WHITE PAPER

BATTERY STORAGE AND CONTRACT MANAGEMENT: CREATING A RENEWABLE FUTURE

Abstract

Amid growing international pressure to resolve the climate crisis, governments and companies are pledging themselves to conscientiously adopt green practices. The power, energy and utilities sector have a crucial role to play in this – with the adoption of revolutionary battery storage systems emerging as a key success factor. This paper looks at the economic considerations of energy storage systems and how these impact existing contracting and procurement processes in the energy and utilities sector. It elaborates on the five-step GESA framework for procurement along with some important recommendations to achieve simplified contract management for storage systems, which is critical for a sustainable future.

Infosys®
Navigate your next

Energy transition and battery storage systems

Mankind's resolve to evolve to a zero-carbon footprint is only getting stronger. While the energy industry, dominated by oil and gas majors, has committed to becoming carbon neutral, the fossil fuel-based power utility industry is already in the midst of an energy transition.

2020 set in motion the convergence of a predominantly fossil fuel-driven oil and gas industry with a power sector that is rapidly transforming to renewable energy. Market reactions are well-aligned and in agreement. This was evident when NextEra Energy briefly overtook Exxon Mobil as the most valuable US-listed company in October.

Energy storage technologies, particularly battery storage, are at the core of this transition to renewable energy. Recently, Gateway Energy Storage, operated by grid infrastructure developer LS Power, overtook Tesla as the world's biggest lithium-ion (LI) battery storage in terms of power capacity at 250 megawatts. It may have taken close to three years for LS Power to displace the Tesla-operated Hornsdale Power Reserve as the biggest LI battery storage. However, it will not be long before we see projects with higher power capacity. The State of New York, which is on its way to carbon neutrality as per its 2019 Climate Bill, is expected to see the commissioning of LS Power's Ravenswood Energy Storage in 2021.

The rest of world is catching up fast. In December 2020, Chinese President Xi Jinping announced his commitment to increase the installed solar and wind power capacity to 1.2 billion kilowatts within the next 10 years. This is more than twice the current capacity. Similarly, India aims to set up 175 gigawatts capacity by 2022 and expects 45% growth in battery storage systems by 2027 due to the declining prices of lithium-ion batteries. This kind of innovation within the Asia-Pacific (APAC) region is not surprising considering it accounts for about 80% of global battery manufacturing capacity.

Wood Mackenzie expects the share of the European, Middle East and Africa (EMEA) region in energy storage deployments to shrink to 13% by 2030. Despite this, the European commission estimates that between 240 and 450 gigawatts of offshore wind power is needed to support the EU's 2050 net-zero goals. This has encouraged enthusiasm in the battery storage industry for both manufactures as well as the utility operators. The Wood Mackenzie report estimates that global energy storage capacity will grow at a CAGR of 31% by 2030 with lithium iron phosphate (LFP) poised to take a dominant position as stationary storage.

As battery storage equipment prices continue to decline and the need for system flexibility increases with wind and solar deployment, more policymakers, regulators and utilities want to develop policies to jump-start the deployment of batteries. Battery storage technologies are becoming one of the most important tools in achieving a low-carbon future. In order for energy and utility companies to deliver on the promise of a sustainable and clean energy future, they must work towards integrating newer sources of energy and energy storage options with a strong focus on battery storage technology. Integrating battery storage systems into the existing landscape of business functions requires distinctive capabilities in several business processes including contract origination, contract management, trading, operations, settlement, and risk management.

Considerations for battery storage economics

George Crabtree, Director of the Joint Center for Energy Storage Research (JCESR), opines, "This is sort of a 'storage moment', we are looking for batteries to do for transportation and the electricity grid what they have done for personal electronics, to really make a huge change in the way these systems operate."

