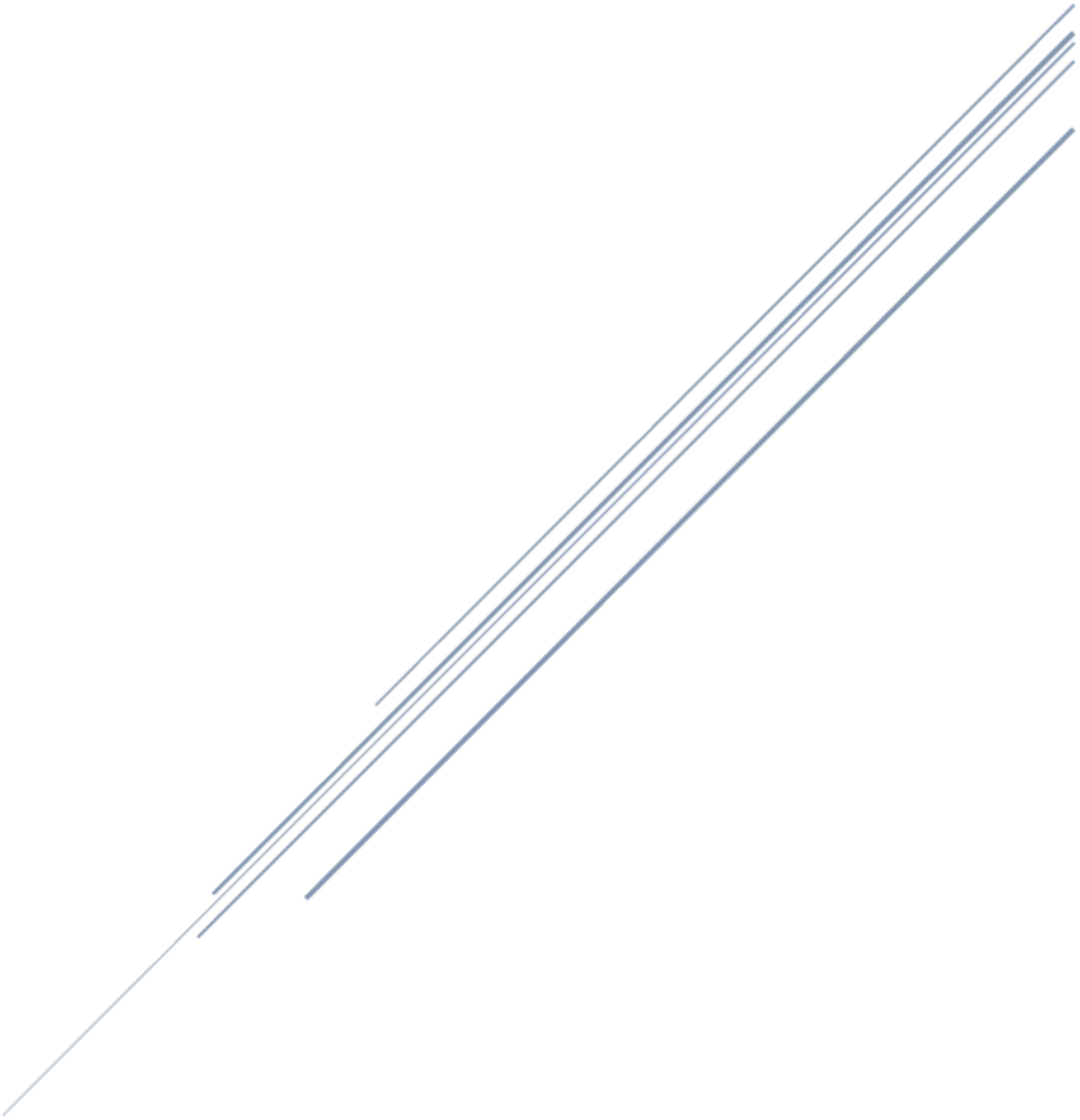
UNDERSTANDING DEMAND FLEXIBILITY

Frequently Asked Questions



MP Ensystems Advisory Pvt Ltd
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MP ENSYSTEMS

