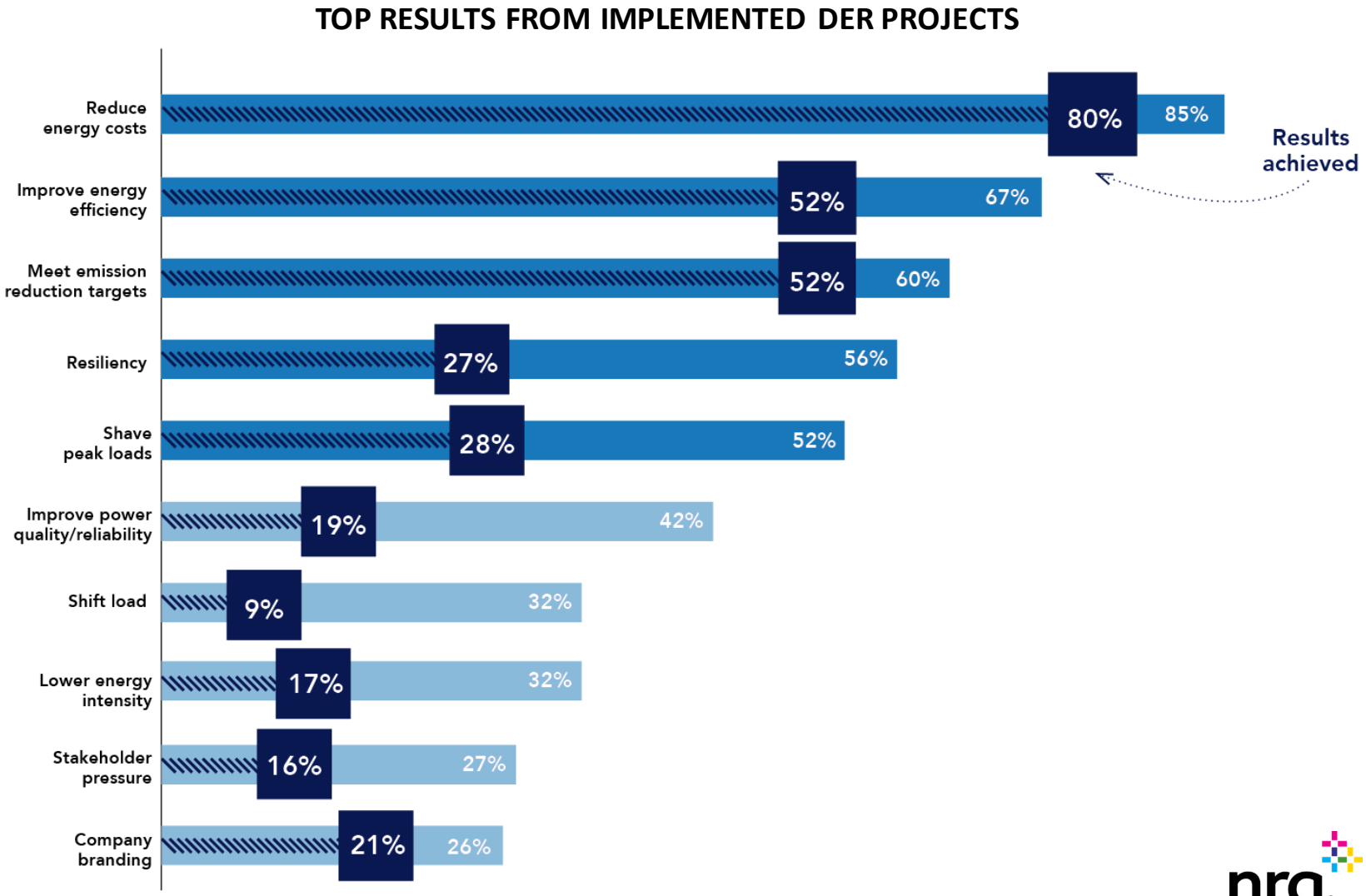
Q. *Does your company have a target for GHG reduction/renewable energy/energy intensity?*

Benefits Realized: How DERs Are Delivering Results

DERs' promises to cut costs, boost resiliency, and lower emissions have been driving growing interest in implementation in recent years. Yet evidence that they deliver on their promises has remained incomplete. Our 2021 findings close this gap. Data shown here — overlaying reported benefits atop the key reasons to deploy DERs (see page 11) — suggest that, simply put, DERs are delivering, especially with regard to our top drivers for implementation. A total of 80% report realizing cost reductions, while more than half are seeing efficiency gains and emissions reductions.

