

# SARAL 2.0: State Rooftop Solar Attractiveness Index

(for the financial year 2019-20)



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## Foreword

India's solar energy market has seen significant growth after 2014, when the Government of India announced enhancement of target under National Solar Mission to achieve 175 GW of renewable power by 2022. Since then, implementation of solar photovoltaic projects has seen a substantial growth. Solar installations will continue to grow, with rooftop solar playing a prominent role in meeting energy demands across consumer segments.

Rooftop solar PV has already achieved grid parity for commercial and industrial consumers and is fast becoming attractive for residential consumers as well. Many State Governments have taken necessary steps to kick-start implementation of rooftop solar PV projects. The Government of India is supporting the States in their endeavor through solar rooftop programme.

It is important to develop an ecosystem that ensures information symmetry, access to financing and clear market signals. Thus, the Ministry of New and Renewable Energy (MNRE) has developed a uniform platform – **State Rooftop Solar Attractiveness Index (SARAL)** – that provides insights on States' solar rooftop attractiveness based on various policy, market and technical parameters. The Index will act as a tool to highlight best practices adopted by States, common challenges and possible solutions, areas of improvement, identify investment opportunities, and induce a spirit of healthy competition among the States. The Ministry of New and Renewable Energy is committed to facilitating knowledge-exchange and easing the challenges that States face.

I congratulate MNRE and their partners for conducting this exercise and developing this comprehensive Index. I am sure that the Index will get strengthened year-on-year, and will be instrumental in advancing the growth of the rooftop sector.

  
( R. K. Singh )



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## Preface

Ministry of New and renewable Energy (MNRE) has launched National Solar Mission which aims at development and deployment of solar energy technologies in the country. Out of the cumulative target of 100 GW, 40 GW capacity has to be achieved in rooftop solar sector.

However, we recognize that the rooftop sector has faced challenges because of which it has not taken up as swiftly as the utility-scale solar sector. To accelerate deployment, consumers can be made aware of the technology and actual economic benefits that can accrue. Appropriate models can be developed that do not require the consumers, particularly institutional and domestic, to invest upfront. State-level policies, regulations and procedures for permissions and installations can be made simple. Some States have taken excellent measures to fast-track deployment. Single window mechanism has been introduced. Online information portals have been developed. Regulatory improvements have been made. Over the last one-year, significant developments in business models and consumer interfaces have taken place.

**The State Rooftop Solar Attractiveness Index – SARAL** – has been developed to evaluate Indian States based on their attractiveness for rooftop solar deployment. SARAL is the first of its kind index to produce a comprehensive overview of state-level measures adopted to facilitate rooftop solar deployment. It accounts for parameters across the rooftop solar value chain such that it is applicable to a broad range of stakeholders, including State Governments, project developers and investors.

SARAL is a step towards identifying drivers for rooftop solar uptake and consequently, sourcing relevant data to measure and evaluate them. It currently captures five key aspects (i) robustness of policy framework (ii) implementation environment (iii) investment climate (iv) consumer experience (v) business ecosystem. Each of these are represented through a set of parameters and scoring indicators. SARAL encourages each State to assess the initiatives taken so far, and what it can do to improve its solar rooftop ecosystem. As a result, it can help channelize investments into States and interventions that can eventually help the sector grow.

I extend my appreciation for our partners who supported the development of SARAL – Shakti Sustainable Energy Foundation and Associated Chambers of Commerce and Industry of India (ASSOCHAM). We would also like to thank NITI Aayog for providing valuable inputs. We are grateful to representatives from States, solar rooftop industry, and experts on the project steering committee for providing timely and relevant feedback.

The Ministry of New and Renewable Energy (MNRE) is keen to promote the sector and is willing to facilitate knowledge exchange between state nodal agencies and state distribution utilities to accelerate deployment of rooftop PV systems.

Moving forward, we hope that future iterations of SARAL will continue to provide insights to rooftop solar stakeholders, helping us surpass our targets.

  
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# Acknowledgement

The transition towards solar as a source of energy has become one of the major initiatives undertaken by the Government of India (GoI). The “SARAL - State Rooftop Solar Attractiveness Index” has been designed collaboratively by the Ministry of New and Renewable Energy (MNRE), Shakti Sustainable Energy Foundation (SSEF), Associated Chambers of Commerce and Industry of India (ASSOCHAM) and Ernst & Young (EY).

Along the tenure of the initiative, the team has received significant guidance and inputs from important stakeholders. We are grateful to Shri R.K. Singh (Hon'ble Minister of State for Ministry of Power and Ministry of New & Renewable Energy (Independent Charge)) for his invaluable inputs and motivation to the team. We sincerely express our gratitude to Shri Anand Kumar (Secretary, MNRE) and Shri Praveen Kumar (Additional Secretary, MNRE) for constantly guiding the exercise and supporting the team at all stages. We sincerely thank Shri Aujender Singh (Deputy Secretary, MNRE), Shri Hiren Borah (Scientist C, MNRE) for providing pertinent inputs for the development of the Index.

In addition, we would like to express our deepest gratitude to Shri R P Gupta (Additional Secretary, NITI Aayog) and his entire team for their closely reviewing the index and providing extensive inputs for improvements. Also, we are grateful to the project steering committee members for regularly informing index design, development methodology, and outreach strategies. We are extremely thankful to all stakeholders who participated in regional workshops in Bengaluru, Kolkata and New Delhi, and to all state government officials who took time to respond to the team's questionnaires and provide valuable feedback that helped shape the SARAL model and finalize the weightages for the parameters.

Finally, we would like to thank all the members of the team who were involved in the development process at various stages of the initiative. We would particularly like to acknowledge the contribution of Mr. Deepak Gupta (formerly, Head - Power Programme, SSEF) who played a key role in designing and guiding the exercise.



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# Glossary

Abbreviations	Full forms
AMR	automatic meter reading
AT&C	aggregate transmission and commercial
C&I	commercial and industrial
CAGR	compound annual growth rate
CEA	Central Electricity Authority
COVID-19	Coronavirus disease of 2019
DISCOM	distribution company
DT	distribution transformer
EODB	ease of doing business
EPC	engineering, procurement and construction
EV	electric vehicle
Goi	Government of India
GNCTD	Government of National Capital Territory of Delhi
GSDP	Gross State Domestic Product
GW	gigawatts
MDA	multilateral development agency
MNRE	Ministry of New and Renewable Energy
MSME	Micro, Small and Medium Enterprises
NBFCs	Non-Banking Financial Companies
NCAER	National Council of Applied Economic Research
NREDCAP	New and Renewable Energy Development Corporation of Andhra Pradesh Ltd.
O&M	operations and maintenance
PAC	Public Affairs Centre
PAI	Public Affairs Index
PM	particulate matter
PPA	Power Purchase Agreement
RECAI	Renewable Energy Country Attractiveness Index
ROI	return on investment
RPO	renewable purchase obligation
RTS	rooftop solar
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SC	steering committee
SDG	Sustainable Development Goals
SI	scoring indicator
SNA	state nodal agency
T&D	transmission and distribution
UDAY	Ujwal DISCOM Assurance Yojana
UT	union territory
UWP	unified web portal





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# Executive summary

India has adopted renewable energy as the way to a future, where it is self reliant for its burgeoning energy requirements and at the same time, steps out of the current quagmire of huge outlays on fuel imports. India's crude oil import bill stood at a massive US\$102 billion<sup>1</sup> in 2019-20. This drive for meeting multiple important goals has been aided in a big way specifically by the leadership stance of the Indian Government in the solar sector. This has led to the installation of 37 GW of solar capacity, including ~6 GW of rooftop solar. This has been made possible by the Government of India (GoI) striving to support the rapid scale up of solar through several initiatives such as policy advocacy, financial assistance schemes and regulatory interventions. However, the rooftop solar sector has not yet found its feet with respect to its inherent potential.

Some states have taken the lead in promoting rooftop solar by putting in place adequate support for key stakeholders involved in the process. However, other states have not been able to match pace with the leaders due to various reasons. Based on states' stakeholders' readiness, availability of natural resources and state governments' approach towards rooftop solar, the proliferation has been non-uniform across the states. It is believed that a platform for benchmarking against the best and knowledge and experience sharing is imperative to improve the overall rooftop solar ecosystem in the country. This will go a long way in helping the nation gallop towards the 40 GW target set by the Ministry of New and Renewable Energy (MNRE) by 2022.

With this background, the idea of introducing a platform for knowledge-sharing and inducing healthy competition in rooftop solar segment among Indian states was envisioned. Thus, the MNRE and its partners decided to introduce a measuring scale or an index that can evaluate and rank all states according to their performance, growth, level of maturity, policy framework and implementation environment in the rooftop solar sector. As a result, the SARAL index was launched in 2019. This platform depicted the most attractive states, best practices and positive developments, while highlighting key improvement areas across policy development and implementation, consumer involvement and investment ecosystem.

Based on the conversations generated post SARAL and the feedback received from stakeholders, a successor to SARAL has been conceptualized. The same has been christened as SARAL 2.0. This version builds on the foundation already set by the preliminary version, so that a more updated picture of the sector is portrayed through updation of data, addition of new parameters and fresh insights from stakeholders. It is hoped that SARAL 2.0 will empower state government entities as well as investors with evidence to make informed decisions.

To comprehensively and realistically assess the performance of rooftop solar sector in all states, five broad buckets have been identified in both the versions of the index after extensive stakeholder consultation. These buckets are:

- ▶ Comprehensiveness/robustness of policy and regulatory framework
- ▶ Ease of implementation/effectiveness of policy support
- ▶ Investment climate for the rooftop solar sector
- ▶ Consumer experience
- ▶ Business ecosystem

Multiple parameters and sub-parameters have also been identified to quantify the buckets, for which data points have been captured through primary and secondary researches and subsequently mapped to a numeric scale. Finally, each score has been scaled based on the assigned weightages and an aggregate score has been computed. Based on the states' scores, grades have been assigned on the following scales: A++, A+, A, B++, B+ and B. The exercise has been completed with the help of extensive stakeholder support from almost all the states and guidance from experts in the sector.

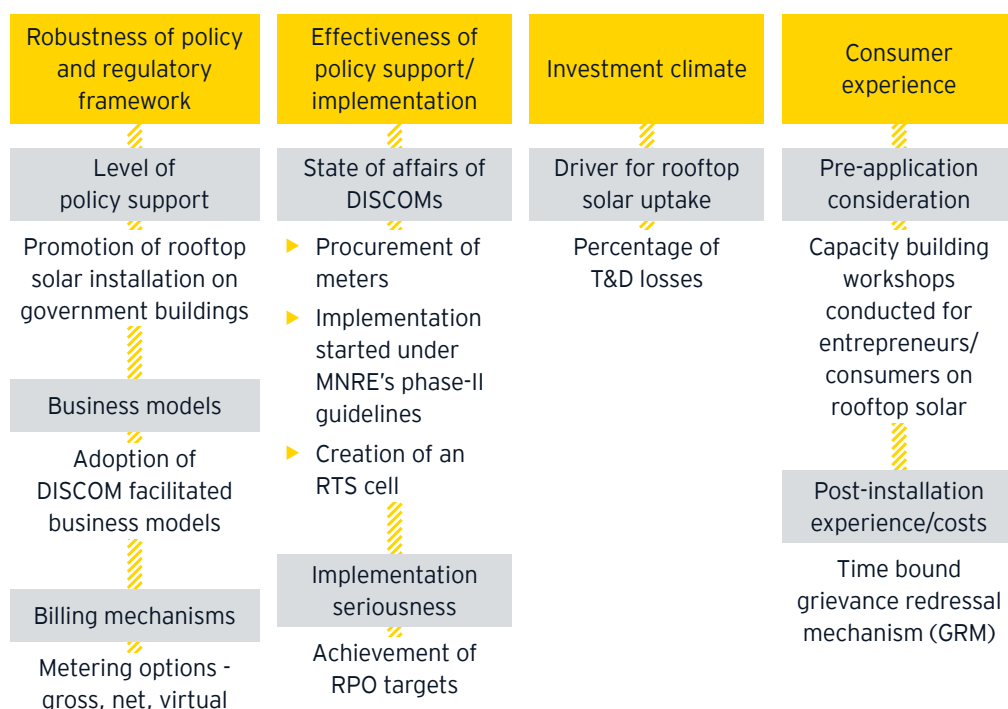
1 <https://economictimes.indiatimes.com/news/economy/foreign-trade/indias-crude-oil-import-bill-fell-9-to-102-billion-in-2019-20/articleshow/75473757.cms>



A three-tier stakeholder consultation mechanism comprising of a steering committee, regional workshops and state consultations was instituted during the preparation to gather inputs and test parameters that are being considered so that the final rankings could be as comprehensive as possible. The final weightages and parameters were arrived at by considering the inputs from the aforementioned stakeholders.

The changing circumstances after the release of SARAL have mandated that the parameters, used under the preliminary version, be revisited and fresh parameters which are more reflective of the current ecosystem be added.

**Figure 1: New scoring indicators under SARAL 2.0**



Source: EY analysis

The objective of the exercise is to use the findings and insights to reach out to as many stakeholders as possible so that the benefits accrued can help the sector. Apart from the release of a final report, the findings will be portrayed in the form of a web-based dashboard so that they can be accessed by any stakeholder to benchmark the states on their rooftop solar performance.

Based on the states' scores, six grades have been assigned, namely, A++, A+, A, B++, B+ and B. These grades are derived after using a combination of qualitative and quantitative methods. The top performing states are given A++ and A+ grades. The comprehensive list of state rankings and their comparison with SARAL rankings are provided in the body and annexure of the report.

**Table 1: Top 10 ranked states under SARAL 2.0**

Ranking	State	Grade
1	Gujarat	A++
2	Delhi	A++
3	Telangana	A++
4	Karnataka	A++
5	Madhya Pradesh	A+
6	Punjab	A+
7	Kerala	A+
8	Rajasthan	A+
9	Haryana	A+
10	Maharashtra	A+

1





Introduction to

# SARAL 2.0



## Context

India has assumed a leadership role in renewable sector, especially in solar energy, evidenced by the leading role it is playing among the International Solar Alliance (ISA) nations. Fuelled by its rapid progress towards being a developed nation, it has had to depend on imports to meet its burgeoning energy requirements, thereby clocking up crude oil import bills of US\$101.4 billion<sup>2</sup> in FY 2019-20. This has been the case even though India is blessed with about 5,000 trillion<sup>3</sup> kWh of incident solar energy per year over its land area. But with a keen focus on utilizing this unexplored potential, the country has set a highly ambitious target of 100 GW solar installations to be achieved by 2022, of which 60 GW is planned from utility scale installations and 40 GW from rooftop solar. This target has driven the market, leading to close to 37 GW<sup>4</sup> of solar installations as of September 2020.

However, the rooftop solar sector is still finding its feet. Installations in this segment stand at about 5.9 GW<sup>5</sup>, which tells its own story. Nevertheless, there have been numerous initiatives recently to kickstart the sector. One of the most notable ones being the MNRE's Rooftop Solar Phase-II scheme. Since its inception, some states have taken the leading role in adopting them and have charted a path to be emulated by other states. The progress of rooftop solar in states has not been equitable. This can be attributed to a host of factors including the geographical location of the state (irradiation), overall business ecosystem in the state, policy interventions, institutional strength etc. When states are measured against such factors on a single platform, they draw up interesting insights which can help states in improving themselves in the rooftop solar drive.

### Need for SARAL

Considering the vast potential of solar energy available on Indian rooftops, rooftop solar offers vast opportunities for states in taking it up and developing their existing infrastructure, thereby opening up new avenues of employment and adopting a greener future. However, there are variances observed in the existing conditions and intent of promotion in various states. Every state has different rooftop solar policies, incentives, metering regulations and rooftop availability. Electricity tariffs, consumer mix and robustness of distribution infrastructure also vary across states. The best practices in regulations, strong monitoring and enforcement mechanisms, new institutional structures, promotion of innovative discom-centric business models, and adoption of strategies to spread awareness among consumers and other actors along the value chain from the high performing states need to be emulated by other states to enable the nation to move towards its immediate goal of achieving 40GW rooftop solar by 2022. Therefore, a standardized tool that can assess and evaluate various states for their preparedness to support rooftop solar deployment is very essential.