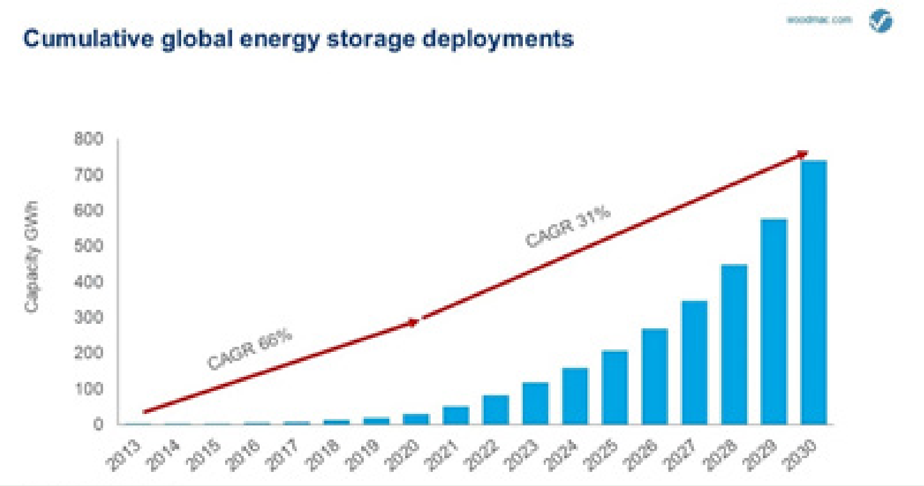


Fig 1: Growth in energy storage deployments

Energy storage is a unique technology because of the multiple functions it plays in the generation, transmission and distribution infrastructure. The economics of battery storage is directly influenced by the application of the installed capacity and the costs of the batteries and the dispatch operations.

Supply demand balancing	Reliability services	Emission goals	Transmission and distribution deferral
Peaker replacement	Renewable energy storage	Generation economics	Storage to reduce consumer charges

Fig 2: Applications of battery storage technology

Consequently, contracts and agreements pertaining to battery storage are different from any traditional power purchase agreements (PPAs) due to the differences in storage capacity configurations (short-term and long-term storage) and the multitude of applications on the demand side. The major challenges in determining the profitability of battery storage systems include the consideration of individual markets served by the storage system, how the system will degrade over time and the trends of purchased power prices through PPAs. Further, operators and investors should consider operational dimensions like the impact of political and economic policies, regional regulations across the value chain and the long-term operating model.

Some of the key factors pertaining to the implementation of battery storage solutions that utility companies should consider and evaluate as part of their planning are:

Technical requirements	• Targeted function of the storage project: behind-the-meter and front-of-meter • Battery management processes for the stated objectives with appropriate implementation of software solutions to integrate the new sources into the existing energy supply landscape • Clear understanding of accounting, billing and metering methods for utility-scale grid-connected battery storage systems
Economic policies	• Project economics and business case should align with regional economic policies to validate the viability of energy storage projects • Company policies around investments in pilot projects and battery technology and their applicability to long-term objectives should be understood
Regulatory environment	• Integrate battery resources in the wholesale energy market to provide ancillary services • Incentivize long-term contracts • Facilitate deployment of large-scale battery storage systems as a solution to reduce overall investments in capacity generation and network reinforcement
Operating model	• Define regulations for ownership and operating models • Include storage batteries in the long-term plans of system expansion along with traditional grid and generation investments

Changing characteristics of procurement and contracting

Over the last decade, the utility sector has executed numerous contracts with different structures for battery projects and services. Recent studies have shown that the renewable energy systems or photovoltaic (PV) plus battery hybrid systems are cost efficient for capex as well as opex compared to independently sited systems. This trend will see more share of contracts dealing with hybrid systems. In effect, contract management processes and systems will need to support wider and varying types of battery storage systems, in addition to covering terms specific to the value stream.