Across a wide set of secondary drivers, benefits remain emergent, with resiliency (27%) and peak load shaving (28%) reporting similar levels. Company branding follows close behind (21%), reinforcing the fact that DERs are complex and are being asked to deliver a growing mix of benefits.

Q. *If you have implemented DERs, what benefits have you already achieved?*



SPOTLIGHT ON
DEMAND RESPONSE

Demand Response (DR) is an energy solution that helps customers reduce energy consumption during periods of high stress on the electric grid and get paid for using less during peak demand.

A total of 53% of respondents are currently using demand response, with another 52% considering implementation (this includes a significant number who currently use these programs and may expand).

An interesting point about demand response is that other DERs will support demand response participation. Natural gas generators, in particular, can be a clear path to executing DR programs in most markets. Companies like NRG are innovating DR programs, which offer customers a variety of ways to monetize flexible load.

While natural gas generators are most commonly used to support demand response, other DERs are gaining traction to facilitate participation in economic and emergency demand response programs.

SMART ENERGY DECISIONS RESEARCH

The Road to Optimizing Demand Response

NRG's Demand Response program features a series of steps allowing operators to reduce energy consumption and increase revenue:

STRATEGY
A tailored reduction plan drives everything

We collaborate to create a solution to meet your business objectives and manage your energy footprint.

COMMUNICATION
We're your single point of contact

If a crisis arises, we receive initial notification.

ACTION
When the time is right, we let you know

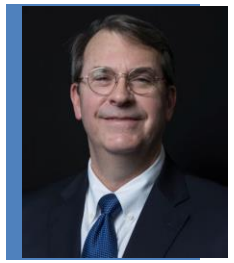
From here, your reduction action plan is put in place.

REVENUE
When DR season ends, you get a bill credit

The amount is based on your performance and the programs in which your company was registered.

EMPOWERMENT
Access to our dashboard brings added control

Real-time tracking is provided by a meter or device upgrade.



Doug Sansom
Director of Distributed Energy Resources
NRG Energy
HughDouglas.Sansom@nrg.com



Tracy Alexander
Strategic Market Development Manager
NRG Energy
Tracy.Alexander@nrg.com