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Frequently Asked Questions on Demand Flexibility

Basics of DSM and DF

1. What is Demand Side Management (DSM)?

Ans:

- Demand Side Management (DSM) refers to the planning, implementation, and monitoring of utility programs and strategies aimed at encouraging consumers to modify their electricity usage patterns either by reducing overall consumption or shifting usage from peak to off-peak periods. It focuses on shaving the peak and fill the valley to make the grid more stable.
- The primary goal of DSM is to enhance grid reliability, decongesting grid, reduce energy costs, and improve energy efficiency, all while minimizing the need for additional power generation or transmission infrastructure investments.
- It includes both energy efficiency initiatives and demand response programs that incentivize consumers to change their behaviour in ways that benefit consumers, DISCOMs and the environment.

2. What are some major programs implemented under DSM in India?

Ans:

Some of the key DSM initiatives conducted in India include:

I. **Energy-Efficient Air Conditioner Program:** This initiative focused on replacing old, non-star-rated, and up to 3-star air conditioners with more efficient 5-star-rated models.
II. **Pilot Demand Response Programs**: This program aimed to voluntarily reduce or shift consumers' electricity usage during peak demand periods in response to signals from the utility.
III. **Energy Efficient LED Lighting Scheme (UJALA):** The UJALA scheme promoted the widespread adoption of LED bulbs by replacing traditional lighting, significantly reducing household and commercial energy consumption.
IV. **Agricultural DSM Project:** This program involved replacing conventional agricultural pump sets with energy-efficient pump sets.
V. **Energy Efficient BLDC Fan Scheme:** Replacing conventional ceiling fans with energy-efficient BLDC fans, which consume less electricity.
VI. **Automated Demand Response (ADR) Program:** Automated systems were implemented to enable real-time control and adjustment of consumer loads in response to grid requirements.
VII. **Time of Use (ToU) /Time of Day (ToD) Tariffs:** This program involves reducing the energy demand during peak load times by applying additional tariffs.

These programs have been rolled out in various states and cities, including Maharashtra, Delhi, Gujarat, Karnataka, Haryana and Andhra Pradesh etc.

3. What is Demand Flexibility (DF)?

Ans:

- Demand Flexibility (DF) refers to the ability of electricity consumers to adjust their power usage either by shifting it to different times or reducing it temporarily in response to signals such as grid conditions, price changes, or incentives.
- Unlike general energy efficiency, which permanently reduces energy use, DF focuses on dynamic and real time adjustment of electricity usage, and time-based adjustments that help balance supply and demand, especially during peak periods or when renewable energy generation is high. It is a key tool for enhancing grid reliability, integrating more renewable energy, and optimizing the use of existing power infrastructure.
- This can be defined in various ways and according to the Maharashtra Electricity Regulatory Commission (MERC), Demand flexibility and demand side management regulations, 2024, *Demand Flexibility means the capacity of demand-side loads that can vary their consumption patterns hourly or on another timescale to help integrate higher amounts of renewable energy resulting in making electricity more affordable to consumers with the co-benefits of reducing or deferring system costs or a end-use consumption that can increase or decrease as a demand response measure.*

4. What is the difference between Demand Response (DR) and Demand Flexibility (DF)?

Ans:

- Demand Response (DR) and Demand Flexibility (DF) are closely related concepts, but they differ in scope and application.
- DR typically refers to programs where consumers reduce or shift their electricity usage in response to specific grid signals or incentives, often during peak demand or emergency conditions. It is usually event-based and focused on short-term, immediate grid needs.
- In contrast, DF is a broader concept that includes DR but also encompasses ongoing, routine adjustments to energy use based on price signals, renewable energy availability, or other factors. DF emphasizes a more continuous and proactive approach to managing demand, supporting both grid stability and the integration of renewable energy sources.
- DF mainly aims to improve efficiency and maximize the utilization of renewable or cheaper energy, while DR focuses on maintaining grid stability through quick adjustments in electricity use.
- An important distinction between the two is that DF is consumer centric as it empowers a consumer to manage its consumption pattern while DR is more discom driven, that is, designed, implemented and monitored by utilities.