<sup>2</sup> <https://www.livemint.com/industry/energy/india-s-crude-oil-import-bill-fell-by-10-in-fy20-11590738102783.html>

<sup>3</sup> <https://mnre.gov.in/solar/current-status/#:~:text=India%20is%20endowed%20with%20vast,m%20per%20day.&text=Further%2C%20solar%20energy%20sector%20in,generation%20capacity%20over%20the%20years.>

<sup>4</sup> <https://mercomindia.com/solar-share-in-india/>

<sup>5</sup> <https://bridgetoindia.com/backend/wp-content/uploads/2020/09/BRIDGE-TO-INDIA-India-solar-rooftop-map-June-2020.pdf>



# Stakeholder takeaways from SARAL and benefits to be accrued from SARAL 2.0

Post release of SARAL, a few stakeholders have tried to understand the background behind the rankings and the constructive steps that need to be taken by them to portray themselves better in future rankings.

The SARAL 2.0 rankings offer stakeholders a platform to gauge the performance trends of states and draw insights that can help improve themselves (in case of state government bodies) or to take more informed decisions about investments (in case of businesses).

## Takeaways from SARAL

### Governments

- ▶ Benchmarked performance of states in regulatory and ease of setting up roof top solar projects
- ▶ Identified areas of improvement by studying the areas of excellence of counterparts

### Businesses

- ▶ Identified states which can yield better returns on investment in solar rooftop

## Potential benefits from SARAL 2.0

### Governments

- ▶ Understanding of whether constructive steps taken during the period have shown any marked improvement in the rankings
- ▶ Awareness about any new initiatives taken by states which have led to improved standings

### Businesses

- ▶ Can take guidance on identifying states for potential investment which have shown progressive trends
- ▶ Can understand the direction that already invested states are moving





2



Approach and methodology for

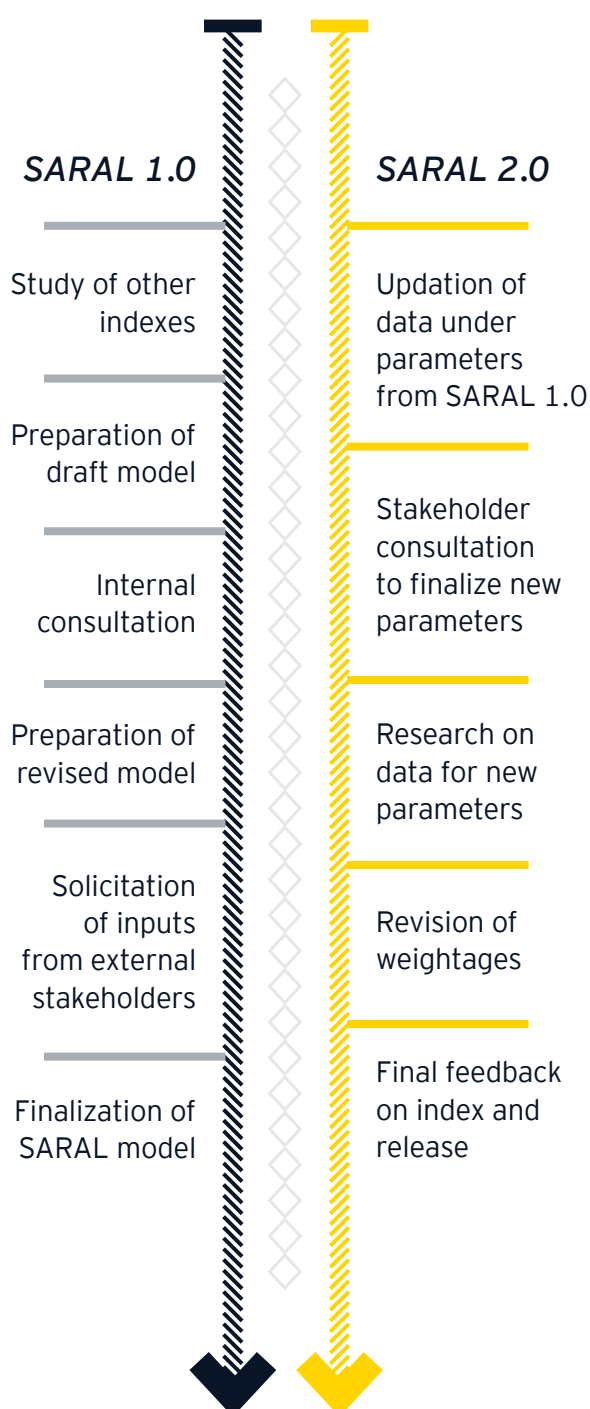
# **developing SARAL 2.0**



# Evolution of SARAL

An index is an analytical tool that gives the stakeholders insight into the relative position of the subjects, scaled using appropriate parameters. It becomes a yardstick against which progress can be measured.

**Figure 2: Evolution of SARAL index**



There are a number of indices that have gained importance over the years. These indices underpin policy developments and help measure the impact of policy changes in different technical fields. International indices such as the World Bank's Ease of Doing Business, World Economic Forum's Inclusive Development Index and Human Development Index of United Nations Development Program are widely respected and give countries clear indicators of progress. In India, the central and state governments are adopting indices as a tool for evaluation in various sectors. Some of these are the Health Index, Liveability Index, Start-up Ranking Framework and Swachh Bharat Index.

Some indices specific to the renewable energy segment are the Renewable Energy Country Attractiveness Index, (RECAI), the United States Renewable Energy Attractiveness Index, and the Solar Power Rocks' United States Solar Power Ranking.

SARAL 2.0 has been developed to evaluate Indian states on different parameters based on their attractiveness for the solar rooftop market. The tool encompasses a host of parameters that define solar rooftop market landscape. It assigns a grade to each state based on the overall performance of that state. It also provides insights on strengths of states vis-à-vis other states.

SARAL 2.0 builds on the work done under SARAL and tries to present a comprehensive picture of developments that have taken place post release of SARAL. It also retains all the significant aspects that are a part of the first version. Significant developments such as announcement of the MNRE's Rooftop Solar Phase-II scheme and developments resulting from it such as utilities being placed at the forefront of the ecosystem, utilities adopting innovative business models and regressive actions in many states with respect to the rooftop solar market have been reflected in SARAL 2.0.

A comprehensive list of parameters has been drawn up after multiple brainstorming sessions and stakeholder consultations. The data used in the index has been sourced from:

1. Publicly-available documents and databases
2. Interactions with multiple stakeholders in states in case where data was not available from secondary research

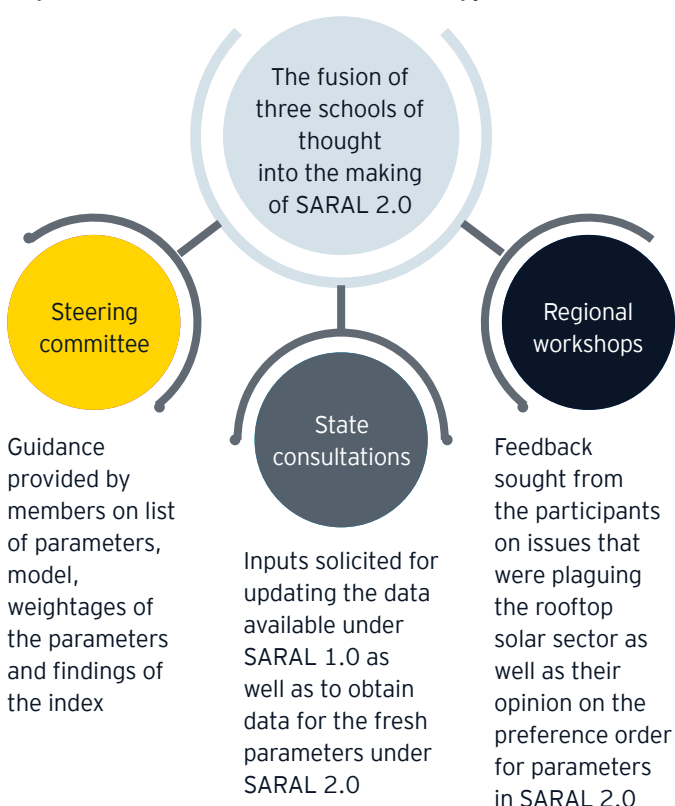
Any resulting subjectivity has been attempted to be minimized through the scoring methodology.



## Final model

In order to realize the intended benefits of the index, the visibility and the acceptance of the index amongst various stakeholders is of utmost importance. For this, the SARAL team solicited inputs and feedback on the model from the steering committee, a sounding board comprising of sector experts, to ensure that the index is reflective of real considerations. The perspectives and views expressed during the state consultations and regional workshops were also kept in mind while refining the model. The final model has been arrived at after multiple iterations. Details such as scoring methodology for arriving at the final scores have been detailed out in Annexure III of this report.

**Figure 3: Model refinement methodology**

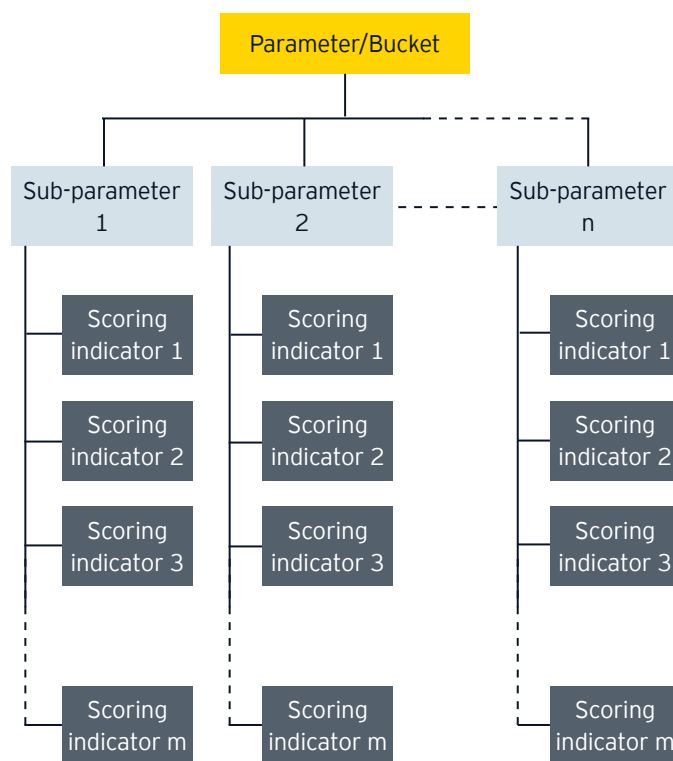


Source: EY analysis

The discussions with the steering committee brought in various relevant insights. The steering committee was of the view that the index should not be lop-sided towards a particular sector/segment. Towards this end, the index has been built in a way to be reflective of developments in different sectors. Scoring indicators related to aspects such as 'DISCOM T&D losses' and 'payment security mechanism' were deliberated upon at length by the members of the committee. For instance, prior to discussions, DISCOM AT&C losses were being considered as a driver for rooftop solar in place of T&D losses. Members were appreciative of the fact that the index reflected major developments after release of SARAL and opined that policy headwinds still have a major effect on the Indian rooftop solar ecosystem. These discussions helped in refining the model.

The model consists of buckets, sub parameters and scoring indicators. The final version of the model consists of five buckets with 14 sub-parameters and 33 scoring indicators.

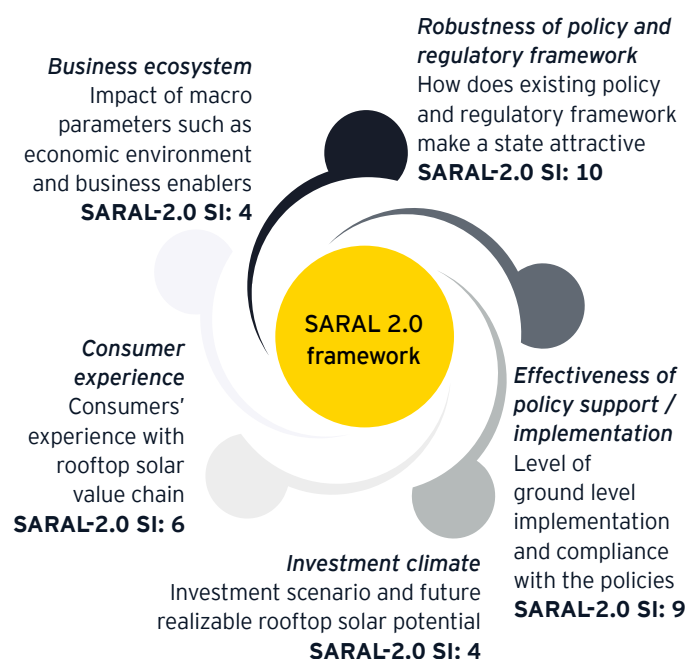
**Figure 4: Concept of buckets, sub-parameters and scoring indicators**



Source: EY analysis

All the scoring indicators that have gone into rating the performance of states come under five well-deliberated buckets which cover policy side interventions, ground-level implementation, consumer side perspective as well as the business ecosystem and investment climate in a state.

**Figure 5: Buckets in the SARAL 2.0 model**



Source: EY analysis

## Robustness of policy framework

*How supportive is the existing policy and regulatory framework for rooftop solar deployment?*

The policy framework of a state determines the state's regulations. It also governs routes available to prospective prosumers for setting up a rooftop solar system and financial incentives and non-monetary support available to them.

Sub-parameters covered under robustness of policy framework:

- ▶ **The level of policy support** encompasses a complete set of aid extended to prosumers for setting up of rooftop solar systems.
- ▶ **Policy covenants** refer to the support offered or limitations imposed by the regulatory authority on prosumers for installing a rooftop solar system.
- ▶ **Business models** refer to innovative utility-centric business models that DISCOMs have been mandated to adopt as part of change in approach under the MNRE Rooftop Solar Phase-II scheme.
- ▶ **Billing mechanism** plays a crucial role in making rooftop solar attractive for consumers or prosumers.

## Effectiveness of policy support/policy implementation

*What has been the ground-level implementation and compliance with policies?*

The effectiveness of policy support/implementation highlights how the policy framework actually translates into uptake of rooftop solar systems, making them more accessible to the end-users. It also takes into account how dynamic and relevant the framework of the policy is to confirm its effectiveness throughout the tenure of the policy.

Sub-parameters covered under effectiveness of policy support/implementation:

- ▶ **Ease of application**, as the name suggests, captures the ease with which any prospective consumer can get authentic information and can apply the same for setting up a rooftop solar system. It also includes the time taken from application to installation of rooftop solar systems.
- ▶ DISCOMs are now at the heart of adoption of utility-centric business models and demand aggregation through floating of tenders under the MNRE phase-II scheme. These functions are in addition to already existing functions for DISCOMs such as timely procurement of net meters. Therefore, the **state of affairs of the DISCOMs** is a good reflection of how policy changes have been effected on ground.

- ▶ **Implementation seriousness** captures the intent of a state in promoting rooftop solar. This has been reflected through projection of a state's performance in some prominent metrics as well as through actions that have had a negative impact on the rooftop solar vibes in the states.

## Investment climate

*What are investment scenarios and market conditions in the state?*

The investment climate includes all the factors pertaining to monetary competitiveness of the rooftop solar segment in the state and the availability of resources to back rooftop solar systems. This is pivotal in appraising the attractiveness of a state well-endowed with natural resources and a mature market (comparatively) to drive investments since the chances of failure are low and the state seems a sure bet to investors.

Parameters covered under investment climate:

- ▶ **Drivers for rooftop solar uptake** covers a few factors available in the state ecosystem which may incentivize uptake of rooftop solar.
- ▶ **Ease of financing/securing loans** looks at how readily is the capital available and how can it be deployed in the state for installing rooftop solar systems at different scales.