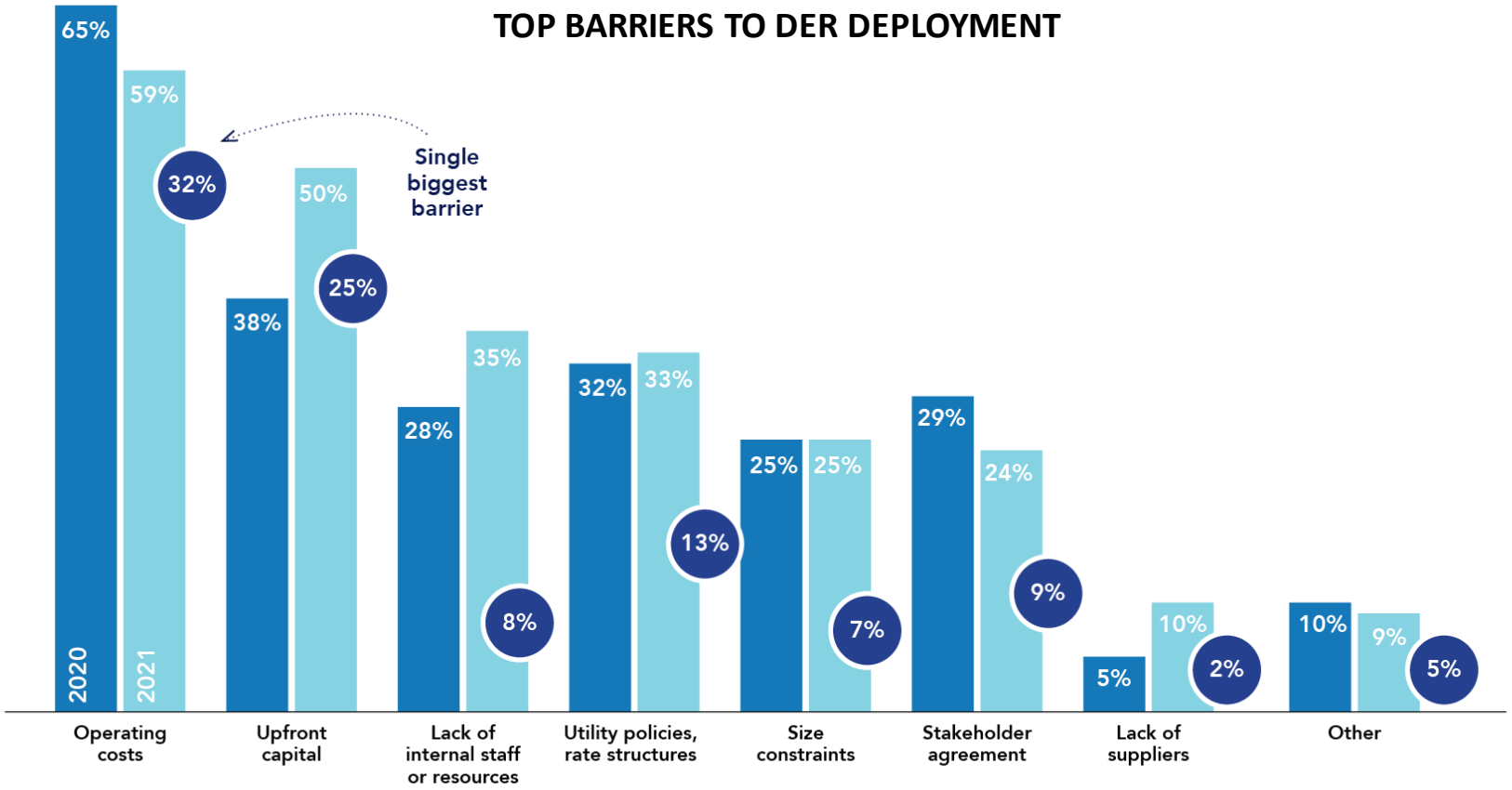
nrg®

Barriers Persist: Upfront Costs and Operating Expenses

As the benefits of DERs come into focus, the costs to build and operate these facilities remain a top barrier to deployment. In 2021, op-ex continues to be the most-cited challenge at 59% overall, with all subgroups ranking it first. This year, upfront development costs (cap-ex) have surged in concern, to 50%, up 12 percentage points from 2020. Both op-ex (32%) and cap-ex (25%) emerge as the biggest single barriers to deploy DERs.

These concerns underscore that more players are reckoning first with financial, rather than technical, challenges. It follows that a lack of internal staff or resources, cited by 35%, is also rising as a barrier. This combination of financial and resource barriers may be the animating force behind rising interest in outsourced DER models (see page 10), which can zero-out upfront capital needs while also simplifying ongoing operations.