5. How can DF contribute to India's Net Zero goals or energy transition?

Ans:

- By enabling more efficient use of renewable energy and reducing reliance on fossil fuels.
- As India rapidly expands its solar and wind capacity, DF helps align electricity demand with the variable generation patterns of these sources shifting consumption to times when clean energy is abundant. This reduces curtailment of renewables and minimizes the need for carbon-intensive backup power during peak periods.
- Additionally, by managing peak demand and optimizing grid operations, DF can delay or avoid investments in new fossil fuel-based infrastructure, lowering overall emissions and supporting a more resilient, low-carbon energy system.

DF Program Design and Implementation

6. What are the standard programs that can be taken up by the DISCOM for the DF/DR program?

Ans:

- **Public water Pumping Systems:** This includes systems used by urban local bodies, Municipal corporations, etc. The access water storage capacity can be adjusted to pump water during off-peak or high-renewable generation times.
- **Electric Vehicles (EVs):** With the rapid growth of EVs, especially in urban areas, their charging infrastructure presents a significant opportunity for DF.
- **Thermal Energy Storage**: Systems that store cold for later use (e.g., to reduce AC load during peak hours). This applies to residential, commercial, and industrial sectors.
- **Behind-the-Meter Battery Storage Systems:** Consumers with battery storage can charge when power is cheap and discharge during peak times, offering flexibility.
- **Ancillary Services**: Demand flexibility resources can also be utilized to provide ancillary services to the grid, creating a new revenue stream for discoms and participants.
- **Agricultural Sector:** Programs like the solarization of agricultural feeders could integrate DF for managing irrigation loads.
- **Pumped Storage Hydropower Plant:** During solar hours or off peak demand, the lower electricity cost can be used to pump up the water for storage and use the same to run the hydro power turbine and generate power during non-solar hour.

7. Are there any case studies available for DF programs?

Ans:

- Yes, Tata Power, in collaboration with the Brihanmumbai Municipal Corporation (BMC), implemented a successful DF initiative by shifting the operation of BMC's water pumping station in Bhandup to align with solar power availability.

This program incentivized moving the high electricity demand for water pumping from non-solar to solar periods. A 23-day trial in February 2024 effectively shifted 345 kW of daily demand for three hours, resulting in a total shift of over 23,000 units of electricity and offsetting 21 tonnes of carbon emissions. Expanding this program across Mumbai water pumping stations could achieve a monthly demand shift of approximately 50 MW, amounting to 1.8 million units annually. This case study shows how DF can lead to increased utilization of clean energy sources and environmental benefits.

8. What are some international examples of DF programs, and what economic benefits do they deliver to consumers and utilities?

Ans:

Internationally, successful DF/DR programs have delivered good economic and operational benefits to both utilities and consumers. Two examples are given below:

Program & Location	Consumer Category	Program Type and Technology	Results
Santa Rosa Water DR Program (US)	Water Utility	Demand reduction in water treatment (smart meters, operational flexibility)	Over 2,000 kW (~50%) load reduction, more than $700,000 in incentives since 2009, supports reliable water service without disruption.
Peak Perks program (Canada)	Residential & small business	Smart thermostat control of AC & heat pumps	Up to 187 MW peak reduction (2024), expected 200MW+ in 2025, $75 sign-up plus $20/year incentives, instant or discounted smart thermostats and AC tune-ups for participants.

These programs use smart technologies and operational flexibilities to reduce or shift electricity demand during peak periods. Utilities benefit from lower peak loads, deferred infrastructure investments, and enhanced grid stability, while consumers receive bill savings, supply reliability, and ongoing rewards, all while remaining in control of their comfort and operations.