## Consumer experience

*What has been consumers' experience with rooftop solar value chain?*

The experience of consumers is an important factor in evaluating offtake potential of any technology, programme or scheme. The more aware and accepting the consumers are, the more likely it is for them to adopt that technology, and in this case, the rooftop solar systems. However, the decision is driven by cost-benefit analysis thus capturing that perspective is equally important. Consumer experience driver covers this by measuring the cost considerations made by the consumer, ease of installation and reliability of supply from the grid.

Sub-parameters covered under consumer experience have been classified under three chronological phases - before, during and after installation of a rooftop solar system.

- ▶ **Pre-application consideration** parameters cover factors such as awareness, tariff rise, etc., which consumers ponder over before deciding on/against getting a rooftop solar system installed
- ▶ **Post-application** parameters reflect consumer experiences from application through the installation tenure.



- **Post-installation** parameters cover the concerns of a consumer after installation such as operations and maintenance (O&M) costs, and their availability and warranty for equipment and performance, which also significantly affect the consumer journey.

## Business ecosystem

*What has been the impact of macro-parameters such as political, economic and other business enablers?*

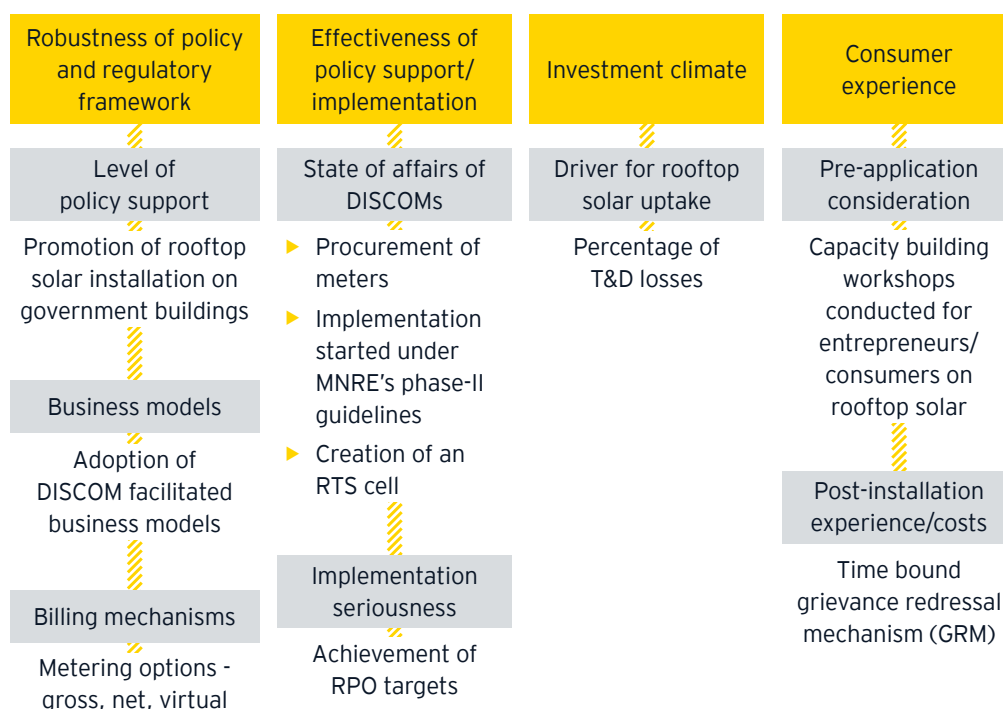
Business ecosystem signposts the performance of an economy, its behavior and prospects. It encompasses the economic environment in states and thus helps ascertain attractiveness of the state for long-term investments. The parameters also determine the presence and strength of the business enablers in the states.

Sub-parameters covered under business ecosystem:

- The current and projected **economic outlook**.
- **Business enablers** account for ease of doing business in that state and support framework that exists in the state for any business.

Considering the changing business scenario, few fresh scoring indicators have been added under different buckets and sub-parameters to make the index comprehensive and more in line with the current ecosystem.

**Figure 6: New scoring indicators in SARAL 2.0**



Source: EY analysis

All the parameters are listed in the table given below. However, details of each parameter with respect to what it measures, rationale for inclusion, mode of measurement, scoring criteria and data sources are given in the annexure.

**Table 2: The SARAL 2.0 framework**

Parameter	Weightage of parameters (Wp)	Sub-parameter	Weightage of sub-parameters (Ws)	Scoring indicator	Weightage of scoring indicators (Wi)
Robustness of policy and regulatory framework	24%	Level of policy support	37.5%	Clarity and detailing in metering regulations	25%
				Availability of other states' schemes to promote solar rooftop	25%
				Provision of a single window mechanism	25%
				Promotion of rooftop solar installation on government buildings	25%
		Covenants	25.0%	Minimum grid connected solar rooftop power plant (rooftop solar) system's size allowed in the state	33%
				Maximum rooftop solar system size allowed in the state	33%
				Permissible cumulative capacity of solar viz.- à-viz. regional DT (distribution transformer) capacity	33%
		Business models	15.0%	Adoption of DISCOM facilitated business models	100%
		Billing mechanism	22.5%	Metering options - gross, net virtual	50%
				Settlement time - yearly, bi-annually, monthly	50%
Effectiveness of policy support/ implementation	28%	Ease of application	20.0%	Average time taken from the date of application to system installation	50%
				Ease of availing state's subsidies	50%
		State of affairs of DISCOMs	50.0%	Credit rating of DISCOMs	25%
				Procurement of meters	25%
				Implementation started under the MNRE's Phase-II guidelines	25%
				Creation of a rooftop solar (RTS) cell	25%
		Implementation seriousness	30.0%	Achievement of renewable energy purchased obligation (RPO) targets	15%
				Instances of retrospective changes to the policy	40%
				rooftop solar target achieved so far (in %)	45%



Parameter	Weightage of parameters (Wp)	Sub-parameter	Weightage of sub-parameters (Ws)	Scoring indicator	Weightage of scoring indicators (Wi)
Investment climate	11%	Driver for rooftop solar uptake	50.0%	Share of C&I consumers in total rooftop solar installation in the state	50%
				Percentage of T&D losses	50%
		Ease of financing	50.0%	Ease of securing loans for installing rooftop solar systems	50%
				Availability of RTS system insurance providers in the state	50%
Consumer experience	28%	Pre-application consideration	55.0%	Consumer awareness	33%
				Tariff rise for end consumers	33%
				Capacity building workshops conducted for entrepreneurs/consumers on rooftop solar	33%
		Post-application process	15.0%	Ease of execution - from application to installation	100%
		Post-installation experience/costs	30.0%	Time-bound grievance redressal mechanism (GRM)	50%
				Warranty and aftersales experience	50%
Business ecosystem	9%	Business enablers	40.0%	Ease of doing business index (EODB)	50%
				National Council of Applied Economic Research (NCAER) economy rating of the state	50%
		Economic outlook	60.0%	GSDP per capita	50%
				GSDP growth	50%

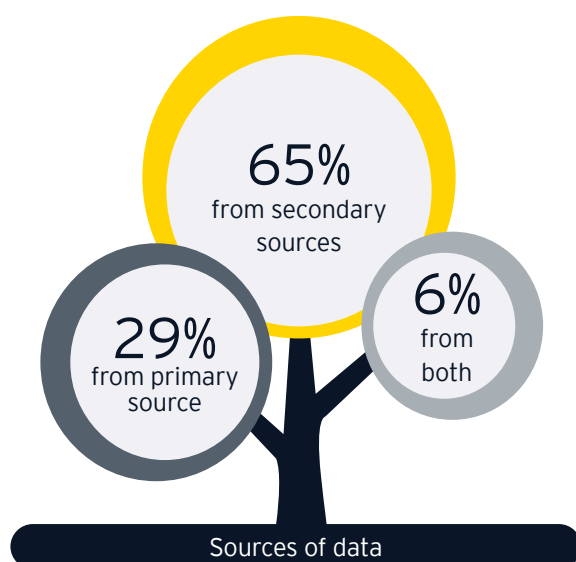
Source: EY analysis

## Feedback received from stakeholders

To involve states in the development of the index and to draw insights from different government institutions, industry, think tanks and other agencies, feedback was solicited from:

- ▶ Members of the steering committee
- ▶ Regional workshops
- ▶ State consultations

**Figure 7: Data sources for building the model**



Source: EY analysis

The sections below highlight the feedback received through each of these channels.

### Steering committee

The steering committee (SC) was consulted to bring about a rounded viewpoint from key stakeholders from different spheres. This was done to make the index comprehensive and reflective of all the important aspects of the rooftop solar sector. The SC provided overall guidance on the index in general as well as on the parameters.

#### Review of index generics

- ▶ The SC deliberated on relevance of state rankings since many states were going in different directions regarding their intent towards promoting rooftop solar (RTS).

- ▶ The SC was of the opinion that the perspective from which residential is viewed is different from how C&I is viewed. It also wondered whether the index can cover all aspects under a single umbrella. For instance, subsidies alone may not be crucial for residential sector's growth, subsidy disbursement process and tenure are also significant. On the other hand, the C&I segment looks for longevity.
- ▶ The SC quipped that the index would do well to reflect the steps taken by a state to become "rooftop solar" state and also to clearly bring out their progress in both subsidized and non-subsidized segments separately.
- ▶ The SC brought in aspects apart from the ones included in the index. They discussed the challenges in O&M, in terms of cost and availability of O&M. The committee also captured promotion of an RTS installation on government buildings. The index, on the other hand, captured repayment performance of state governments, as late payment from entities might hamper projects' planning.

#### Review of parameters

- ▶ The SC brought in their opinion on the parameters in the index too. In this regard, they highlighted the "ease of application" parameter and requested to consider manual consumer applications through each district's DISCOM offices along with AMR meter because of their vital roles in rural areas. Readiness of DISCOMs from the perspective of having undertaken feasibility studies for DT capacity, etc. may be accounted for in the index ranking.
- ▶ The SC explained the reasons behind AT&C losses not being an accurate parameter to be considered here. The SC also suggested considering T&D losses in place of AT&C and states to follow the CEA methodology for giving higher weightage.
- ▶ The SC enquired about the "settlement time" scoring indicator and highlighted the importance of net billing.
- ▶ An SC member suggested that indicators such as long-term policies, business models, settlement mechanisms, net metering, tariffs, ecosystem of financiers and developers and consumer awareness should carry maximum weightage in the model.
- ▶ The SC enquired about skill development aspect in SARAL 2.0 and proposed that capacity building for entrepreneurs should deal with installation aspects. It was brought out in discussions that the importance of skill development has been indirectly captured through 'entrepreneurs' training' and 'warranty and after sales experience' scoring indicators.



Training for consumers is not directly covered but it has inherent understanding in improving O&M, warranty, after sales experience and entrepreneur's development training program.

- ▶ The SC also enquired about the 'ease of financing' scoring indicator and requested for clarification on whether the indicator had considered aggregation model. It was clarified to the SC that aggregation issues are not mentioned directly, but most of the underlying issues are already covered under various scoring indicators.
- ▶ The SC suggested to include the energy capita per unit in scoring indicator and highlighted that it will reflect the energy consumption of the state. It was pointed out that energy capita per unit is inherently considered under the GSDP per capita.
- ▶ The SC suggested considering Sustainable Development Goals (SDGs) parameters as scoring indicators in the model. It was clarified that earlier, public sustainability index was considered for incorporation in the model. However, it was excluded as it is a subset of the scoring indicator "Credit rating of state".

## Regional workshops

Apart from consulting the experts, the SC gathered insights from a wider and more inclusive mélange of region-specific stakeholders. These were acquired on the identified five buckets that collectively determine the potential of a state to attract investments in the solar rooftop space. The stakeholder brought in regional perspectives about the issues pervading there and also possible mitigating actions to tackle them. This brought in good perspective for preparing the index by helping the team understand whether most of the problems projected by the stakeholders had been covered in the index. Four regional consultations were held as part of this exercise:

- ▶ Western region (01 September 2020)
- ▶ Eastern region (15 September 2020)
- ▶ Southern region (24 September 2020)
- ▶ Northern region (08 October 2020)

Due to the restrictions imposed due to the COVID-19 pandemic, all the workshops were conducted virtually. The details of the discussions concluded in these regional workshops have been laid out in a later section.

The following are a few key challenges that were discussed during these sessions:

- ▶ Unstable policies in rooftop solar
- ▶ Poor equipment standards and quality in cyclone-prone coastal regions
- ▶ Difficulties in availing subsidies
- ▶ Lack of awareness by state nodal agencies (SNAs)
- ▶ Limits under net metering regulations
- ▶ Non-availability of smart meters

- ▶ Delays in installation of net meters
- ▶ Creation of asset security in PPAs
- ▶ Lack of installer expertise
- ▶ Concerns of DISCOMs fearing loss of revenue due to rooftop solar

The participants in the regional workshops were also consulted about their preference for the buckets used in SARAL 2.0 in rating the states. The consensus from the majority of respondents to the questionnaire was of a high significance for policy-related parameters, especially for parameters measuring policy implementation.

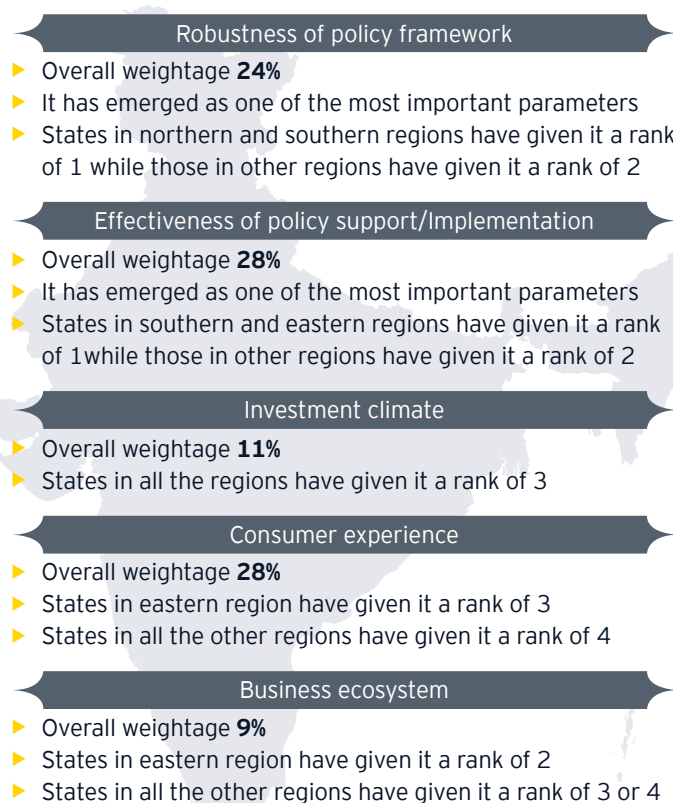
## State consultations

State consultations over the course of SARAL and SARAL 2.0 focused on the following key objectives:

- ▶ Arriving at preferences and weightages for the buckets
- ▶ Updating the data for parameters under SARAL 2.0 over SARAL
- ▶ Collection of data for new parameters under SARAL 2.0

One of the main objectives of state consultations was to confirm the validity of five buckets on which the SARAL model is built on and to capture relative importance of these buckets. Officials from DISCOMs and SNAs from all the states were heard by the project team. Basis the importance given by different stakeholders, the weightage was decided on each parameter. The feedback generated from this is represented in the subsequent infographic.