Q. *What are the top barriers/the single most important barrier to deploying distributed energy resources?*

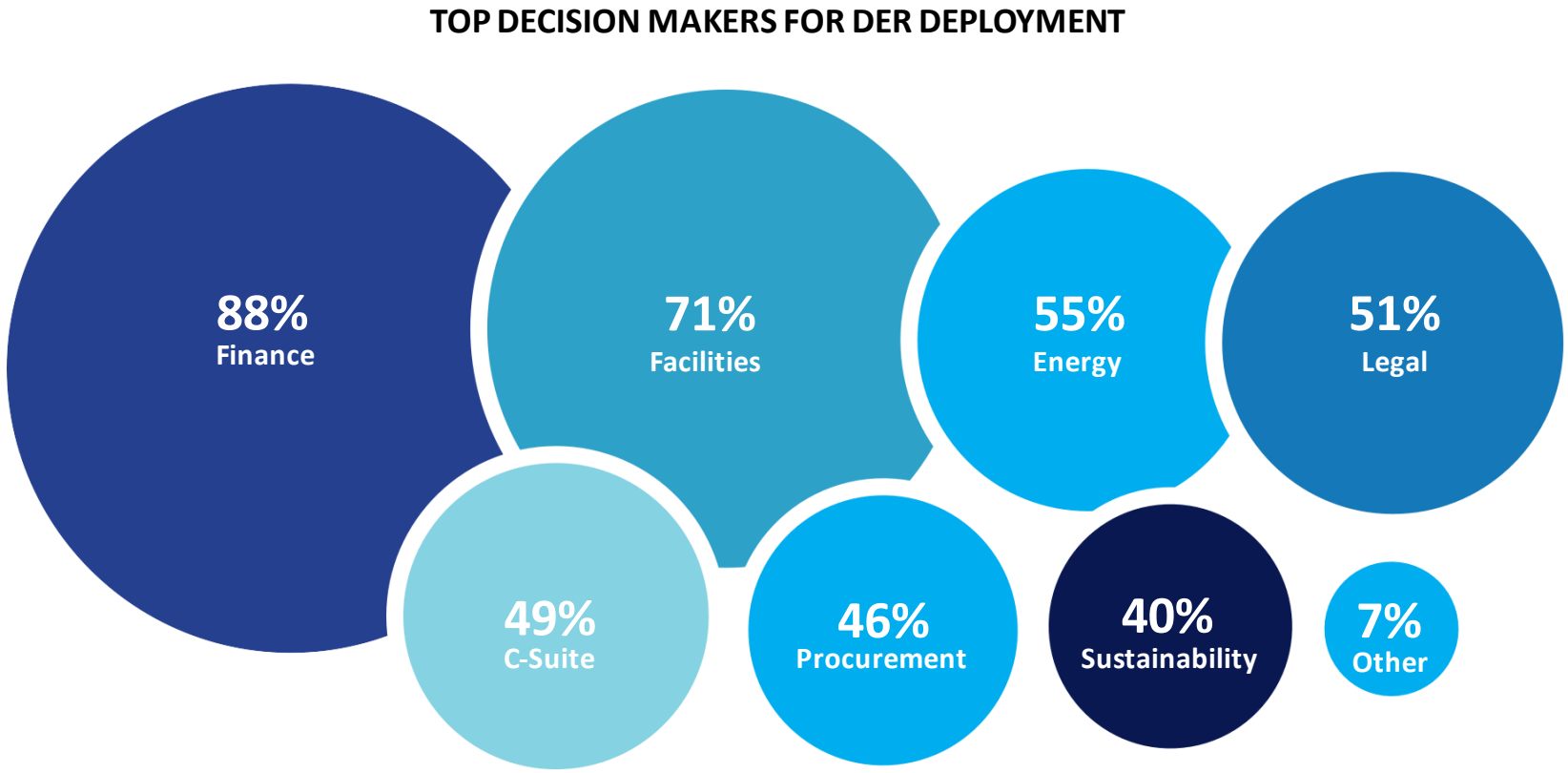


Swaying Decision Makers: Build Buy-in with Benefits

While a third of respondents cited a lack of staff and internal resources (last page) as a key barrier to deployment, a related challenge is winning the OK on new DER projects. While finance, at 88%, and facilities, at 71%, emerge as the top gatekeepers, a second tier of stakeholders — energy, legal, c-suite and procurement — are clustered at around 50%. And each will have a different view of the risks and benefits posed by DERs.

For new developments, in particular, the more people who are engaged in DER decisions, the more successful deployment is likely to be. To encourage buy-in, educate each decision-maker by speaking their language: explain DERs' benefits as they relate to each leader's domain. For finance, enumerate the return on investment; for facilities, share data on typical outage reductions; and so on. It truly takes a village.

Q. *Which of the following departments in your company must sign off on the deployment of distributed energy resources? (Select all that apply)*