9. What are the Demand Flexibility Portfolio Obligation (DFPO) targets, and how are they calculated?

Ans:

- DFPO targets are specific percentages of a discom's peak electricity demand that they are obligated to meet through DF programs. it's a mandate for discoms to

encourage and enable consumers to reduce or shift their electricity usage during peak hours.

- The DFPO targets are set as a percentage of the previous year's reported peak demand of the distribution licensee. In simple terms, if the discom's highest recorded electricity demand in a year was 1000 MW. If the DFPO target for the next year is 1.5%, the discom would be obligated to manage 15 MW of that peak demand through demand flexibility programs. This 15 MW can come from various sources.
- According to recent demand flexibility regulations in Maharashtra, the DFPO target for the first year will be 1.5%, and it will go up to 3% by the 5th year.

10. How many states currently have DFPO targets?

Ans:

- As of now, Maharashtra is the only Indian state with formal regulations mandating a Demand Flexibility Portfolio Obligation (DFPO).
- The Maharashtra Electricity Regulatory Commission (MERC) has introduced draft regulations requiring distribution licensees to achieve a specified percentage of their peak demand through demand flexibility programs.
- The DFPO target starts at 1.5% in the first year, increasing to 3.5% by the fifth year, with incentives for exceeding targets and disincentives for underachievement.

11. Will consumers bear the cost of the DFPO targets?

Ans: The policy introduces new obligations for distribution licensees; it does not explicitly state that consumers will bear the costs associated with meeting these targets. DF interventions will work towards reducing the costs for the consumers or have very small impact (approx. 0.005Rs/kWh) on long term costs for the consumers.

12. Are there legal provisions supporting demand flexibility and DFPO targets in India?

Ans: The Electricity Act, 2003, in Sections 23 and 42, authorizes regulators “to maintain an efficient, coordinated, and economical electricity supply,” while Section 61 states that tariffs encourage efficiency and the optimal use of resources. Specifically, Section 61(e) highlights “the principles rewarding efficiency in performance,” and Section 61(h) highlights “the promotion of cogeneration and generation of electricity from renewable sources of energy.”

These sections state that efficient and economical electricity supply and rewarding utilities for good performance in delivering efficient services collectively form a sound basis for states to develop DF regulations. If central entities, such as the CERC and the Forum of Regulators, develop model DF regulations, this would help states adopt the same approaches more easily. Notably, the Maharashtra Electricity Regulatory Commission has

already issued DF regulations as an extension of the existing DSM regulation, aligning with the Act and incorporating new trends in demand-side management.

13. What is the role of load research in DF/DR planning? / Why is load research essential for implementing DF/DR programs?

Ans:

- Comprehensive load research is necessary for DF/DR planning because it helps identify system's load curve, consumer inter-day and intra-day peak, consumer category wise co-incidental and non-coincidental peak to map the flexibility potential of different consumer categories and specific loads at the consumer's end.
- Through detailed analysis, utilities can understand the operational constraints, levels of inconvenience, and the expected incentives required for each consumer group.
- Moreover, load research is important to interpret consumer awareness and their willingness to participate in DF/DR initiatives.
- These insights serve as inputs for DF models, enabling utilities to design scenarios that maximize benefits for both consumers and themselves.
- Without such research, it is challenging to design targeted, efficient, and cost-effective DF/DR programs that achieve good consumer participation and deliver reliable benefits.

14. How will you evaluate the demand flexibility for incentivizing the consumers?

Ans:

- The "X of Y" baseline method is primarily used to evaluate energy reduction or shifts during the DF/DR event.
- Before applying these, it's essential to establish a baseline of the consumer's typical energy usage. This baseline acts as an important reference point, enabling accurate measurement of the reduction or shift achieved during an event.
- Utilities rely on this measurement to provide incentives to consumers and for regulatory filings. Therefore, the correct assessment of how much consumers reduced their usage compared to what they would have consumed without any DF/DR event is necessary.
- Regulatory commissions will approve baseline methods and the actual shift or reduction in consumers' energy demand during an event, ensuring fairness for those receiving incentives. They may also establish guidelines for measurement and verification, and will verify the methodologies established by discoms for assessing these DF/DR events.