**Figure 8: Findings from state consultations**



Source: EY analysis



3



Final results and

# **key takeaways** **for the states**





# Comprehensive SARAL 2.0 state scores

**Table 3: SARAL 2.0 state scores under five broad buckets**

Ranking	State/UT	Grade	SARAL 2.0 score	Robustness of policy and regulatory framework	Effectiveness of policy support/ implementation	Investment climate	Consumer experience	Business ecosystem
1	Gujarat	A++	70.86	47.40	70.00	70.97	74.17	60.55
2	Delhi	A++	69.22	56.25	58.75	34.62	70.91	72.04
3	Telangana	A++	65.61	30.73	55.00	66.00	81.85	62.48
4	Karnataka	A++	62.75	46.61	46.25	72.16	70.67	49.98
5	Madhya Pradesh	A+	60.39	31.25	36.25	80.57	84.24	39.95
6	Punjab	A+	60.16	26.56	40.00	65.39	89.70	37.43
7	Kerala	A+	59.89	52.24	36.25	64.11	69.17	44.25
8	Rajasthan	A+	59.77	31.25	35.00	78.32	88.30	43.32
9	Haryana	A+	59.72	46.61	52.50	42.93	61.72	54.43
10	Maharashtra	A+	58.48	50.78	38.75	59.42	70.02	48.70
11	Chandigarh	A	58.06	26.04	47.50	29.62	63.15	55.42
12	Chhattisgarh	A	55.54	54.69	53.75	38.59	46.47	41.37
13	Tamil Nadu	A	55.44	39.06	27.50	60.69	69.50	57.58
14	Goa	A	54.16	21.35	53.75	12.22	59.45	76.73
15	Andhra Pradesh	A	54.05	63.33	37.62	60.01	62.06	48.23
16	Jharkhand	A	53.55	50.78	38.75	32.83	66.47	33.96
17	Uttar Pradesh	B++	53.14	49.22	47.50	20.77	63.45	35.62
18	Bihar	B++	53.13	50.78	53.75	32.92	44.83	23.30
19	Himachal Pradesh	B++	51.03	35.94	41.25	27.69	60.29	47.71
20	Odisha	B++	50.48	41.41	42.50	51.91	50.92	25.79
21	Assam	B++	46.55	38.28	25.00	33.48	59.06	28.85
22	Sikkim	B+	42.98	34.90	25.00	21.92	54.14	44.12
23	Meghalaya	B+	42.97	29.69	30.00	24.66	56.54	29.06
24	West Bengal	B+	42.32	20.05	52.50	17.24	53.37	42.15
25	Uttarakhand	B+	41.24	21.88	35.00	23.70	44.06	46.08
26	Mizoram	B	40.35	23.70	37.50	15.04	45.36	18.80
27	Nagaland	B	38.27	26.82	12.50	19.49	51.67	26.42
28	Manipur	B	37.10	21.35	17.50	19.93	53.21	13.35
29	Jammu and Kashmir	B	31.07	24.22	17.50	17.26	34.77	26.78
30	Tripura	B	28.47	19.53	22.50	22.87	17.63	33.05
31	Arunachal Pradesh	B	27.55	19.53	17.50	34.92	18.33	22.28

# Inferences

There has been quite a lot of movement in the rankings under the SARAL 2.0 index viz.-à-viz. the preliminary version of the index. Many states have given stellar performances that can provide inspiration to other states to perform better. The addition of fresh parameters to reflect the changed scenario has also led to changes in the states' rankings. A few highlights from the index have been illustrated in the section below:

- ▶ Gujarat has moved to the top of the index with good ratings in almost all the five buckets under SARAL 2.0. There are many arguments which have gone in favor of the state. It scores well on scoring indicators under the policy implementation bucket. It was found that the average time taken from the date of application to plant installation in Gujarat is low. Credit rating of the state's DISCOMs are among the highest (A++) in the country. In the bidding sphere, it has taken a fast lane. It has floated 600MWp residential tenders under the MNRE Phase-II Rooftop Solar Scheme and its implementation phase has also begun. In the compliance aspect, RPO achievement is a very decent at 90%.
- ▶ Delhi has moved places to be placed in the second position. Its performance in the buckets of robustness of policy, policy implementation and business ecosystem has been good. It scores well on business ecosystem indicators such as NCAER Economic Rating where it scores maximum and its ease of doing business is good too. On the policy front, Delhi has promoted rooftop solar in government buildings/departments. Under regulations, it has introduced favorable clauses such as no upper limit on maximum allowable capacity of rooftop solar as well as allowing RTS system up to 100% of connected load. The Government of National Capital Territory of Delhi (GNCTD) has issued 30MWp residential tenders under the Phase-II Rooftop Solar Scheme for implementation.
- ▶ Karnataka has moved down by a few positions. The shift from net metering to gross metering for particular segments is one of the reasons seen behind this change in rankings. Moreover, it has not adopted innovative DISCOM-centric business models, which goes against it. In the state ease of doing business index (EODB), it has shifted to the 17th rank.
- ▶ Kerala has performed well and has moved six places to be placed in seventh in SARAL 2.0. It introduced the SOURA scheme, which is aimed at developing solar PV rooftop/ground mounted plants aggregating to 1000MWp in the state in the true spirit of MNRE goal of achieving 100 GW of solar plants by the year 2022. SOURA scheme includes 500MWp through rooftop

program. As part of the scheme, it has also introduced DISCOM-centric business models, which have been duly captured in the index under the bucket 'effectiveness of policy support/implementation'.

- ▶ Rajasthan has moved down to a few places, but still remains as one of the better performing states. A few factors that can be attributed to this slide in rankings are that on the policy front. The state is yet to adopt DISCOM-facilitated business models. On the regulations front, DT capacity is only till 30% which is prohibitive compared to that in many other states. Moreover, the credit rating of all the three DISCOMs in Rajasthan are on the lower side, which affects its standing in the 'state of affairs of DISCOMs' sub-parameter.

The changes in rankings have also laid bare a few takeaways from each of the buckets that states can adhere to for better performance in the future. A few aspects worthy of mention from the perspective of the buckets in the index are:

## 1. Robustness of policy framework

It measures how clear, detailed and supportive is the existing policy and regulatory framework.

### Scope for improvement

- ▶ MNRE has mandated DISCOMs to take the leading role in improving the rooftop solar scenario in states. This can be made possible by adopting more inclusive business models. States can improve their rankings in this bucket by adopting DISCOM-facilitated innovative business models, which will be an evidence for DISCOMs being an enabling presence in the rooftop solar ecosystem of the state.
- ▶ Some states are still quite prohibitive in their regulations leading to regressive covenants such as 'permissible cumulative capacity of solar viz.-à-viz. regional DT capacity', 'minimum and maximum rooftop solar system size allowed in the state'. These criteria need to be relaxed further to open up the market.

## 2. Effectiveness of policy support/implementation

It measures how effectively and efficiently the laid down policies and regulations have been adopted in practice.

### Scope for improvement

- ▶ It has been observed that some states have brought in policies which may have resulted in loss of trust among stakeholders. This has been captured under 'instances of retrospective changes to the policy'. It is hoped that such decisions will eventually be overturned, or amendments brought about to assuage the concerns of affected stakeholders.
- ▶ Tendering under MNRE Phase-II program needs to be expedited so that the demand of rooftop solar in these states is captured.

## 3. Investment climate for the rooftop solar sector

It measures how well a state is positioned to attract investments in this sector.

### Scope for improvement

- ▶ In many states, it has been observed that stakeholders find it difficult to access debt for installation of rooftop solar plants. Ease of securing loans for installing rooftop solar systems is a key parameter under this bucket. The financing ecosystem needs to be improved by supporting underserved stakeholders with innovative products and bankers need to be educated on processing rooftop solar loan applications.





## 4. Consumer experience

It measures perception, acceptance and experience of consumers.

### Scope for improvement

- ▶ The experience of consumers has suffered in many states due to ineptitude of customer-facing entities such as installers. This situation can be improved in states by conducting capacity-building workshops for entrepreneurs/developers/installers on rooftop solar. The training programs, being run by multilateral developmental agencies (MDAs), can be utilized for this purpose. Local entrepreneurs can be trained to help in improving O&M performance as local developers are more readily available to attend cases.


## 5. Business ecosystem

It measures how supportive are the state's law and order, institutions and infrastructure for any business.

### Scope for improvement

- ▶ Ease of doing business plays a major role in improving the business ecosystem in a state. Transparency in the functioning of government departments, strict timelines in executing a process and digitization to enable monitoring of such timelines can go a long way in improving the ease of doing business in a state. From this perspective, it is essential for DISCOMs to track application processes, subsidy application and disbursal, net metering installation, etc. for operation of fully functional unified web portals (UWPs).





The endeavor behind the concept of SARAL has been to act as a guide for stakeholders before investing in the idea of transition to rooftop solar. Through every version of the index, the objective has been to reflect the current ecosystem in the sector and to present a comprehensive picture to all stakeholders. In that way, the SARAL 2.0 index is an updated version of SARAL in many respects. Many new parameters have been added in the new index to reflect changed scenario. Another major update executed under SARAL 2.0 is a web-based dashboard to be hosted on a suitable platform, so that any stakeholder can very easily get updated on the performance of states in rooftop solar at the click of a button on their laptops or mobile devices.

Even though the best efforts of the team have gone into making the index, the restrictions brought about by the COVID-19 pandemic have had their effect in the making of the index. Some parameters which had to be culled from the index due to difficulties in reaching out to stakeholders is one aspect which will be strengthened in the upcoming versions.

Benchmarking city-specific interventions is one aspect which will involve a deep dive on another level. Prominent cities that have launched special projects, which directly or indirectly lead to rooftop solar proliferation, will be covered under this aspect. The inclusion of such an aspect will represent another step in the evolution of the index.

Manifestation of the effect of rooftop solar on other technologies such as the proliferation of electric vehicles (EV) or battery storage is another aspect that will add dimension to the index. Ways to capture such facets will be deliberated as an additional arm to the evolving SARAL index.

SARAL 2.0 has seen introduction of a preliminary version of the dashboard, which will be a static one. However, it goes without saying that a lot of scope still remains to improve the dashboard in future iterations, prime among them being to infuse dynamic features into the dashboard, so that it can represent the most updated benchmark statistic at any moment.

It is hoped that the current iteration of the index as well as incremental changes in the upcoming versions will make the SARAL index being the one-stop reference for stakeholders before investing in rooftop solar in any state. More so, it is hoped that the SARAL index will continue to inspire states to lift their performance a notch higher with every upcoming version and inspire their peers towards a successful rooftop solar program and a cleaner India.

# Way forward

Figure 9: Evolution of the SARAL index



Source: EY analysis





4

# Annexures



# Annexure I:

## *SARAL 2.0 scoring indicators*



# 1. Robustness of policy framework

How clear, detailed and supportive is the existing policy and regulatory framework?

## Clarity and detailing in metering regulations

Robustness of  
policy framework

Level of  
policy support

Clarity and detailing  
in metering regulations

What it measures	The clarity, depth and exhaustiveness of the state's metering policy as measured by assessing various provisions provided in solar regulations and policies of states.						
Rationale for inclusion	The policies and regulations have a direct impact on the growth of any technology. Therefore, we have included this parameter to measure quality and extent of policy support in different states. Most states have come up with a net/gross metering policy of their own, adapted from the Central Electricity Regulatory Commission model regulations of 2013. However, there are subtle variations in each state's policies and regulations that this parameter attempts to capture. The comprehensiveness of regulations addresses questions that may arise in minds of a prosumer or any other interested party. It gives a clear directive to DISCOMs and other agencies involved in this sector. The expectations and responsibilities are spelled out to boost confidence among the applicants of a rooftop solar system. The clarity with which the regulations have been laid down too have been taken into consideration while grading the states.						
Mode of measurement	<p>An exhaustive checklist was prepared that also provided limit on sanctioned load, details on the wheeling, banking and cross subsidy charges, bearer of metering cost, minimum limit for the Chief Electrical Inspector to Government's (CEIG's) approval and detailing in procedure of application. A number of data points were collected from below mentioned sources and were mapped against each state to arrive at a score. The qualitative data has been quantified on a scale of one to five.</p> <p>Score 5: Very clear and detailed policy/regulations that contain five items from the checklist (listed above)</p> <p>Score 4: Policy/regulations that contain four items from the checklist</p> <p>Score 3: Policy/regulations that contain three items from the checklist</p> <p>Score 2: Policy/ regulations that contain two items</p> <p>Score 1: Policy/regulations that contain one item</p>						
Scoring criteria	Higher is better	Unit of measurement	Scale of 5	Range	Lowest - 1 Highest - 5	Time period	FY19
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ Respective states net/gross metering policy/regulations</li> <li>▶ States' solar policy documents</li> <li>▶ Subsequent amendments and other announcements</li> </ul>						

## Availability of other state schemes to promote solar rooftop

Robustness of  
policy frameworkLevel of  
policy supportAvailability of other state schemes  
to promote solar rooftop

What it measures	Various incentives and other schemes provided by state governments are documented under a policy framework checklist to capture exhaustiveness and comprehensiveness of the exemptions.						
Rationale for inclusion	To achieve renewable energy targets set by the government, the central as well as state governments have incorporated various incentives, subsidies and other facilities. These effectively bring down the cost and risk associated with the rooftop solar system. The exemptions, subsidies and other such schemes vary from state-to-state. The extent of these support schemes and incentives also vary. Thus, these play a key role in determining attractiveness of a state towards solar rooftops because most of them directly benefit prosumers by creating an environment most propitious for the success of rooftop solar.						
Mode of measurement	<p>An exhaustive checklist was prepared to enumerate subsidies, incentives and other facilities. The data points collected from below mentioned sources were mapped against each state to arrive at a score. The qualitative data has been quantified on a scale of one to three.</p> <p>Score 3: given to states that had maximum numbers of items from the checklist</p> <p>Score 2: given to states that had lesser number of items compared to score 3 states</p> <p>Score 1: given to states with no items from the checklist</p>						
Scoring criteria	Higher is better	Unit of measurement	Scale of 3	Range	Lowest - 1 Highest - 3	Time period	FY19
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ Respective states net metering policy/regulations</li> <li>▶ State's solar policy documents</li> <li>▶ Subsequent amendments and other announcements</li> <li>▶ News articles</li> </ul>						

## Provision of a single window mechanism

Robustness of  
policy frameworkLevel of  
policy supportProvision of a single  
window mechanism

What it measures	This mechanism captures the provisions for a single platform for consumers to submit the application and other regulatory documents required for installing a rooftop solar system.						
Rationale for inclusion	The single window mechanism facilitates in clearances of all requisite approvals, permissions and consents required at a single point of contact. The provisions for such a system streamline the tedious and time consuming process for installing a rooftop solar system, making it more accessible and convenient for an interested party. The perceived challenges and cost associated with installing a rooftop solar system reduce its attractiveness, driving away interested parties. But a single window mechanism can overcome this perception.						
Mode of measurement	<p>Checked presence of a single window mechanism in regulation or its subsequent revisions. The qualitative data has been quantified on a scale of one to three.</p> <p>Score 3: Presence of a single window mechanism and evidence of its implementation</p> <p>Score 2: Presence of a single window mechanism but no evidence of its implementation status</p> <p>Score 1: Absence of a single window mechanism</p>						
Scoring criteria	Higher is better	Unit of measurement	Scale of 3	Range	Lowest - 1 Highest - 3	Time period	FY19
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ Government/SNAs' websites</li> <li>▶ Online portal of DISCOMs</li> </ul>						

## Promotion of rooftop solar installations on government buildings

Robustness of  
policy framework

Level of  
policy support

Promotion of rooftop solar installations  
on government buildings

What it measures	This captures states' mandates on provision of 100% solarization of government buildings in their respective states.						
Rationale for inclusion	Presence of this provision indicates the state's inclination towards the government sector in a major way.						
Mode of measurement	<p>The data has been quantified in the binary mode between zero to one.</p> <p>Score 0: Absence of state provision of 100% solarization of government buildings</p> <p>Score 1: Presence of state provision of 100% solarization of government buildings</p>						
Scoring criteria	Higher is better	Unit of measurement	Scale of 2	Range	Lowest - 0 Highest - 1	Time period	FY19
Data source: (Secondary)	<p>► Survey responses from questionnaires developed by SARAL team for state consultations</p> <p>► Answered by: SERCs, EPCs and DISCOMs</p>						