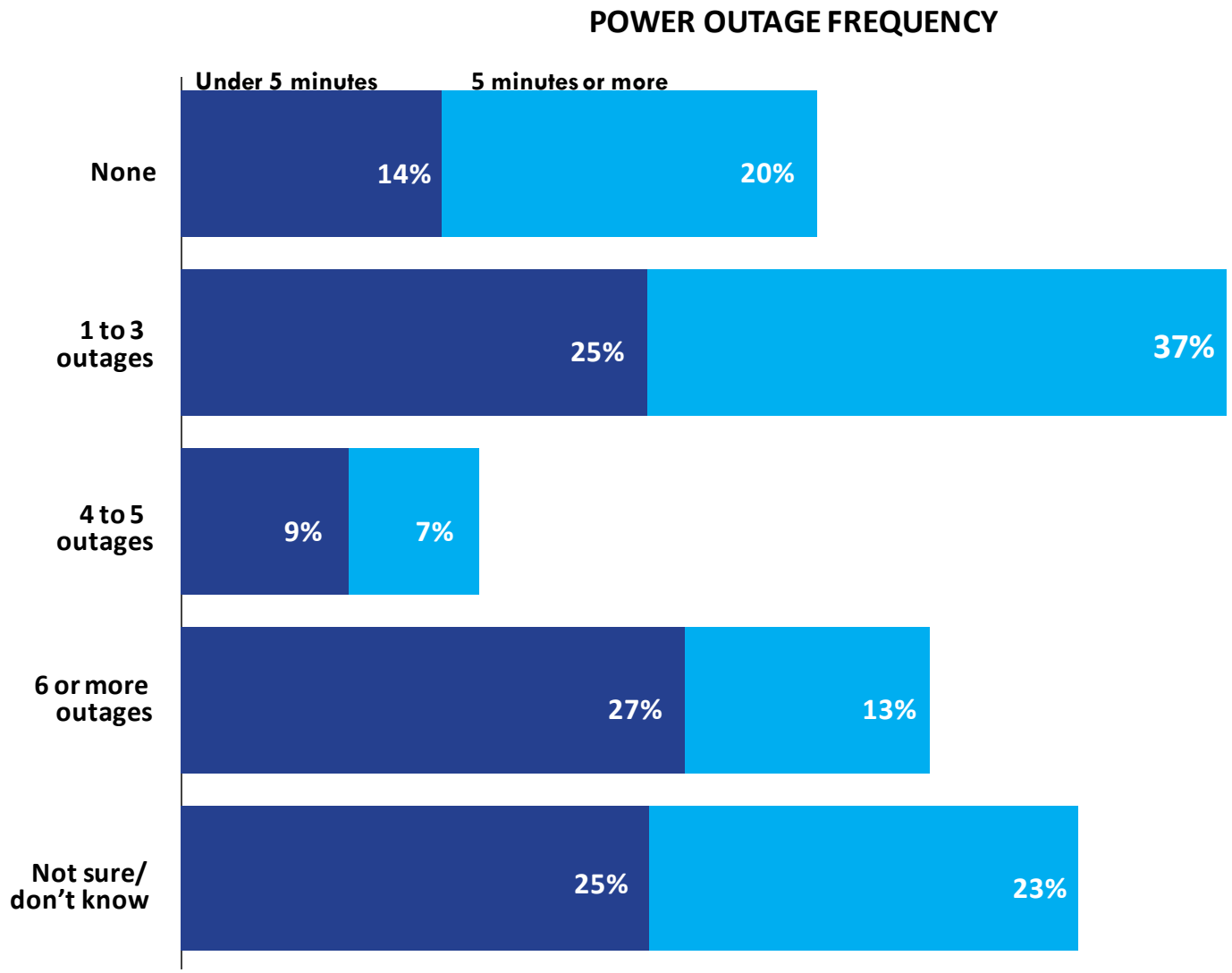


Power Outages: Widespread and Multiplying

Blackouts and power disruptions have been growing more frequent and longer in duration in recent years. Since 2000, outages across the U.S. have increased by 67%, according to Carbon Central. Aging grid hardware is facing more frequent and harsher natural risks, from hotter heat waves and wider wildfires to more intense windstorms and more frequent flooding.

So while the grid remains fundamentally sound, resiliency is a rising priority to minimize the risk of outages. Our survey found that in 2021, at least 60% reported dealing with outages of some duration. While the largest cohort reported experiencing just a few (1-3) outages, just over one-quarter (27%) posted six or more outages of short duration and 13% were hit with longer-duration outages.

Q. *How many of the following types of power outages have you experienced in the last 12 months?*



Outage Costs and Risks: Under Assessed

More frequent outages translate into real economic loss, whether measured by downtime, lost output, or damaged equipment. Assessing the dollar value of these disruptions is a crucial step to better assess the value of resiliency offered by DERs. In a single brief outage, for example, an industrial manufacturer reported they could lose work-in-progress worth far more than the cost of the DER gear installed to prevent disruptions.

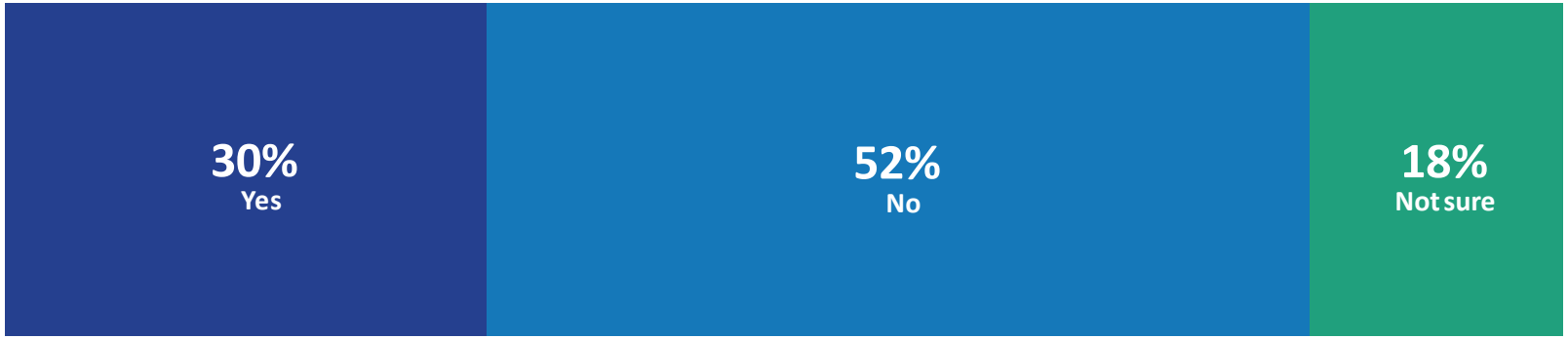
Indeed, among respondents reporting the cost of power outages, 25% have been hit with losses of $1 million or more. Given such high risks to costs and operations, it is somewhat surprising that more than half of respondents report they have not yet completed a cost analysis of the impact of outages. A similar share (52%) reported not having conducted a broader risk analysis on the threat of outages.