15. Does the funding for DF programs fall under Capital Expenditure (CAPEX) or Operational Expenditure (OPEX)?

Ans:

- Funding for DF programs will involve both CAPEX and OPEX. Capex will be incurred for upfront investments in infrastructure like new smart meters, smart plugs, etc., at consumer premises, for certain DF programs.
- OPEX will cover the ongoing costs associated with running the programs. This includes expenses related to: Incentives, Program Management (monitoring and evaluation)

16. Do DISCOMs need to submit a DPR for each DF program if regulations are notified?

Ans: Generally, regulators prefer to receive a comprehensive proposal outlining all the DF programs. This typically includes a total DF target and a portfolio detailing the various DF assets involved.

17. Who are the key stakeholders involved in a Demand Flexibility (DF) program?

Ans:

- **Distribution companies** (DISCOMs), who design and implement the programs
- **Electricity regulators**, who set mandates and approve program structures
- **Consumers** (residential, commercial, and industrial, etc.) who provide the flexible demand.
- **Demand aggregators** or **service providers** help bundle and manage flexible loads (creating and maintaining the DF portfolio), while technology providers supply essential tools like smart meters and control systems.
- **Government agencies** and **policy institutions** offer strategic direction and support, system operators may use DF for grid balancing
- **Financial institutions** or **donors** can fund initial deployments, especially for enabling technologies.

18. What kind of regulatory support is needed for scaling DF programs?

Ans:

- Setting mandatory DF targets (like DFPOs) for discoms, enabling flexible tariff structures and incentive mechanisms for consumers, and allowing cost recovery for investments in enabling technologies such as smart meters and automation.
- Regulators should also establish transparent measurement and verification protocols, facilitate market participation of demand aggregators, and promote integration of DF with renewable energy and grid operations.
- Supportive policies that encourage innovation, consumer engagement, and data privacy protections are equally important to create a conducive environment for widespread adoption and sustained growth of DF programs.
- Regulations notified by State Electricity Regulatory Commission will support the DF programs being legalized to include targets, verifications and other procedural aspects. Regulations directly will not lead to success of the programs.

19. What kind of capacity-building is required for DISCOMs to implement DF programs?

Ans:

- DISCOMs need capacity-building in areas such as advanced data analytics, smart grid technologies, and real-time load management to monitor and control flexible demand accurately.
- Training in designing and managing incentive structures, customer engagement strategies, and contractual frameworks with aggregators is essential.
- Additionally, DISCOMs require skills to navigate regulatory compliance, integrate DF with existing operations, and leverage emerging digital tools for automation and communication.
- Strengthening internal teams with expertise in demand forecasting, program evaluation, and cybersecurity will also be crucial for the successful and scalable deployment of DF initiatives.
- Conducting detailed load research to understand usage patterns and identify target groups for DF programs.
- Broadened the understanding of consumer engagement and behavioral analysis for effective onboarding and participation in the program.

20. How are DF programs monitored and verified (M&V)?

Ans:

- By establishing a baseline of typical energy consumption for participating consumers and then measuring the actual reduction or load shift during DF events.
- This involves using smart meters and advanced data analytics to capture real-time, granular consumption data.
- The 'X of Y' baseline method is commonly applied to ensure accurate and fair measurement by comparing event-period usage against expected usage without the event.
- M&V processes also include auditing, data validation, and reporting to ensure transparency, enable proper incentive distribution, and maintain regulatory compliance.

21. Can DF programs help avoid new generation or grid investment?

Ans: Yes. By encouraging consumers to shift or reduce their electricity usage during high-demand periods, DF alleviates stress on the grid, minimizes the need for costly upgrades to generation plants, transmission lines, and substations, and improves overall system efficiency. This not only lowers capital expenditures for utilities but also supports better integration of renewable energy, ultimately leading to more sustainable and cost-effective grid management.