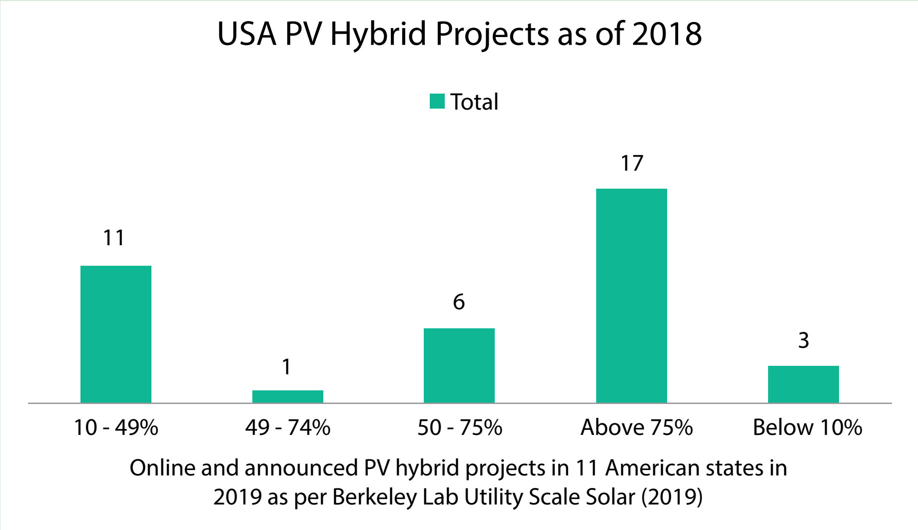


Fig 3: PV hybrid projects across 11 American states

The declining costs of battery storage technology is a major component influencing the contracting process. A review of PPAs for hybrid projects in Hawaii shows that the prices dropped rapidly from US $120/MWh in 2015 to US $70/MWh in 2018. Further, as the cost to add medium to long duration battery storage, which is called 'price adder', continues to decline, an increasing number of PPAs are now including battery storage solutions. This needs to be addressed as hybrid system contracts will have to accommodate price adders as a key parameter.

With sliding prices of battery storage per unit of power and the price adder, contract management should incorporate short-term and long-term price strategies while considering the investments made by utility companies in pilot projects.

Profitability analytics of new large-scale battery storage projects addresses the degradation of storage systems. It considers the overbuilding storage or discharge capacity that is needed at the time of commissioning and includes a provision to continuously upgrade the systems by replacing storage equipment that falls below the desired performance levels. Hence, the storage contracts must consider the effect of continuous upgrades against the cost variations due to technology advances and the application of stored power.

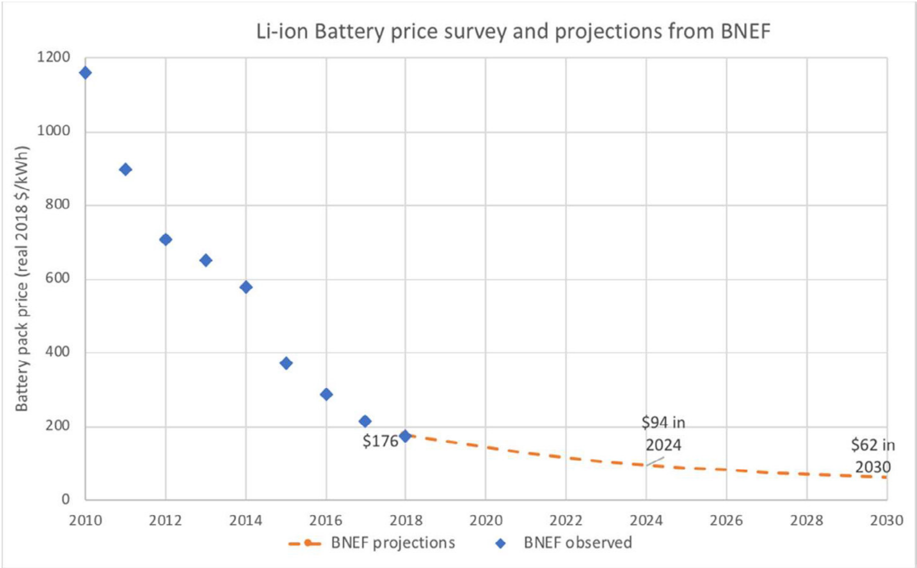


Fig 4: Li-ion battery pack historical prices and price negotiations. Source: BNEF (2019)

As in the case of PJM Interconnection and in California region, independent power producers (IPPs) tend to dominate power-oriented storage facilities that offer frequency regulation applications. Conversely, investor-owned utilities (IOUs) dominate the energy-oriented storage market that provides a wider array of services. Robust and adaptive contract management capabilities are now a critical element in the utility industry due to the increasing number of private ownership and public-private partnerships driven by recent developments in the renewable energy sector. Moreover, software systems and IT processes around storage contracts must be properly architected and integrated.

Preparing for battery storage procurement in the future

The five-step energy storage procurement framework by the Global Energy Storage Alliance contains best practices in procurement process crafted by experts at California-based IOUs:

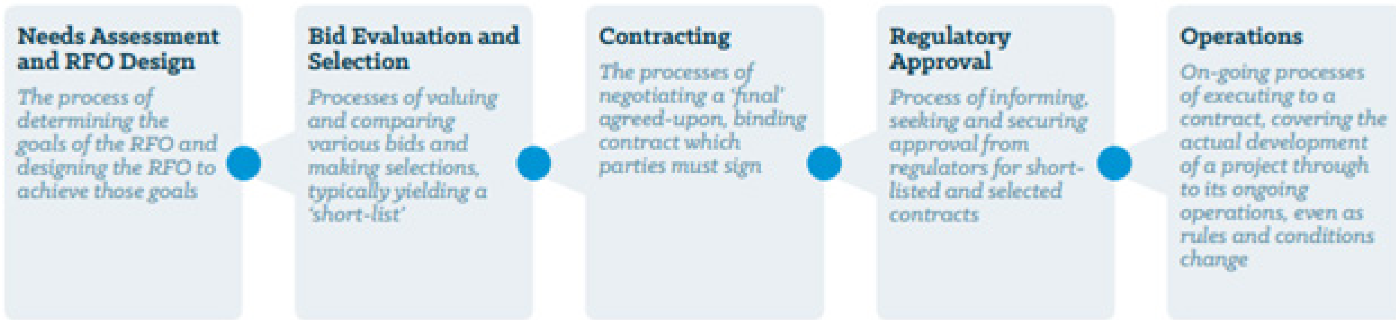


Fig 5: Five-step energy storage procurement framework. Source: GESA

While applying this guidance as the basis for procurement, utility companies must also consider, in detail, the business objectives of the project, local regulations, contracting landscape and operational aspects, and how they apply against each of the above five processes.

Some of the key considerations within these five processes are:

1. Needs assessment and request-for-offer (RFO) design

The RFO design process requires a cross-functional team of experts from planning, transmission and distribution, customer services, and energy operations groups within the utility company. This step defines the goals of the RFO. It also includes RFO design that eventually helps achieve these goals. To deliver a successful RFO, utilities must focus on the following key areas as part of the RFO creation process:

Value assessment of the storage system	Ownership model definition	Requirements definition	Risk management
• Value assessment is important in defining the goals and financial viability of the project. • The utility must design the RFO based on the supply-demand dynamics and fitment of the project considering the requirements that it would serve like real-time, day-ahead markets, ancillary services requirements, etc.	• The utility must consider the ownership model that would be followed for the project in order to manage and deliver the most cost-effective solution. • The utility may consider one or more hybrid models out of the existing models in use like utility-owned projects, independent production model, etc.	• The utility must define certain key requirements as part of the RFO process to be able to design and develop a project that suits its requirements and processes, and ensures adherence to regulatory guidelines. • The key requirements to be defined pertain to: system, site, transmission, validation, cybersecurity and communication, environmental and safety, operations, and maintenance	• Financial risk attached to the viability of the project needs to be closely monitored to avoid major financial losses. • Project schedule and budget control must be kept in check to ensure execution effectiveness. • Compliance and regulatory risks must be defined and addressed to avoid approval delays down-the-line.

Fig 6: Key focus areas for needs assessment and RFO design. Source: Infosys

2. Bid evaluation and selection

In this stage, each bid that is sent in response to the RFAO is evaluated. The bid evaluation team analyzes and reviews the key parameters of the bids against the goals to short-list the best bids.

To ensure that the most cost-effective bid with the best-defined value stream is selected, utility companies should focus on the following parameters and assessments:

Technical assessment

Utilities must assess each bid based on how it fits the project requirements and portfolio planning, as laid out during the RFO process.

The key technical parameters to be assessed are technology, type of storage, size of the system, efficiency, interconnection, transmission capabilities, etc.

Financial assessment

Utilities must also evaluate the bids based on the financial risk associated with the project.

Credit and collateral requirements for both the utility and the bidder must be considered. The energy and capacity payments structure for the project must be vetted. Governmental, environmental, ISO, etc., charges must be clearly assessed.

The financial dispute management process should be defined during this stage.

Major bid assessment considerations

Operations and maintenance assessment

The success of the project depends directly on the ease and cost of operations and maintenance.

To ensure operational success, utilities must assess the bids on parameters such as project start-up cost, variable O&M charges, payment and invoicing process, periodic testing process, metering, scheduling process, outage management, and bidder's maintenance obligations.