Q. *Have you calculated the costs associated with power outages at your company?*

Q. *Have you performed a risk analysis of the impact of a utility outage at your company?*

ASSESSING RISKS AND COSTS OF OUTAGES

PERFORMED COST ANALYSIS OF IMPACT OF OUTAGES



PERFORMED RISK ANALYSIS OF IMPACT OF OUTAGES

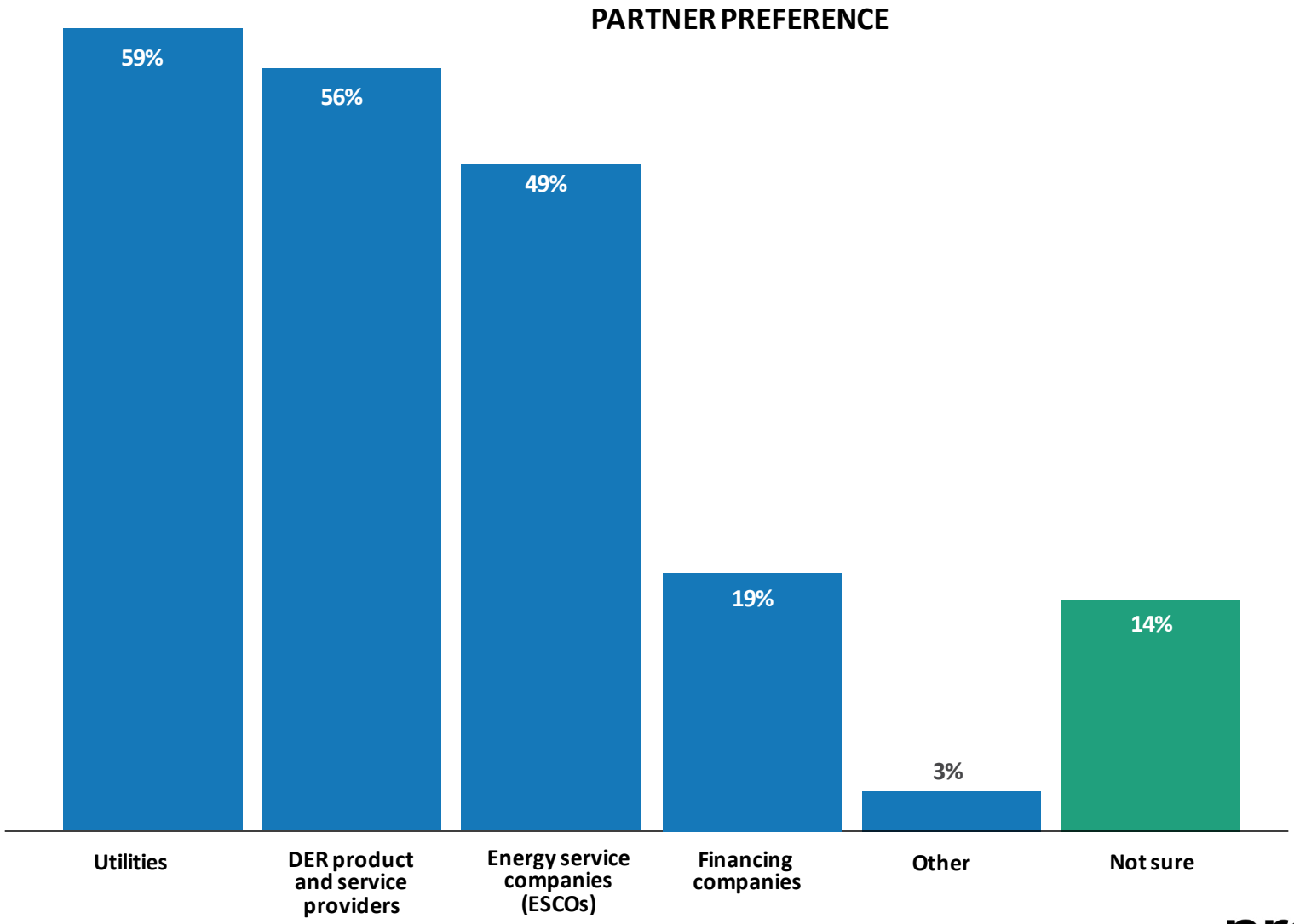


Partners Preferred: Seeking Help to Deploy DERs

As more organizations deploy DERs, partner preference is split. Utilities are often the most familiar and common first stop, as cited by 59% of respondents overall. Trailing close behind are DER product and service providers (56%) and energy service companies (ESCOs, 49%) Tellingly, the preference among energy-intensive industrial respondents showed the sharpest shift, with 74% opting for DER product and service providers, up 15 percentage points in the past year.

Government/institutional and commercial respondents are more often turning to utilities. This may reflect the necessity of grid integration as well as space constraints, given that it can be challenging to install and house energy systems in retail spaces and office buildings. Note, however, that utility offerings vary widely. Among the top barriers to deployment (see page 15), unfavorable utility policies and rate structures was the third most cited challenge.

Q. *What types of partners is your company considering/currently engaging with to deploy distributed energy resources? (Select all that apply)*