## Maximum rooftop solar system size allowed in the state

Robustness of  
policy framework

Covenants

Maximum rooftop solar system size  
allowed in the state

What it measures	This scoring indicator compares the maximum size of a rooftop solar system that is allowed in different states.						
Rationale for inclusion	State policymakers impose covenants on interested parties with respect to the maximum size of a rooftop solar system that can be installed in a state. The larger projects benefit from scale of economies and increase the return on the investment. This is most relevant to the C&I sector since they often have large energy requirements and the financial wherewithal for opting a bigger rooftop solar plant. The maximum size allowed, and its related provisions are taken into consideration to apprise the states.						
Mode of measurement	<p>Enumeration of the maximum project size allowed as per policy. The data points collected from below-mentioned sources were mapped against each state to arrive at a score. The qualitative data has been quantified on a scale of one to three.</p> <p>Score 3: More than 1MWp</p> <p>Score 2: 1MWp</p> <p>Score 1: Less than 1MWp</p>						
Scoring criteria	Higher is better	Unit of measurement	Scale of 3	Range	Lowest - 1 Highest - 3	Time period	FY20
Data source: (Secondary)	► Respective states' metering policy/regulations						



## Minimum rooftop solar system size allowed in the state

Robustness of  
policy framework

Covenants

Minimum rooftop solar system size  
allowed in the state

What it measures	This scoring indicator compares the minimum size of a rooftop solar system that is allowed in different states.						
Rationale for inclusion	The state policymakers impose covenants on interested parties with respect to the minimum size of a rooftop solar system that can be installed in that state. The bigger the size, more is the capital requirement which essentially drives away prosumers who are interested in installing small plants. This is most relevant to the residential sector. The minimum size allowed, and its related provisions are taken into consideration to apprise the states.						
Mode of measurement	Enumeration of minimum project size allowed as per the policy. The data points collected from below-mentioned sources were mapped against each state to arrive at a score. The qualitative data has been quantified on a scale of one to two. Score 2: greater than 1KWp Score 1: Less/equal to 1KWp						
Scoring criteria	Lower is better	Unit of measurement	Scale of 2	Range	Lowest - 2 Highest - 1	Time period	FY19-20
Data source: (Secondary)	► Respective states' net metering policy/regulations						

## Permissible cumulative capacity of solar viz.-à-viz. regional DT capacity

Robustness of  
policy framework

Covenants

Permissible cumulative capacity of  
solar viz.-à-viz. regional DT capacity

What it measures	The indicator denotes the total cumulative capacity of rooftop solar plants that can be installed in an area covered by a single distribution transformer.						
Rationale for inclusion	All state regulations place restrictions on the total capacity of rooftop solar plants connected to one distribution transformer in an area. It is usually a fraction (that varies from state-to-state) of the capacity of the distribution transformer. This restriction limits the extent of proliferation of rooftop solar in a state. If the cumulative capacity is low, it directly affects prosumers' capacity to install rooftop solar and thus greatly affects a state's attractiveness. It is also indicative of the quality of infrastructure in place as better the infrastructure, higher would be the limit.						
Mode of measurement	Enumerated the given permissible cumulative capacity of a solar installation viz.-à-viz. distribution transformer and then gave scores starting from maximum to minimum allowed capacity. The qualitative data has been quantified on a scale of one to three. Score 3: Maximum allowed capacity, i.e., more than 60% of the transformer capacity Score 2: Allowed capacity between 30% to 60% of the transformer capacity Score 1: Allowed capacity less than 30% of the transformer capacity						
Scoring criteria	Higher is better	Unit of measurement	Scale of 3	Range	Lowest - 1 Highest - 3	Time period	FY20
Data source: (Secondary)	► Respective states' net metering policy/regulations						

## Adoption of DISCOM facilitated business models

Robustness of  
policy framework

Business models

Adoption of DISCOM  
facilitated business models

What it measures	This measures DISCOMs' initiatives for creation of business models that can facilitate rooftop solar proliferation in the post-MNRE Phase-II scenario.						
Rationale for inclusion	MNRE Phase-II scheme places DISCOMs at the forefront of the ecosystem. It warrants them to take pro-active measures for rooftop solar promotion in the state. Adoption of alternative business models by DISCOMs show that they are pro-active towards promotion of rooftop solar in their state.						
Mode of measurement	In case the process is in place, relative comparison will be made based on if the tender has been floated with such business models. Score 1: Presence of business models and evidence of its implementation Score 2: Absence of business models by DISCOMs						
Scoring criteria	Higher is better	Unit of measurement	Scale of 2	Range	Lowest - 1 Highest - 2	Time period	FY19-20
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ Status of tenders floated as per the MNRE Phase- II Solar Rooftop scheme</li> <li>▶ Government/SNAs' websites</li> <li>▶ News articles</li> <li>▶ Research articles</li> </ul>						

## Metering options: gross, net, virtual

Robustness of  
policy framework

Billing mechanism

Metering options

What it measures	It measures different provisions that DISCOMs provide in terms of metering and settlement options. These include option of net/gross metering, virtual net metering and other options.						
Rationale for inclusion	The greater the number of these provisions, greater is the flexibility on the part of a DISCOM towards consumers and hence greater will be consumers' eagerness to get on board.						
Mode of measurement	The data has been quantified on a scale of one to three. Score 1: Policy that contains one item from checklist Score 2: Policy that contains two items from checklist Score 3: Policy that contains three or more items from checklist						
Scoring criteria	Higher is better	Unit of measurement	Scale of 3	Range	Lowest - 1 Highest - 3	Time period	FY19-20
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ Respective states' net/gross metering policy/regulations</li> <li>▶ States' solar policy documents</li> <li>▶ Subsequent amendments and other announcements</li> <li>▶ Government/SNAs' websites</li> </ul>						

## Settlement time

Robustness of  
policy framework

Billing mechanism

Settlement time

What it measures	The payment settlement time denotes the payback time taken by DISCOMs for surplus power received by them from the prosumer.						
Rationale for inclusion	The settlement time will be a critical factor in determining the overall pecuniary benefit of the rooftop solar system for a rational prosumer. Shorter the settlement time, shorter would be the payback period resulting in a stronger business case for any rational party. It is expected that this parameter creates a competitiveness among states to improve their billing time frame, thereby winning stakeholders' confidence. The related provisions such as mode of payment, minimum electricity bill to be borne and other such provisions too have been factored in.						
Mode of measurement	<p>Enumerated settlement time mentioned in the policy and gave scores accordingly. Minimum scores were given to states with policies not mentioning the settlement time. Qualitative data has been quantified on a scale of one to three.</p> <p>Score 3: Annually or not defined</p> <p>Score 2: Biannually</p> <p>Score 1: Monthly</p>						
Scoring criteria	Lower is better	Unit of measurement	Scale of 3	Range	Lowest - 1 Highest - 3	Time period	FY20
Data source: (Secondary)	► Respective states' net metering policy/regulations						



## 2. Effectiveness of policy support/implementation

How effectively and efficiently the laid down policies and regulations have been adopted in practice?

Average time taken from the date of application to system installation

Effectiveness of  
policy support

Ease of application

Average time taken from the date of  
application to system installation

What it measures	The time required in the entire process from application for rooftop solar plant to the final installation of the same.						
Rationale for inclusion	Most states do not possess a single window mechanism. In addition, rooftop solar commissioning process is not given a deemed approval status in most states. This make the process cumbersome and time consuming, greatly reducing its attractiveness to potential consumers. It is one of the ground-level challenges that plague the rooftop solar space. Since it has a direct bearing on consumers, it greatly affects states' attractiveness as a whole.						
Mode of measurement	The qualitative data has been quantified on a scale of one to three. Score 3: Time taken is more than three months Score 2: Time taken is between two to three months Score 1: Less than two months						
Scoring criteria	Lower is better	Unit of measurement	Scale of 3	Range	Lowest - 1 Highest - 3	Time period	FY 2019-20
Data source: (Primary/ Secondary)	<ul style="list-style-type: none"> <li>▶ Survey responses from questionnaires developed by SARAL team for state consultations</li> <li>▶ Answered by: DISCOMs, SNAs and developers</li> <li>▶ News articles</li> <li>▶ Government (DISCOM/SNA) websites</li> </ul>						

Ease of availing state subsidies

Effectiveness of  
policy support

Ease of application

Ease of availing state subsidies

What it measures	It measures the ease at which the state governments provided subsidies can be availed by users of the rooftop solar system.						
Rationale for inclusion	Every state comes out with solar/renewable energy polices from time to time. These policies differ from each other. Some of them can prove to be more efficient and effective in making the environment more supportive or lucrative for solar rooftops. This parameter documents different aspects of these policies. The existence of subsidies being offered in the state enhances profitability and speeds up the process of reaching grid parity for the prosumer. It also encourages people from all economic classes to set up a solar system, thereby maximizing the penetration of the technology.						
Mode of measurement	The qualitative data has been quantified on a scale of zero to one based on the responses of the following question: How easy it is to avail subsidies? Please rate in a scale of zero to one, where 1-Yes 0-No						
Scoring criteria	Higher is better	Unit of measurement	Scale of 2	Range	Lowest - 0 Highest - 1	Time period	FY 2019-20
Data source: (Primary)	<ul style="list-style-type: none"> <li>▶ Survey responses from questionnaires developed by the SARAL team for state consultations</li> <li>▶ Answered by: SNAs and developers</li> </ul>						

## Credit rating of DISCOMs

Effectiveness of  
policy supportState of affairs  
of DISCOMs

Credit rating of DISCOMs

What it measures	This indicator evaluates DISCOMs on three broad categories - operational and reform parameters, external parameters, and financial parameters which culminates in a single ranking for DISCOMs.						
Rationale for inclusion	The MNRE has been making continuous efforts to bring DISCOMs to the forefront in accomplishing the ambitious target of installing 40GW from solar rooftop. However, DISCOMs may prove to be the principal stumbling block in India, realizing its rooftop solar power goals. As more C&I users, who bring maximum revenues to state DISCOMs, take to solar power, the revenues of electricity generators and distributors would fall. DISCOMs are already in bad financial position and solar rooftop may further hurt their revenue. The credit rating thus, plays an important role in capturing the ability and willingness of the DISCOMs to support this budding sector.						
Mode of measurement	For states with multiple DISCOMs, the average of individual scores was taken to represent the state's score. Score to the individual state was assigned by normalizing the data on a scale of 0 to 100.						
Scoring criteria	Lower is better	Unit of measurement	Scores out of 100	Range	Lowest - 0 Highest - 100	Time period	FY19-20
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ The Ministry of Power's state Distribution Utilities Seventh Annual Integrated Rating Report, 2019</li> <li>▶ Government (DISCOM/SNA) websites</li> <li>▶ News articles</li> </ul>						

## Procurement of meters

Effectiveness of policy  
support/implementationState of affairs  
of DISCOMs

Procurement of meters\*

What it measures	This is a measure of readiness of DISCOMs with respect to procurement of meters for synchronization of commissioned rooftop solar plants. It takes into account whether the state has empaneled vendors for procurement of net/gross meters and understanding if the state has smart meters in stock or if there is a shortage.						
Rationale for inclusion	With DISCOMs being designated as the focal point of the RTS process, it is essential that they have processes in place for timely procurement of meters. This indicator reflects the readiness of DISCOMs to follow through on the RTS cycle in a streamlined manner.						
Mode of measurement	States which have smart meters installed have been considered as a positive sign for rooftop solar. The data has been quantified on a scale of zero to one. Score 1: Meter procured Score 0: No meter procurement						
Scoring criteria	Higher is better	Unit of measurement	Scale of 2	Range	Lowest - 0 Highest - 1	Time period	FY19-20
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ The Ministry of Power's Uday Portal</li> <li>▶ State DISCOM's website</li> <li>▶ Government (DISCOM/SNA) websites</li> <li>▶ News articles</li> </ul>						

## Implementation under the MNRE's Phase-II scheme

Effectiveness of policy support/implementation

State of affairs of DISCOMs

Implementation under the MNRE's Phase-II scheme

What it measures	The MNRE's phase-II scheme has designated DISCOMs as the frontline agency for kickstarting the RTS process in states. Issuing tenders is a pre-requisite for identifying and bridging supply and demand. This indicator measures if DISCOMs have issued tenders and have allocated capacity to developers for deployment of rooftop solar under the MNRE's phase-II rooftop solar guidelines.						
Rationale for inclusion	This reflects DISCOMs' pro-activeness in kickstarting installation in different states under the phase-II scheme. The higher the number of tenders or allocated capacity to developers and work progress reflects, the better is the approach followed by DISCOMs.						
Mode of measurement	The data has been quantified on a scale of 1 to 3. Score 1: No tender floated under Phase-II scheme Score 2: Tender floated under Phase-II scheme Score 3: Tender floated and work started under Phase-II scheme						
Scoring criteria	Higher is better	Unit of measurement	Scale of 3	Range	Lowest - 1 Highest - 3	Time period	FY19-20
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ The MNRE's SPIN (Solar Photovoltaic Installation) website</li> <li>▶ Government (DISCOM/SNA) websites</li> <li>▶ News articles</li> </ul>						

## Creation of an RTS cell

Effectiveness of policy support/ implementation

State of affairs of DISCOMs

Creation of RTS cell

What it measures	This measures the importance placed by the state on alternative sources of energy, solar power in particular, through the establishment of special cells in state implementing agencies (DISCOMs in most cases).						
Rationale for inclusion	This reflects a DISCOM's initiatives in building a requisite internal structure and staffing to focus on issues related to RTS installations. Setting up of an RTS cell/guidelines to set up such a cell means that the DISCOM is adopting a focused approach towards RTS.						
Mode of measurement	Existence of an RTS cell will facilitate in faster deployment of RTS in the state. The data has been quantified on a scale of zero and one. Score 0: Absence of an RTS cell Score 1: Presence of an RTS cell						
Scoring criteria	Higher is better	Unit of measurement	Scale of 2	Range	Lowest - 0 Highest - 1	Time period	FY19-20
Data source: (Primary/ Secondary)	<ul style="list-style-type: none"> <li>▶ Survey questionnaires from DISCOMs</li> <li>▶ DISCOMs' websites</li> <li>▶ The MNRE's progress reports</li> <li>▶ News articles</li> </ul>						



## Achievement of renewable energy purchased obligation (RPO) targets

Effectiveness of  
policy support

Impact of policy

Achievement of renewable purchase  
obligation (RPO) targets

What it measures	RPOs are the minimum percentages of the total power that electricity distribution companies and obligated entities need to purchase through RE sources. This indicator measures the seriousness accorded by states in meeting their RPO targets.						
Rationale for inclusion	It is envisaged that stricter RPO monitoring and imposition of fines can translate into better RTS compliance.						
Mode of measurement	The percentage of achieved RPO targets have been taken for analysis. Score to the individual state was assigned by normalizing the data on a scale of 0 to 100.						
Scoring criteria	Higher is better	Unit of measurement	%	Range	Lowest - 0% Highest - 250%	Time period	FY19-20
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ The Ministry of Power's website</li> <li>▶ The MNRE's website</li> <li>▶ News articles</li> </ul>						

## Instances of retrospective changes to state RTS policies

Effectiveness of  
policy support

Impact of policy

Instances of retrospective  
changes to state RTS policies

What it measures	This attempts to capture the frequency of changes in the policy and provide evidence of confusion created by the policy among investors through media reports.						
Rationale for inclusion	The rooftop solar sector is in its nascent stage and needs support of the regulatory authorities, DISCOMs and other stakeholders in order to grow. A supportive policy framework becomes necessary for proliferation of rooftop solar. Frequent changes in policies, misleading statements in media reports and ambiguity in the regulation itself can confuse the interested parties and drive away the demand for RTS.						
Mode of measurement	Maximum score was given to those states that have clarified their policies or have reinforced the existing policies. Minimum score was given to states which have made discouraging comments or revoked their initial schemes. The qualitative data has been quantified on a scale of zero to one. Score 1: Evidence of retrospective changes in policy Score 0: No evidence of retrospective changes in policy						
Scoring criteria	Lower is better	Unit of measurement	Scale of 2	Range	Lowest - 0 Highest - 1	Time period	FY19-20
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ News articles</li> <li>▶ Government (DISCOM/SNA/SERC) websites</li> </ul>						

## Rooftop target achieved so far (in %)

Effectiveness of  
policy support

Impact of policy

The rooftop target achieved so far  
(in %)

What it measures	Rooftop target achieved so far denotes the existing installed capacity of rooftop solar in a state.						
Rationale for inclusion	The rooftop target achieved so far explains the current status of the state in terms of installation of rooftop solar panel system. A high target achieved implies that technology has been present for long in the state and most of the hurdles, which crop up in the initial stage, have been sorted out. A state having a high ranking based on rooftop target achieved so far shall have an edge in terms of attractiveness, technology setup, supply and demand side market, and favorable policies for interested stakeholders. This could also serve as a source of information/indication for stakeholders for untapped areas having high potential.						
Mode of measurement	The installed capacity as a fraction of the rooftop solar targets, expressed in percentages, have been taken for analysis. Score to individual state was assigned by normalizing data on a scale of 0 to 100.						
Scoring criteria	Higher is better	Unit of measurement	%	Range	Lowest - 0.02% Highest - 28.37%	Time period	FY19-20
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ Bridge to India's solar rooftop map</li> <li>▶ Grid connected solar rooftop and small solar power plants program documents as published by the Ministry of New and Renewable Energy</li> </ul>						

## 3. Investment climate for rooftop solar sector

How well a state is positioned for investment opportunities in this sector?