Regulatory approvals assessment

It is important to get the required project clearances to avoid schedule delays and budget leakage in the future. These approvals include the bidder's regulatory sign-off, emission regulations, ability to meet compliance requirements, and a plan of action to ensure regulatory approvals during future changes to the project requirements

Fig 7: Key focus areas for evaluation and selection. Source: Infosys

3. Contracting

This stage is about creating a binding agreement that clearly defines the roles and responsibilities and is signed by all the parties involved. Utility companies must consider the following when finalizing agreements with sellers:

- Storage project agreements may be long and complex due to the longer term of the contracts and the regulatory, payment and compliance requirements
- Storage contracts are relatively new and, thus, have not been tested often. Utilities must expect frequent changes to baseline agreements
- Considering the ever-evolving nature of technologies used in energy storage systems, the risk may be significant and will need to be carefully identified and managed
- Contract management requires significant co-ordination among internal and external stakeholders to ensure on-time execution and project success

Here are a few key challenges in energy storage contract management:

Area	Challenges	Addressing the challenges
Revenue stream management	Offtake revenue contracts attached to the sales of products and services from battery storage projects may be different based on where exactly they fit into the scheme of things. This is because front-of-meter contracts (such as tolling agreements, capacity sales agreements and hybrid power purchase agreements) that integrate storage projects with generation facilities are different from behind-the-meter contracts that are primarily designed to support customer load and adhere to utility supply agreements.	• Define a clear ownership and operating model to drive the revenue stream of the projects. • Model must include core requirements like capacity agreements, hybrid agreement, contract for differences, etc., which will decide revenue management.
Flexibility of contracts	As storage contracts are a new concept, the payment formula is not standardized like solar or wind contracts. The different ways in which battery storage can be used adds to the complexity of setting contractual parameters.	• Utilities must be flexible when negotiating the terms and conditions, structure and goals in order to set the right expectations. • Repair and replacement rights for battery storage systems should be liberal in comparison with the conventional agreements due to the changing nature of the technology.
Stakeholder management	Decision-making cycles regarding battery storage may be longer due to the varying laws and rules across different geographies related to actual energy operations. This is compounded by the evolving nature of storage technologies, causing complexity when forming and managing the contracts	All stakeholders must deploy readily available cross-functional groups to facilitate faster decision-making. This includes management of the regulatory approvals as well

4. Regulatory approval

It is important to have a clear understanding of the regulatory processes, which often depend on the area of jurisdiction. This is needed to create a regulatory strategy that is transparent, concise and outcome-driven. Utility companies must chart out a detailed explanation of the application and selection process and how they plan to integrate new and traditional technologies if they want to secure timely regulatory approvals.

5. Contract operations

The successful execution of a contract for a battery storage project depends directly on the effective integration of operational capabilities specific to battery storage contracts with the conventional capabilities. It necessitates smooth coordination among different business groups such as contract origination, contract operations, trading operations, settlements, accounting, risk management, compliance, and regulatory reporting.

A strong technology platform that uses automation can streamline and simplify contract operations for higher efficiency.

Infosys recommendations

Based on our experience, Infosys recommends these best practices, encapsulated in the following contract operations workflow:

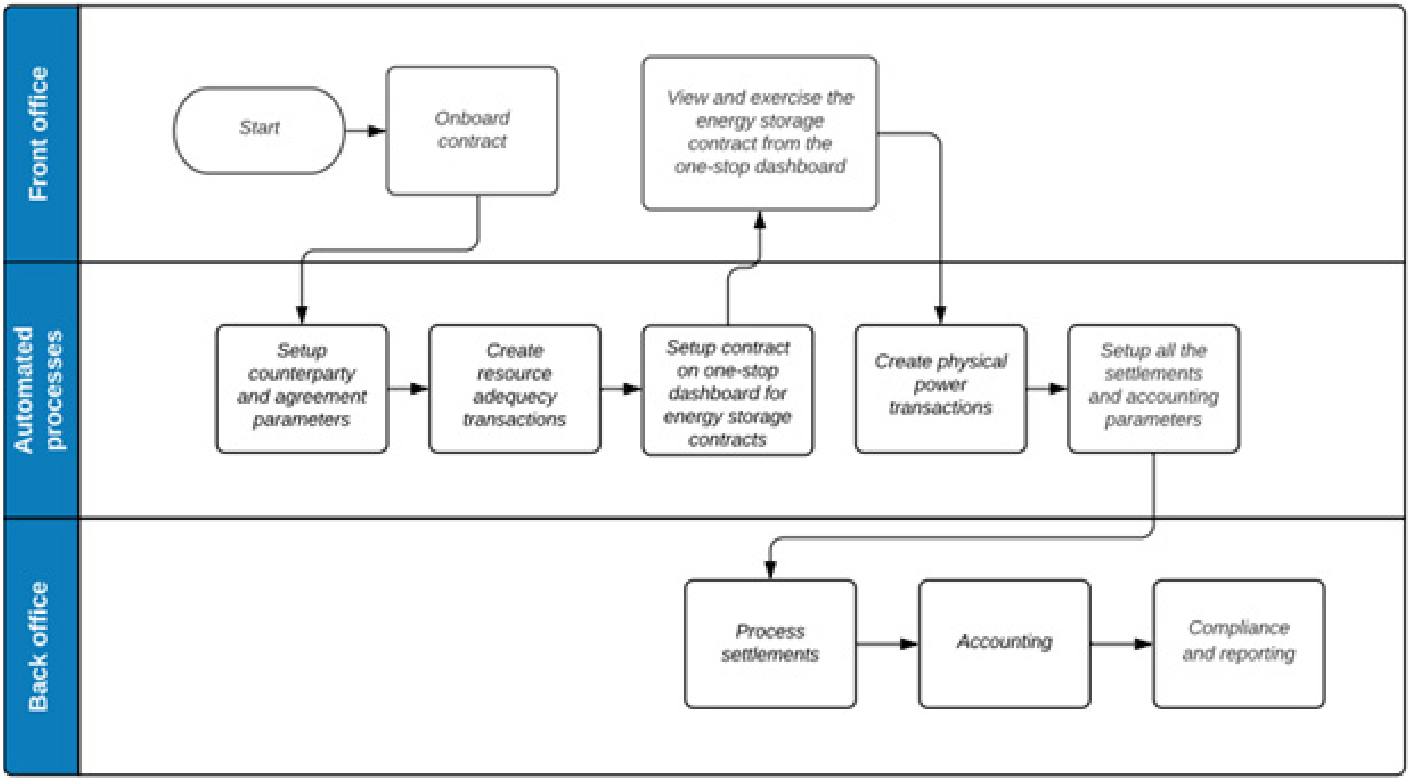


Fig 8: Process flow to manage battery storage contracts. Source: Infosys

Road ahead for energy storage

The declining cost of lithium-ion batteries and rising interest in renewable sources of energy supported by political agreements like the Paris Agreement will drive large-scale adoption of energy storage over the next few decades. Governments across the USA, Europe and Asia are expected to formulate policies that will help remove regulatory barriers, incentivize energy storage projects that reduce carbon emissions and directly contribute to a cleaner and more reliable energy grid. Utilities are expected to invest heavily in energy storage for the foreseeable future. The focus will be on improving the levelized cost of storage (LCOS).

New business models like Energy Storage-as-a-Service (ESaaS) and PV plus storage have the potential to deliver faster business value to utilities with zero or minimal capex requirements. Modern storage contracts will be of shorter duration compared to current long-term ones. They will be operated flexibly and driven by the ESaaS model. Peer-to-peer trading of storage systems is expected to become the new normal. The agility of the operations, processes and systems at utility companies will play a key role in ensuring the success of new energy storage contracts.

Conclusion

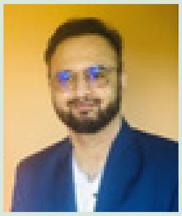
Technology can play an important role in helping energy and utility companies across the world meet their goals of carbon-neutrality and renewable power consumption. Advances in battery storage technologies, systems and solutions are making headway in this sector. Since the power generation, transmission and distribution sector involves many players, it is important to choose the right partner for battery storage project implementations and design comprehensive contracts that assure value. The five-step energy procurement framework by the Global Energy Storage Alliance compiles key best practices for procuring and contracting battery storage equipment. These tie in well with Infosys recommendations for end-to-end automation of contract operations.

About the Authors

Nandakumar Muthukrishnan

Senior Principal – Energy and Utilities Business Consulting

Nandakumar is a Senior Principal and business consulting leader who heads the Infosys Energy and Utilities consulting practice in India. He has over 20 years of experience in the oil and gas and utilities segments as a consultant. He has led large programs and helped business operations drive technology-enabled transformation. Nanda is passionate about articulating and delivering tangible business value from large project investments using the expertise he has gathered over the years in the core business processes of upstream oil and gas and utility industries. With an academic background in electrical and electronics engineering, he is a PMP and Safe Agile certified practitioner.



Manish Mishra

Consultant, Infosys Consulting

Manish is part of the Infosys Consulting in India. He has over 11 years of experience in energy and commodities trading and risk management, customer service, and advanced metering infrastructure and generation. Manish is an integral part of the teams delivering multiple transformation programs for several energy and utilities customers in North America. He is passionate about renewable sources of energy and their larger socio-economic impact.