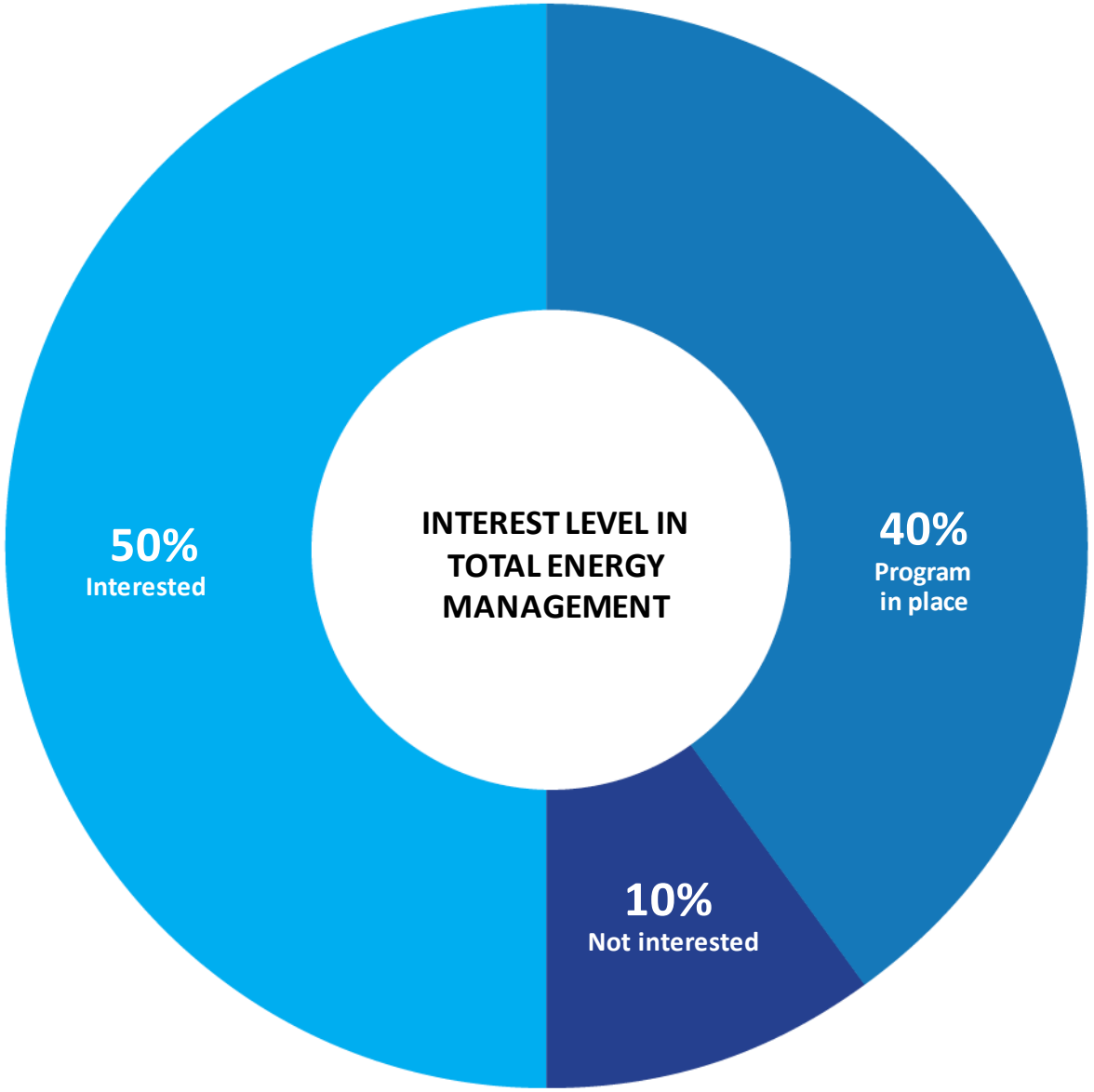


Rising Interest: Optimizing Supply and Demand

The challenge of deploying and managing DER systems continues to grow. Thus 90% of respondents express interest in, or have already deployed, a total energy management approach that dynamically manages both demand and supply. By type of organization, around half of all commercial (50%) and industrial (48%) respondents have deployed such a program. Institutional and government organizations trail behind — 30% or fewer have deployed total energy management — but they show high levels of interest, at over 60% for each.

More are likely to move in this direction. By optimizing energy consumption and use as a whole, a total energy management approach promises to not just increase energy savings and decrease emissions, but to also deliver higher return on investment by providing more advanced energy services to the grid.

Q. *Which best describes your level of interest in developing a "total" energy management program that addresses both demand-side and supply-side strategies?*



Conclusions

From costly grid power, to more frequent blackouts and growing emissions reduction targets, multiple forces are converging to make DERs more compelling for organizations. Such systems have proven their ability to lower energy costs while reducing the risk of blackouts and lowering emissions.

This survey captures the rationale, benefits, and barriers of making such a switch. In summary, we see that:

- The promise of DERs is being fulfilled as benefits from cost reduction to improved efficiency to meeting targets are being achieved.
- Interest and implementation of DERs remain strong, especially for resources that deliver cost savings, decarbonization, and resilience.
- More work is needed to quantify the financial risks associated with outages.
- Partner preference is complex – proceed with caution.
- As part of a total energy management strategy, organizations should explore how DERs can work in tandem to multiply effectiveness. Remember, when optimized, the benefits of an integrated DER system can be greater than the sum of its parts.

Acknowledgements