Consumer Participation and Incentives

22. Who are the aggregators in the DF Program?

Ans: Entities that pool together the flexible demand capacity of multiple consumers residential, commercial, industrial, EV charging stations, Public water works etc., Examples of such aggregators include virtual power plant operators, EV fleet operators, companies managing smart home devices, building management systems, etc. These aggregators act as a single resource to provide load adjustments to the grid or distribution companies. They act as intermediaries between consumers and utilities, using advanced technology and communication systems to coordinate demand response events.

23. What if the aggregator fails to provide the promised flexibility?

Ans: We need to develop a contractual obligation that includes an incentivization/ disincentivizing mechanism.

24. Are consumers penalized if they don't participate or perform as expected in DF/DR programs?

Ans:

- Currently, no. Consumers typically do not face penalties for their non-participation or non-performance in DF/DR programs. These programs are primarily designed to incentivize participation and educate consumers about managing their energy usage.
- However, as the market for demand flexibility matures, there is a future possibility that mechanisms to disincentivize non-performance might be introduced.

25. What types of loads are most suitable for Demand Flexibility programs?

Ans:

- Water pumping systems, electric vehicle charging, thermal energy storage (like cooling or heating systems), behind-the-meter battery storage, industrial processes with flexible timing, and certain agricultural loads such as irrigation pumps.
- Additionally, lighting, HVAC systems, and other controllable appliances in commercial and residential sectors are also good candidates for demand flexibility due to their ability to adjust usage based on grid signals or incentives.

26. What are typical incentives for consumers participating in DF programs?

Ans: Financial rewards such as bill credits, rebates, or direct payments for reducing or shifting their electricity usage during peak periods or renewable hours.

27. How is baseline consumption determined in DF programs?

Ans:

- It is determined by analyzing a consumer's typical energy usage during comparable periods without any demand response events.
- This often involves averaging consumption data from previous days or weeks that match the event day's characteristics such as day of the week, weather conditions, and operational patterns.
- Methods like the 'X of Y' approach select the most representative days to establish a fair and accurate reference, enabling precise measurement of how much energy was reduced or shifted during a DF event compared to what would have been used under normal conditions.

28. Can residential customers also participate in Demand Flexibility programs?

Ans: Yes, they can participate in DF programs by adjusting their usage of appliances like air conditioners, water heaters, electric vehicle chargers, and lighting during peak periods.

29. How can small and medium businesses participate in DF programs?

Ans: By adjusting or shifting non-critical operations, such as running HVAC systems, lighting, refrigeration, or manufacturing processes, during peak demand periods.

Tariffs and Market Signals

30. What is Time-of-Day (ToD) Tariff? How many states have established this tariff?

Ans:

- A Time-of-Day (ToD) tariff is a dynamic electricity pricing system where the cost of electricity varies based on the time it is consumed. The tariff is 10-20% lower than the normal rate, while during peak hours, it is 10-20% higher.
- This structure encourages consumers to shift their electricity usage to off-peak periods, promoting energy efficiency and better alignment with renewable energy generation.
- There is total 29 states/UTs have implemented ToD tariffs in multiple categories. (Key Regulatory Parameters of Power Utilities)