## Share of C&I consumers in total rooftop solar installation in the state

Investment climate for  
rooftop solar sector

Driver for rooftop  
solar uptake

Share of C&I consumers in  
total rooftop solar installation

What it measures	The share of C&I consumers denotes the fraction of the total consumer base that comprises of C&I consumers in the total RTS installation in the state.						
Rationale for inclusion	The electricity bill comprises of majority of the operational costs for any commercial and institutional (C&I) player. Unreliable supply of electricity and high electricity tariffs are the major reasons for high electricity cost. The tariffs are on a higher side for C&I consumers as compared to residential consumers. Thus, installing a rooftop solar system makes it more economical for C&I consumers to not just cut costs but also to explore solar energy as another revenue stream. The more is the proportion of C&I consumers, the more is the scope for installing rooftop solar systems.						
Mode of measurement	rooftop solar capacity installed by C&I consumers divided by the overall rooftop solar installed capacity, expressed in percentage. Score to the individual state was assigned by normalizing the data on a scale of 0 to 100.						
Scoring criteria	Higher is better	Unit of measurement	%	Range	Lowest- 46.7% Highest - 93.7%	Time period	FY19-20
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ Bridge to India's solar rooftop map</li> </ul>						

## Percentage of T&amp;D losses

Investment climate for  
rooftop solar sectorDriver for rooftop  
solar uptake

Percentage of T&amp;D losses

What it measures	When power has to be distributed in DISCOM circles, it undergoes losses in the form of transmission and distribution (T&D) due to mechanical inefficiencies in the system, theft, pilferage, etc. This indicator measures the quantum of T&D losses incurred by DISCOMs.						
Rationale for inclusion	rooftop solar enables in-situ generation and consumption of power, which avoids transporting power over distances, hence saving on T&D losses. Higher the quantum of T&D losses for a DISCOM, higher will be the DISCOM's inclination towards adopting RTS.						
Mode of measurement	The T&D losses in percentages for states are compared. Score to the individual state was assigned by normalizing the data on a scale of 0 to 100.						
Scoring criteria	Higher is better	Unit of measurement	%	Range	Lowest- 6.08 Highest- 55.5	Time period	FY18-19
Data source: (Secondary)	► Power Finance Corporation Ltd.'s report on Performance of State Power Utilities 2018-19						

## Ease of securing loans for installing RTS systems

Investment climate for  
rooftop solar sector

Ease of financing

Ease of securing loans

What it measures	Ease of securing loans gauges the availability and accessibility of obtaining financial assistance by an average investor.						
Rationale for inclusion	Ease of securing loans is indicative of the availability of loans in the market for switching to the solar rooftop system to source power directly. Since the initial investment required for setting up this system is high, it emerges as an important parameter in gauging how the existing infrastructure is placed while planning the move to solar rooftop systems.						
Mode of measurement	The qualitative data has been quantified on a scale of one to five based on the response to the following questions: How easily can loans be availed for rooftop solar installations compared to other loans such as home/car/education? 1-Very difficult 2-Difficult 3-Medium 4-Easy 5-Very easy						
Scoring criteria	Higher is better	Unit of measurement	Scale of 5	Range	Lowest - 1 Highest - 5	Time period	FY 19-20
Data source: (Primary)	► Survey responses from questionnaires developed by the SARAL team for state consultations ► Answered by: developers and lenders						

## Availability of RTS system insurance providers in the state

Investment climate for  
rooftop solar sector

Ease of financing

Availability of insurance  
providers for RTS projects

What it measures	Insurance providers attempt to portray how can an interested party get insurance for RTS.						
Rationale for inclusion	For most MSMEs, the energy cost comprises of majority of operational costs. An unreliable supply of electricity and high electricity tariffs are the major reasons that increase this cost. Scoring indicators such as insurance providers give an insight into the risk appetite for debt financing and availability of insurance policies for rooftop solar investments. The indicators shall also take into consideration the schemes provided by the government in each state, Small Industries Development Bank of India (SIDBI) and non-banking financial companies' involvement, loan disbursement time, etc. Each state shall then be ranked based on all these variables favoring investments in rooftop solar.						
Mode of measurement	<p>The qualitative data has been quantified on a scale of one to five based on the responses to the following question: Are there any specialized insurance companies providing insurance services especially for rooftop solar installation in your state? How is their presence?</p> <p>1-Very low 2-Low 3-Medium 4-High 5-Very high</p>						
Scoring criteria	Higher is better	Unit of measurement	Scale of 5	Range	Lowest - 1 Highest - 5	Time period	FY 19-20
Data source: (Primary)	<p>► Survey responses from questionnaires developed by the SARAL team for state consultations</p> <p>► Answered by: developers</p>						



## 4. Consumer experience

What is perception, acceptance and experience of consumers in this sector?

### Consumer awareness

Consumer experience

Pre-installation  
consideration

Consumer awareness

What it measures	Level of consumer awareness captures the acceptance and readiness of consumers towards installation a rooftop solar system on their roofs.						
Rationale for inclusion	A high level of consumer acceptance is pivotal for installation of solar rooftop to gain momentum. Awareness of benefits, procedures and approvals for rooftop solar systems are key determinants for the offtake of this alternative sources of energy. Hence, this is one of the key considerations for the index.						
Mode of measurement	Consumer awareness has a positive impact on the installed RTS capacity. Qualitative data has been quantified on a scale of one to three based on the responses to the following question: How are consumers cognizant of rooftop solar technology and their benefits? 3-High level of consumer awareness 2-Medium level of consumer awareness 1-Low level of consumer awareness						
Scoring criteria	Higher is better	Unit of measurement	Scale of 3	Range	Lowest - 1 Highest - 3	Time period	FY 19-20
Data source: (Primary/ Secondary)	<ul style="list-style-type: none"> <li>▶ Survey responses from questionnaires developed by SARAL team for state consultations</li> <li>▶ Answered by: DISCOMs, SNAs and developers</li> <li>▶ State governments (SNA/DISCOM) website</li> <li>▶ News articles</li> </ul>						

### Tariff rise for end consumers

Consumer experience

Pre-installation  
consideration

Tariff rise for end consumers

What it measures	Tariff rise captures the increase in the price of a unit of electricity in last four years for end consumers.						
Rationale for inclusion	With surge in tariffs, the attractiveness and affordability of grid electricity start to decrease for end consumers. This is particularly true for C&I consumers, where price of electricity is a crucial component of their overall operational cost. This decreased attractiveness of grid electricity could result in an opportunity for proliferation of rooftop solar energy as a viable and price-competitive source of energy.						
Mode of measurement	Tariff rise is tabulated as CAGR for past three years which is a better indicator of growth over multiple time periods. To arrive at per unit price of electricity, simple average of tariff for low tension and high-tension industry is taken. For states with multiple DISCOMs, weighted average tariff is calculated with the number of consumers served as weights. Score to individual states was assigned by normalizing the data on a scale of 0 to 100.						
Scoring criteria	Higher is better	Unit of measurement	%	Range	Lowest - 8.80 Highest - 52.56	Time period	FY 19-20
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ State's tariff order for respective years</li> </ul>						

## Capacity-building workshops conducted for entrepreneurs/consumers on rooftop solar

Consumer experience

Pre-installation  
consideration

Capacity-building workshops

What it measures	rooftop solar is a relatively niche technology for many stakeholders. It is seen that DISCOM officials from many far-flung districts in a state are not aware of the key characteristics of RTS. Workshops are of utmost importance to make DISCOMs aware about RTS. This indicator measures the awareness and readiness of DISCOMs for promoting RTS in the state.						
Rationale for inclusion	A few multilateral developmental agencies are involved in conducting workshops for DISCOM officials as part of technical assistance programs. Greater coverage of employees through these workshops indicate greater understanding of the technology amongst employees and their readiness to implement it on-ground.						
Mode of measurement	The data has been quantified on scale of zero and one. 1- Workshop conducted 0 - Workshop has not been conducted						
Scoring criteria	Higher is better	Unit of measurement	Scale of 2	Range	Lowest - 0 Highest - 1	Time period	FY 19-20
Data source: (Primary/ Secondary)	<ul style="list-style-type: none"> <li>▶ Survey questionnaires for SNAs/DISCOMs</li> <li>▶ State governments (SNA/DISCOM) websites</li> <li>▶ Reports from multilateral development agencies</li> <li>▶ News articles</li> </ul>						

## Ease of execution: from application to installation

Consumer experience

During installation

Ease of execution:  
from application to installation

What it measures	The indicator captures the experience of a prosumer while installing a rooftop solar system – from the application stage till the system is up and running.						
Rationale for inclusion	The perceived challenges and cost associated with installation of a rooftop solar system determine its attractiveness as an alternative source of energy. If the cost, time and efforts outweigh the benefits, then few people would be interested in investing in a rooftop solar system. In that case, large scale proliferation will never take place. Thus, ease of execution becomes a key parameter in determining the attractiveness of a state for its rooftop solar potential.						
Mode of measurement	The qualitative data has been quantified on a scale of one to three, based on the responses to following question: Consumers face a hassle-free process from application to commissioning in the state: Score 3: Yes Score 2: Neutral Score 1: No						
Scoring criteria	Higher is better	Unit of measurement	Scale of 3	Range	Lowest - 1 Highest - 3	Time period	FY 19-20
Data source: (Primary/ Secondary)	<ul style="list-style-type: none"> <li>▶ Survey responses from questionnaires developed by the SARAL team for state consultations</li> <li>▶ News articles</li> </ul>						

## Time-bound grievance redressal mechanism (GRM)

Consumer experience

Post-installation  
experience/costsTime-bound grievance  
redressal mechanism (GRM)

What it measures	It measures the availability of a platform to address complaints and issues to avail services related to application and installation of RTS more effectively.						
Rationale for inclusion	Presence of a GRM ensures consumers have greater faith that a proper system is available in their service.						
Mode of measurement	The data has been quantified on a scale of zero and one, based on the presence of GRM system in state.						
Scoring criteria	Higher is better	Unit of measurement	Scale of 2	Range	Lowest - 0 Highest - 1	Time period	FY 19-20
Data source: (Primary/ Secondary)	<ul style="list-style-type: none"> <li>▶ State governments websites</li> <li>▶ News articles</li> <li>▶ Survey questionnaires</li> </ul>						

## Warranty and aftersales experience

Consumer experience

Post-installation  
experience/costs

Warranty and aftersales experience

What it measures	This indicator captures the experience of a prosumer in terms of warranty and aftersales services after installing a rooftop solar system.						
Rationale for inclusion	The life of a rooftop solar system is expected to be around 20-25 years. Solar panels may have a warranty clause and a long life expectancy means that warranty and aftersales experience will have a great bearing on the offtake potential of rooftop solar. If the experience of prosumers has been bad so far, word of mouth may result in lesser number of new prosumers investing in an RTS installation.						
Mode of measurement	<p>The qualitative data has been quantified on a scale of one to three based on response to following question:</p> <p>Are consumers satisfied with warranty and aftersales services?</p> <p>Score 3: Agree</p> <p>Score 2: Neutral</p> <p>Score 1: Disagree</p>						
Scoring criteria	Higher is better	Unit of measurement	Scale of 3	Range	Lowest - 1 Highest - 3	Time period	FY 19-20
Data source: (Primary/ Secondary)	<ul style="list-style-type: none"> <li>▶ Survey responses from questionnaires developed by the SARAL team for state consultations</li> <li>▶ Answered by: DISCOMs, SNAs and developers</li> </ul>						

## 5. Business ecosystem

How supportive is the law and order, and infrastructure for any business in the state?

### Ease of doing business (EODB) index

State's Business Ecosystem

Business enablers

Ease of doing business index

What it measures	The Ease of doing business index makes an assessment of state implementation. The Business Reform Action Plan 2018-19 includes 180 reform points covering 12 business regulatory areas such as access to information, single window system, labor, environment, etc.						
Rationale for inclusion	The EODB index is indicative of how friendly the state is for setting up a business and not just rooftop solar sector. It paints the real picture of the business ecosystem and progress made by the states in improving their investment climate. It is particularly relevant for large scale rooftop solar projects.						
Mode of measurement	The EODB index is based on the assessment of state implementation of business reforms as measured by the implementation percentage. Score was assigned to states individually by normalizing the data on a scale of 0 to 100.						
Scoring criteria	Higher is better	Unit of measurement	Index scores states	Range	Lowest - 1 Highest - 36	Time period	FY19
Data source: (Primary/ Secondary)	► Business Reform Action Plan, a ranking by the Department for Promotion of Industry and Internal Trade (DPIIT)						

### NCAER's rating of state economies

State's Business Ecosystem

Business enabler

NCAER's ratings of state economies

What it measures	The NCAER's State Investment Potential Index 2018 is the second edition in the annual series of rankings of states on their growth and investment potential done by the National Council of Applied Economic Research (NCAER).						
Rationale for inclusion	The NCAER State Investment Potential Index 2018 is a systematic and evidence-based index that assesses competitiveness of states on 50 parameters grouped under six broad pillars: land, labor, infrastructure, economic climate, governance and political stability, and business perceptions. This index provides a single composite score that gives a holistic view of how the states are positioned to encourage and attract investment. It is valid to assume that investments into rooftop sector too will flow in those states which are attracting investors in other sectors as well.						
Mode of measurement	The scores have been taken directly taken from the NCAER's State Investment Potential Index 2018. It covers only 20 states and one UT (Delhi). For others, the imputation of data was done. Score to the individual state was assigned by normalizing the data on a scale of 0 to 100.						
Scoring criteria	Higher is better	Unit of measurement	Index score out of 100	Range	Lowest - 33 Highest - 56	Time period	FY18
Data source: (Secondary)	► National Council of Applied Economic Research's State Investment Potential report						



## GSDP per capita

State's Business  
Ecosystem

Economic outlook

GSDP per capita

What it measures	GSDP per capita is a measure of economic output of an economy that takes gross state domestic product (GSDP) and divides it by the number of people.						
Rationale for inclusion	GSDP per capita is reflective of the health of economy and the living standards of its people. It is used for comparing one state to another, because it shows the relative socio-economic performance of the states. High GSDP per capita implies that the residents have means to switch to an alternative source of energy if they see long-term gains even if it means an initial investment on their part. Therefore, implying the potential for growth of the solar power sector in such areas should be high.						
Mode of measurement	GSDP per capita for FY18 has been taken at current prices with FY12 as the base year. Score to the individual state was assigned by normalizing the data on a scale of 0 to 100.						
Scoring criteria	Higher is better	Unit of measurement	INR	Range	Lowest - 40,982 Highest - 4,30,081	Time period	FY18-19
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ Economic and Statistical Organization, Punjab</li> <li>▶ Central Statistical Organisation, New Delhi</li> </ul>						