At NRG, we're bringing the power of energy to people and organizations by putting customers at the center of everything we do. We generate electricity and provide energy solutions and natural gas to millions of customers through our diverse portfolio of retail brands. A Fortune 500 company, operating in the United States and Canada, NRG delivers innovative solutions while advocating for competitive energy markets and customer choice, working towards a sustainable energy future.

See more information at www.nrg.com. Connect with NRG on Facebook, LinkedIn and follow us on Twitter.

We're committed to your success. Smart Energy Decisions is the leading information resource and research platform dedicated to addressing the information needs of large electric power customers. We deliver news, analysis, and research in addition to producing events designed to help our community make better decisions. We are a catalyst for change in support of the dramatic energy transformation taking place in the electric power markets impacting customers, utilities, and suppliers. Our mission is to help large electric power users improve their profitability and reduce their carbon emissions by adopting best practices in energy efficiency and renewable energy sourcing.

For more, contact John Failla, Founder & Editorial Director, at john@smartenergydecisions.com





NRG.COM

TAKE CONTROL OF YOUR ENERGY STRATEGY

SUSTAINABILITY | **RELIABILITY** | **AFFORDABILITY** | **PREDICTABILITY**

Energy goals such as sustainability, reliability, affordability, and predictability are common for every business, but how each business chooses to focus on them is what makes every situation unique. No matter if your business is singularly focused on one goal, or hoping to achieve all four, we are guiding our customers to the perfect blend of components to help them get there.

Finding what works, starts with you. That's why we offer a range of solutions that put control back into your hands.

Regardless of your goals, we have the solutions to match them. Learn more about what we have to offer at **nrg.com/DERyourway**

NRG and the plus signs are registered servicemarks of NRG Energy, Inc. NRG is a registered trademark of NRG Energy, Inc. © 2021 NRG Energy, Inc. All rights reserved. 781653961

Debra Chanil
Research and Content Director
debra@smartenergydecisions.com

John Failla
Founder and Editorial Director
john@smartenergydecisions.com