Status of ToD tariff implementation across consumer categories

State	Year	Domestic	LT commercial	LT industrial	LT other	Agricultural	HT commercial	HT and EHT industrial	HT and EHT Others
Andhra Pradesh	2023-24	No	No	No	No	No	Yes	Yes	No
Assam	2023-24	No	No	Yes	No	No	No	Yes	Yes
Bihar	2023-24	No	No	Yes	No	No	Yes	Yes	Yes
Chandigarh	2023-24	Yes	No	No	No	No	Yes	Yes	Yes
Chhattisgarh	2023-24	No	No	No	No	No	No	Yes	No
Daman & Diu	2022-23	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Delhi	2021-22	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Goa	2023-24	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Gujarat	2023-24	No	No	No	Yes	No	Yes	Yes	Yes
Haryana	2023-24	No	No	No	Yes	No	No	Yes	Yes
Himachal Pradesh	2023-24	No	No	Yes	No	Yes	No	Yes	No
Jammu &Kashmir and Ladakh	2022-23	No	No	No	No	No	No	Yes	Yes
Jharkhand	2020-21	No	No	No	Yes	No	Yes	Yes	No
Karnataka	2022-23	No	No	Yes		No	Yes	Yes	Yes
Kerala	2022-23	Yes	No	Yes	No	No	No	No	Yes
Madhya Pradesh	2023-24	No	No	No	No	No	Yes	Yes	Yes
Maharashtra	2023-24	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Meghalaya	2022-23	No	No	No	No	No	No	Yes	No
Nagaland	2022-23	No	No	No	No	No	No	No	No
Odisha	2022-23	No	No	Yes	Yes	Yes	No	Yes	Yes
Puducherry	2023-24	No	No	No	No	No	No	Yes	No
Punjab	2022-23	No	Yes	No	No	No	No	Yes	Yes
Rajasthan	2023-24	No	No	No	Yes	No	No	Yes	Yes
Tamil Nadu	2022-23	No	No	Yes	Yes	No	No	Yes	No
Telangana	2023-24	No	No	No	No	No	Yes	Yes	Yes
Tripura	2022-23	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Uttar Pradesh	2022-23	No	No	Yes	Yes	No	No	Yes	No
Uttarakhand	2023-24	No	Yes	Yes	No	No	No	Yes	No
West Bengal	2022-23	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

LT: Low tension; HT: High tension

Source: REC's report on Key Regulatory Parameters for Power Utilities, March 2023

31. If ToD tariffs already exist for industrial and commercial consumers, what is the purpose of Demand Flexibility?

Ans:

- While TOD tariffs encourage load shifting through price signals, DF/DR are designed for extreme grid conditions, specifically targeting the highest 1% of the year's peak load, approximately for 100 hours annually, and are incentivized separately from the existing TOD tariff structure.
- This ensures the grid has additional flexibility when it's most needed, beyond what standard TOD pricing can achieve.

32. Why aren't consumers shifting their load, even with existing ToD tariffs?

Ans:

- Consumers often don't shift load under standard TOD tariffs because of the operational constraints or perceived inconvenience. However, for just 15 to 20 critical events a year, consumers face no harm in shifting their load.
- If these specific events are incentivized, even considering operational constraints, participation can be attractive and beneficial for both consumers and the grid.

33. What role do tariffs play in enabling DF programs beyond ToD?

Ans:

- Electricity tariffs play a critical role in enabling DF programs by providing targeted price signals that encourage consumers to adjust their usage patterns in response to grid needs.
- Dynamic tariffs like real-time pricing, critical peak pricing, and demand charges can incentivize consumers to reduce or shift demand during high-stress periods or when renewable generation is low.
- Special incentive tariffs for participating in DF events, or reduced rates during high renewable availability, can further align consumer behaviour with grid efficiency goals.
- Tariffs also support the financial viability of DF by allowing cost recovery for enabling technologies and program administration, making them essential tools for scaling DF initiatives.

Technology, Data, and Infrastructure

34. How crucial are smart meters for DF programs, and who will handle their installation?

Ans:

- It is important for providing real-time, granular data on energy consumption. It's not possible to measure how much a consumer reduces or shifts their usage during a DF event, which is crucial for providing incentives and for regulatory compliance.
- Regarding installation, it can work in both ways:
    - Discoms are investing in smart meter rollout as part of national initiatives like the Revamped Distribution Sector Scheme (RDSS), viewing smart meters as key to reducing losses and improving operational efficiency.
    - Demand flexibility aggregators, who manage portfolios of consumer loads, might also install smart sub-meters at the appliance level, especially for specific DF programs.
- While installation incurs costs, these are typically considered program costs and can be recovered through the regulatory process.