## GSDP growth

State's Business  
Ecosystem

Economic outlook

GSDP growth

What it measures	The GSDP growth measures the increase in GSDP of a state over the period of last five years.						
Rationale for inclusion	The GSDP growth experienced by an economy has always been considered by the government and economic decision-makers for planning, policy formulation and taking investment decisions. High GSDP growth indicates an increase in production, spending and general prosperity of the state. Thus, a state, which is well-off, has more opportunities for all kinds of investment projects. For rooftop solar projects too, states that have more financial muscle are likely to attract more investments.						
Mode of measurement	GSDP growth is tabulated as a CAGR for past three years which is a better indicator of growth over multiple time periods. Score to individual states was assigned by normalizing the data on a scale of 0 to 100.						
Scoring criteria	Higher is better	Unit of measurement	%	Range	Lowest - 1.92% Highest - 14.4%	Time period	FY18-19
Data source: (Secondary)	<ul style="list-style-type: none"> <li>▶ Economic and Statistical Organization, Punjab</li> <li>▶ Central Statistical Organisation, New Delhi</li> </ul>						

# Annexure II:

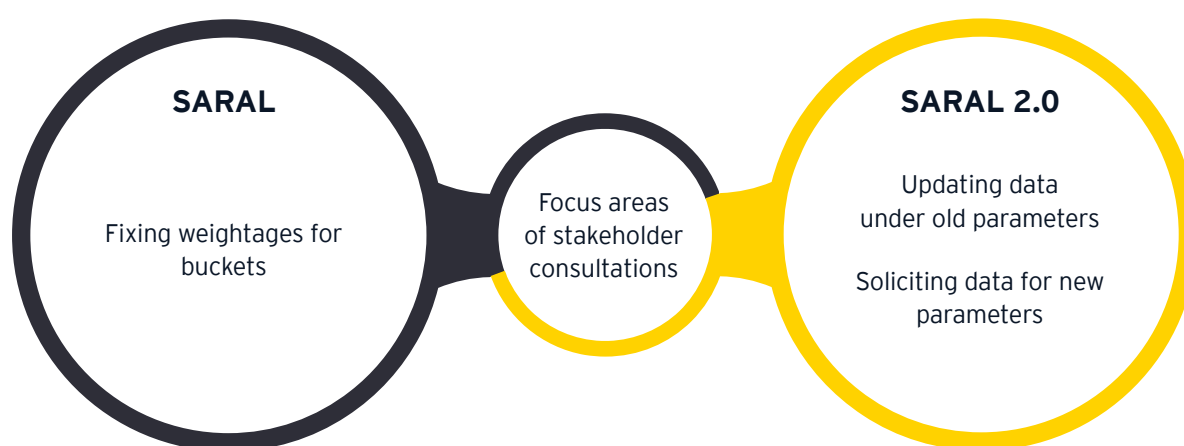
*State consultations and  
regional workshops*

# Summary of state consultations

## Introduction

In order to achieve its intended benefits, visibility and acceptance of the SARAL 2.0 index, amongst various industry stakeholders, is of utmost importance. The stakeholders can provide invaluable insights for building the index. To achieve this, the SARAL 2.0 project team reached out to the states to solicit their opinions and concerns over the index as part of exercise spanning over SARAL and SARAL 2.0.

**Figure 10: Focus areas of stakeholder consultations**



Source: EY analysis

## Stakeholders contacted

The SARAL index is based on equity to bring in objectivity and fairness to the model. With this aim in mind and to portray a comprehensive picture, the EY team reached out to different stakeholders in different states and captured the data holistically. The following stakeholders were consulted to solicit responses:

- ▶ State electricity regulatory commission
- ▶ State nodal agencies
- ▶ Distribution companies (DISCOMs)
- ▶ Developers

## Mode of interaction

State consultations were done either in person and over e-mails and/or telephones. The face-to-face interactions under SARAL 2.0 were comparatively reduced due to the restrictions imposed by government due to the COVID-19 pandemic.



## Collation of the responses/inputs

### Objective

The interactions under SARAL involved soliciting feedback from stakeholders regarding their preference for parameters and their weightages. This ultimately helped in preparing the index with appropriate weightages assigned to buckets, sub parameters and scoring indicators.

The interactions under SARAL 2.0 focused more on collecting data and opinions from stakeholders to update the model with fresh parameters and underlying data.

### Methodology

The project team prepared detailed questionnaires. Meetings or interviews were guided by these questionnaires as well as general discussions arising out of the interactions. The team analyzed the responses so collected to drive out meaningful insights.

## Analysis and findings

### Consultation under SARAL

One of the main objectives of state consultations was to confirm the validity of the five drivers/parameters on which the SARAL model is built and also to capture the relative importance of these drivers. The weightages assigned to each driver/parameter was arrived after assessing the importance different stakeholders gave to them.

The purpose of this consultation was to gauge the mindset of the stakeholders and their perceived importance of the different drivers/parameters to have a bearing on the solar rooftop sector in their states. The inputs collected and collated were analyzed to arrive at the weightages for the drivers/parameters.

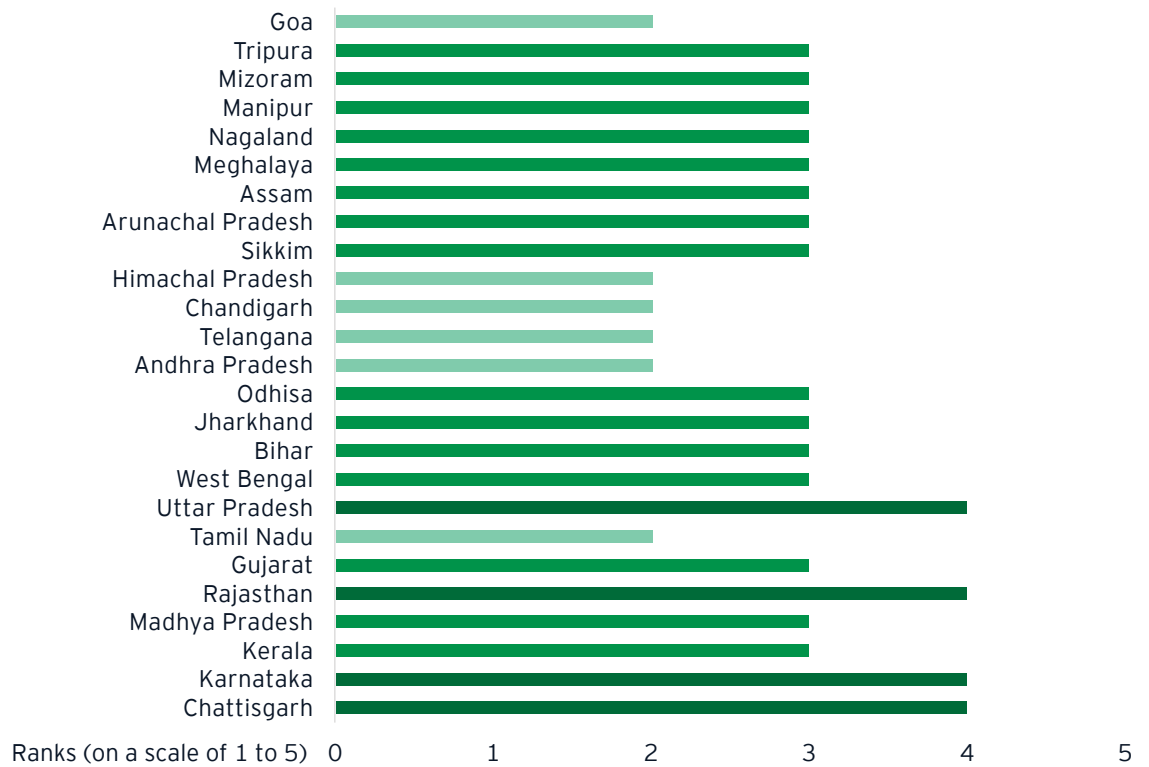
Each stakeholder gave its own ranking (from one to five) for the five buckets. After qualitative assessment and analysis of their interactions, the EY team obtained the relative ranking of these buckets for all the 28 states and 3 UTs. The process followed by EY to arrive at the weightages is illustrated through the following example:

**Illustration:** For simplification purposes, it is assumed that the states under consideration are only four. The bucket “Robustness of policy framework” receives the following ranks from the four states – 4, 5, 3 and 4. The sum of these ranks is 16. The grand sum should be equal to the sum of the ranks, i.e., 1 to 5 (sum is 15) multiplied by the number of states considered (4). This amounts to 60 (15\*4). The relative importance of this driver is reached by dividing the sum of ranks for this driver divided by the grand sum. This comes out to be 27% that will be the weight for this driver.

The distribution of preferences of states on the buckets are summarized in the following response graphs:

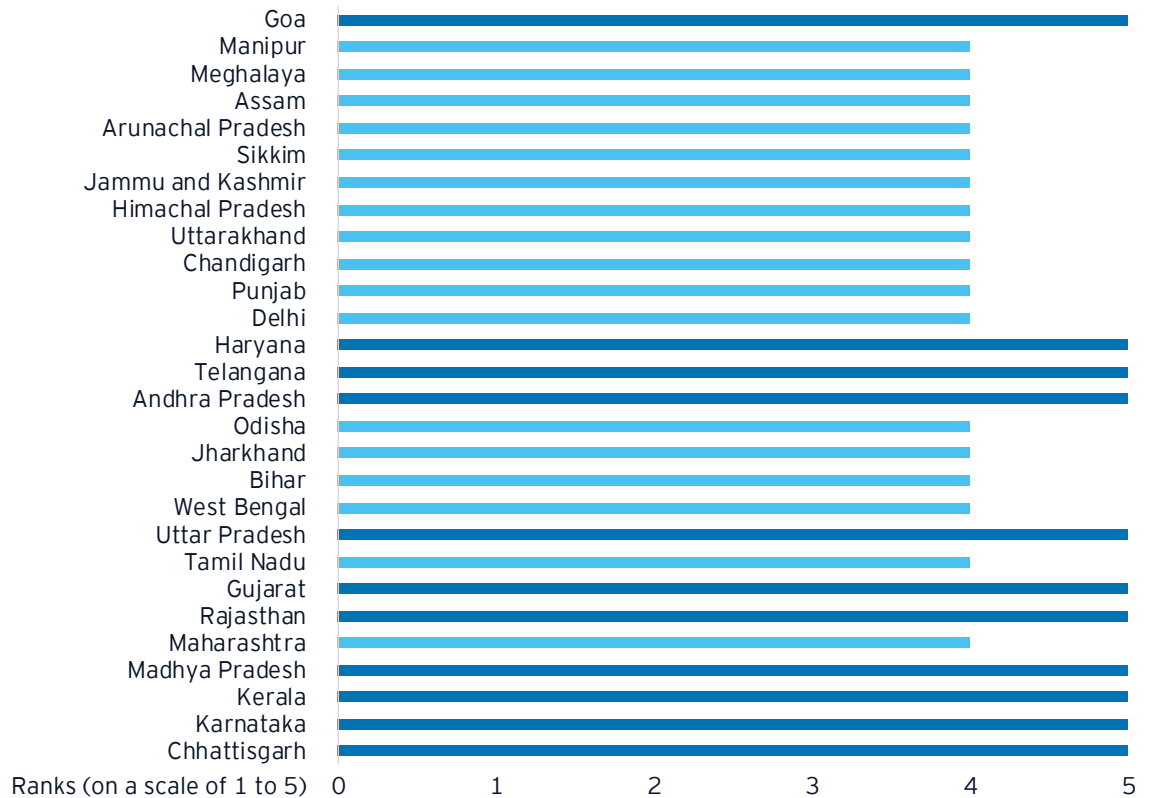
**State-wise ranks given to the parameter "robustness of policy framework"**

Source: EY analysis



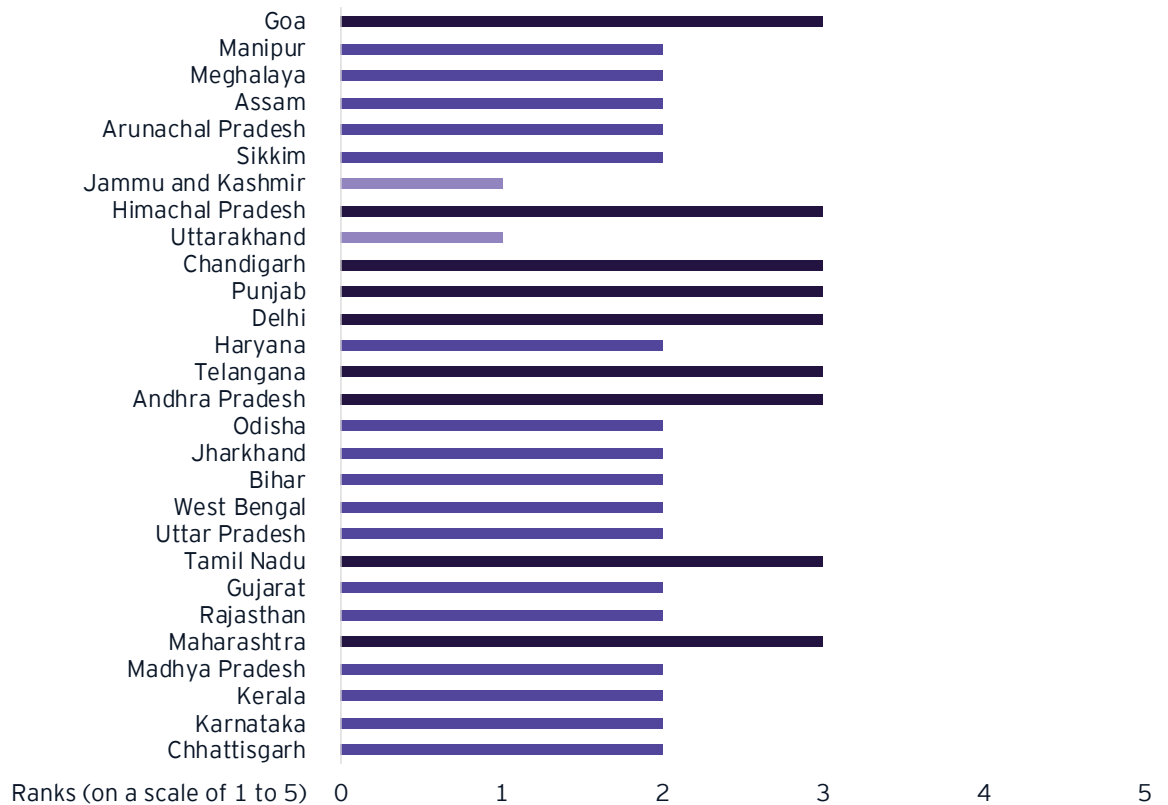
**State-wise ranks given to the parameter "effectiveness of policy support/implementation"**