35. Are there privacy or data-sharing concerns in DF programs?

Ans:

- Yes, as these programs rely on detailed, real-time energy consumption data from consumers. This raises concerns about how data is collected, who has access to it, how it is used, and how securely it is stored. Consumers may worry about unauthorized access, misuse of personal information, or surveillance.
- To address these concerns, DF programs must implement strong data protection measures, follow clear consent-based data-sharing protocols, and comply with relevant privacy regulations. Transparent communication and trust-building are key to ensuring consumer participation and the long-term success of DF initiatives.

36. What kind of communication infrastructure is needed for DF programs?

Ans:

- **Advanced Metering Infrastructure** (AMI) such as smart meters that can record and transmit consumption data at granular intervals, and two-way communication systems that allow utilities to send signals and receive responses from end-user devices.
- **Internet of Things** (IoT) platforms, **cloud-based analytics**, and **secure data management systems** are also essential for monitoring, control, and verification.
- Additionally, strong **cybersecurity protocols** must be in place to protect data integrity and user privacy across all communication layers.

37. What kind of digital tools or platforms are needed to implement DF programs effectively?

Ans:

- **Advanced Metering Infrastructure (AMI)** for collecting real-time consumption data, **Energy Management Systems (EMS)** for monitoring and optimizing loads, and **Demand Response Management Systems (DRMS)** to coordinate, dispatch, and verify flexibility events.
- **Consumer engagement platforms (**like mobile apps or web portals) are also essential for enrolling users, sending notifications, and tracking performance.
- Additionally, **data analytics platforms** help forecast demand patterns and identify flexibility potential, while **IoT-enabled devices** like smart plugs, thermostats, or automated controls enable remote management of loads.
- All these tools must integrate securely and seamlessly for efficient program execution.

As this market is growing, and DF/DR services will be provided through a unified national platform where aggregators and utilities can trade their DF assets, it will require a data management system, real-time transactions capabilities, and a robust communication protocol to serve multiple stakeholders at the same time.

Regulatory & Financial Concerns

38. How can we justify the cost of an AC Demand Response program to regulators if its immediate benefits seem lower than the expenses?

Ans:

- While the initial, short-term benefits from an AC DR program might appear lower than its capital costs, the justification lies in adopting a longer-term Net Present Value (NPV) perspective. When evaluating the program over an extended period, the benefits will increase. The devices (like smart thermostats or smart plugs) remain installed at consumer premises, continuing to provide flexibility year after year.
- Also, it's essential to include the avoided costs related to distribution infrastructure deferral (deferral costs).

39. How can utilities manage the impact of demand response programs on existing long-term power purchase agreements (PPAs)?

Ans:

- To address the impact of demand response on existing long-term power purchase agreements, utilities should begin by reviewing contract terms for flexibility, such as take-or-pay provisions or change-in-law clauses. Where possible, they can renegotiate terms to reduce fixed obligations or introduce more flexible delivery structures.
- Additionally, excess contracted energy can be absorbed through energy storage or sold in spot markets, while DR can generate offsetting revenue through participation in ancillary or capacity markets.
- Operational strategies can align DR events with PPA delivery periods to minimize mismatch, and regulatory engagement may open pathways for cost recovery or contract amendments.
- Together, these approaches help mitigate the financial and operational risks of over-procurement caused by DR-induced demand reductions.

40. What is the financial risk to DISCOMs if DF targets are missed or under-delivered?

Ans:

- These may include regulatory penalties or disallowance of cost recovery, especially in states like Maharashtra where DF targets are mandated under the DFPO framework.
- Failure to meet targets can also result in higher peak power procurement costs, as DISCOMs may need to buy expensive power from short-term markets or rely more heavily on fossil-fuel-based generation.

- Additionally, missing DF targets could lead to delayed infrastructure savings, such as postponing upgrades to substations or transmission lines, thereby increasing long-term capital expenditures. It may also affect revenue stability if consumer trust or participation in future programs declines.