Source: EY analysis



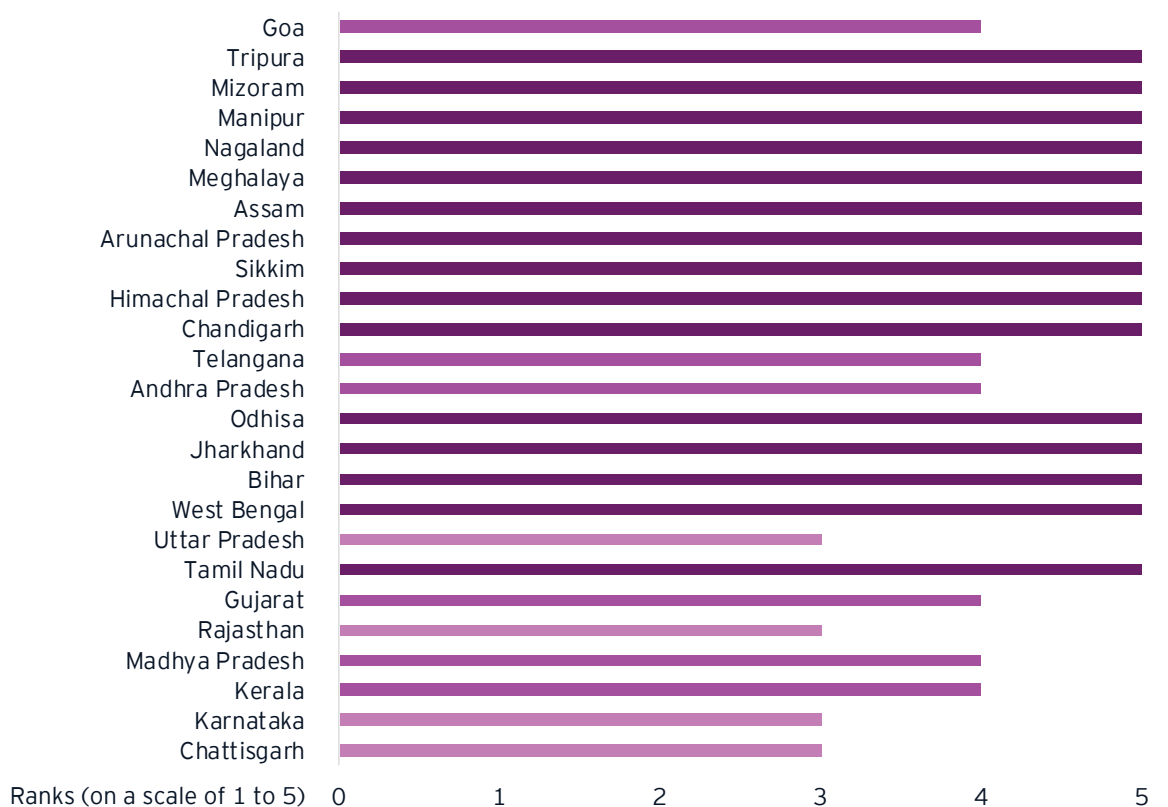
### State-wise ranks given to the parameter "investment climate"

Source: EY analysis



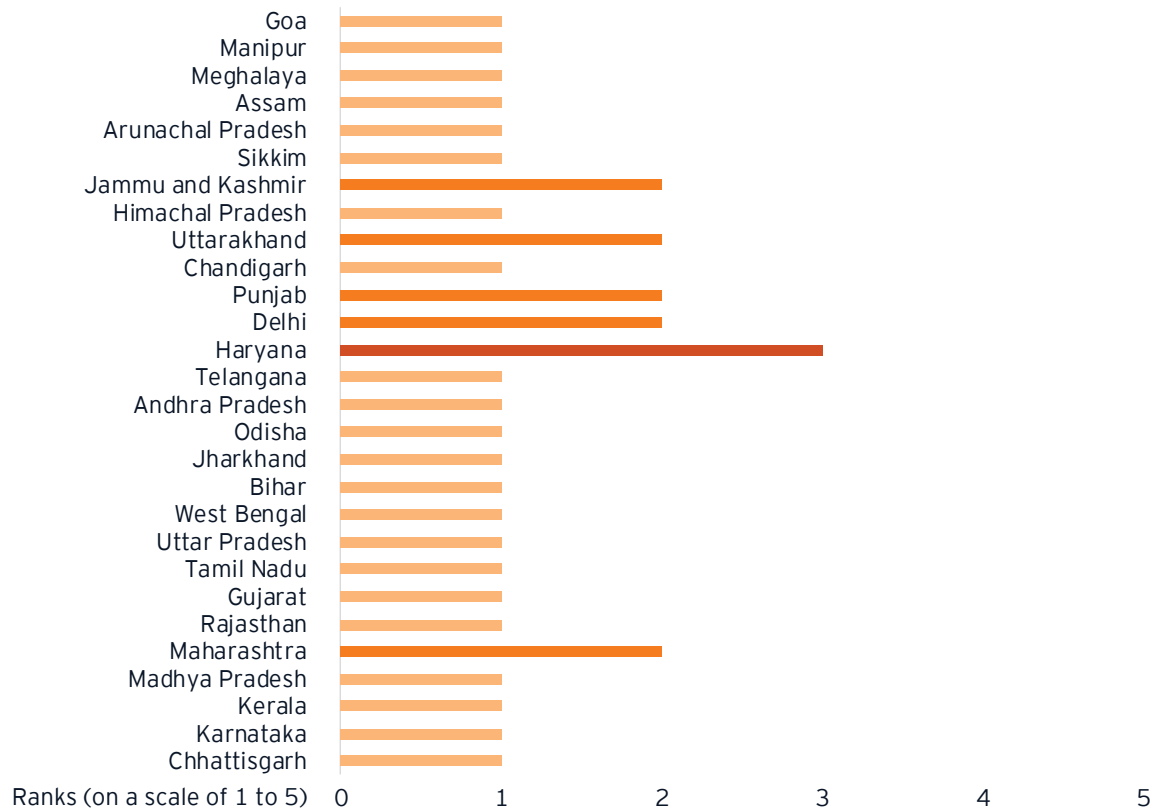
### State-wise ranks given to the parameter "consumer experience"

Source: EY analysis



## State-wise ranks given to the "business ecosystem"

Source: EY analysis



The overall message was that the buckets "effectiveness of policy support/implementation" and "consumer experience" hold the most significance for wide range of stakeholders who were consulted across the states.

## Consultation under SARAL 2.0

The overall preference for buckets under SARAL has largely been followed under SARAL 2.0 too, with a slight modification done to weightage numbers, without tampering the preference/order of the buckets.

Consultation under SARAL 2.0 has been focused on updating the index with fresh parameters, by collecting the data required for these parameters, as well as for updating the old parameters.

The change in the rooftop solar scenario after the inception of MNRE Phase-II scheme was made evident from the discussions with the stakeholders. The renewed significance of DISCOMs, being at the heart of rooftop solar initiatives, was driven home through the discussions. Accordingly, new scoring indicators to measure the performance of DISCOMs with reference to Phase-II regulations have been discussed with stakeholders and finally included. These new scoring indicators have been illustrated in an earlier section of the report.

Another major aspect covered through these consultations pertains to updating the data from old to new parameters. A few topics touched upon during the course of the consultations are:

- ▶ Whether state DISCOMs have created an RTS cell as per the provisions of the MNRE Phase-II scheme or DRE cell.
- ▶ Whether state DISCOMs have conducted workshops for entrepreneurs/consumers.
- ▶ Whether states have any promotional rooftop solar installation schemes/notifications for government buildings
- ▶ Whether there are any medium-/long-term rooftop solar deployment targets for DISCOMs.
- ▶ What is the average time taken from date of application to system installation in a concerned DISCOM's territory?



## Regional workshop: western region (virtual)

### SARAL 2.0: The State Rooftop Solar Attractiveness Index

1<sup>st</sup> Regional Workshop  
(Western region)

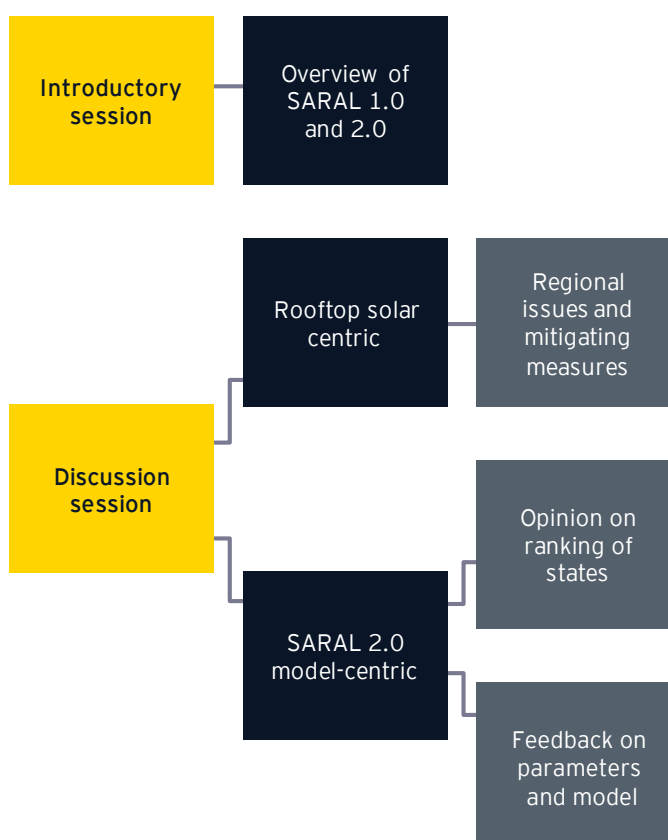
01 September 2020



The workshop for the western region was conducted with stakeholders majorly from the western region. The workshop saw enthusiastic participation from more than 30 participants.

The workshop was structured around the following broad themes:

- ▶ Overview of SARAL and SARAL 2.0
- ▶ Generic discussion on rooftop solar issues with a regional flavor
- ▶ Discussion and feedback session on SARAL 2.0's models and parameters



## Introductory session

At the very outset, the EY team gave a brief outline of the work that was done under SARAL and the extension of that work being executed under SARAL 2.0. The introductory session involved apprising the participants on the following:

- ▶ Brief introduction of the SARAL-2.0 project and its strategic context.
- ▶ Market feedback on SARAL and its launch by the Ministry of New and Renewable Energy, Government of India.
- ▶ Relevant stakeholders involved in SARAL-2.0, their intended objectives and outcomes.
- ▶ Benefits of SARAL 2.0 for stakeholders across rooftop solar value chain.
- ▶ Overview of five broad parameters, sub-parameters and scoring indicators that form a part of the index.
- ▶ Guidance provided by subject matter experts (SMEs) appointed under the steering committee on various aspects of index development

## Discussion session

The introductory session was followed by a detailed discussion on rooftop solar issues and a feedback session on the SARAL 2.0 models and parameters with the participants. The following section presents a brief on the discussion carried out during this session.

**Discussion:** What are the key barriers hindering the uptake of rooftop solar (RTS) in India?

According to the panel, a few key barriers hindering uptake of RTS in India are:

- ▶ Subsidy schemes cannot support the sector for a long period. However, in the absence of subsidies and considering high upfront costs, accessing debt finance is a hassle.
- ▶ Challenges in the residential segment in getting access to roof area as people use their roofs for other household purposes.
- ▶ Delay in release of subsidies create hurdles because of stringent administrative procedures and lack of accountability on the part of SNAs in disbursing subsidies.
- ▶ For developers, the smaller size of rooftop solar system, the higher is the cost of procurement and installation of system due to non-uniform characteristics of rooftop and fragmented distribution of installations. For the same reason, access to finance for small rooftop developers becomes a challenge.
- ▶ The creditworthiness of solar developers and consumers is a major concern for financiers when it comes to RTS owing to its small and distributed nature.

**Discussion:** What are the key barriers that hinder the uptake of rooftop solar in the western region of India?

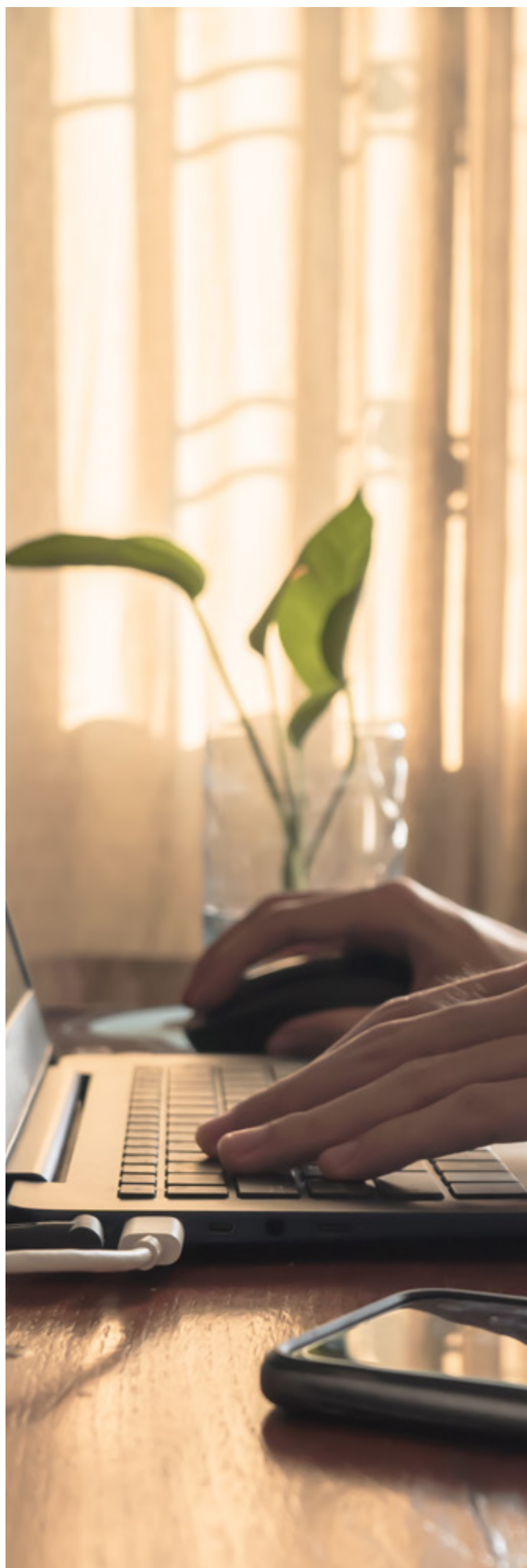
The panel suggests the following observations as key barriers:

- ▶ Limited awareness and understanding of RTS among consumers
- ▶ High cost and short payback periods
- ▶ No business model for consumers with shared roof spaces or with suitable shadow-free roofs to avail the benefits of solar energy
- ▶ Lack of information on how to select a project developer and limited interaction between the utilities and end consumers
- ▶ Limited reach and appeal of the net-metering program in states due to scanty marketing and outreach campaign

**Discussion:** How rooftop solar deployment can be catalyzed to achieve the target of 40GWp installations by December 2022?

The MNRE Phase-II scheme have been circulated to give an impetus to the ailing rooftop solar sector. The participants were of the view that if DISCOMs invest and follow the guidelines, it will help in achieving the set target of 40GW rooftop solar installations in the country by 2022.

They also opined that favorable net metering policies, corporate social responsibility programs and increased consumer awareness can help in promoting the sector.



**Discussion:** What factors would you consider while ranking Indian states on their rooftop solar attractiveness?

The panel opined that attractiveness of states can be measured on the following lines:

- ▶ How well is a state growing in terms of rooftop solar installation and promotion in the region.
- ▶ Whether the state government at all levels, leadership bodies, non-governmental organizations and financial institutions is working together to strengthen and advance regulations and is providing an aspirational vision.
- ▶ The incentives and measures in place to ensure scalability of the solar system, so that SPDs can open new avenues to cleaner and more sustainable form of energy.
- ▶ Awareness levels of end consumers regarding business models of rooftop solar and their benefits and modalities involved, from applying for installation to commissioning of the project.
- ▶ The conduciveness of solar policies and regulations in the state, as they have a direct impact on the growth of the rooftop solar systems.
- ▶ Viability of state-accepted business models in proliferation of rooftop solar systems, as economic viability of business models varies with several parameters like consumer consumption slab, system size, ownership and mode of financing.
- ▶ Ease of availing state subsidy for a prosumer.

**Discussion:** What factors would you consider while ranking Indian states on their rooftop solar attractiveness?

Feedback on the SARAL 2.0 model, preference of buckets to assess rooftop attractiveness

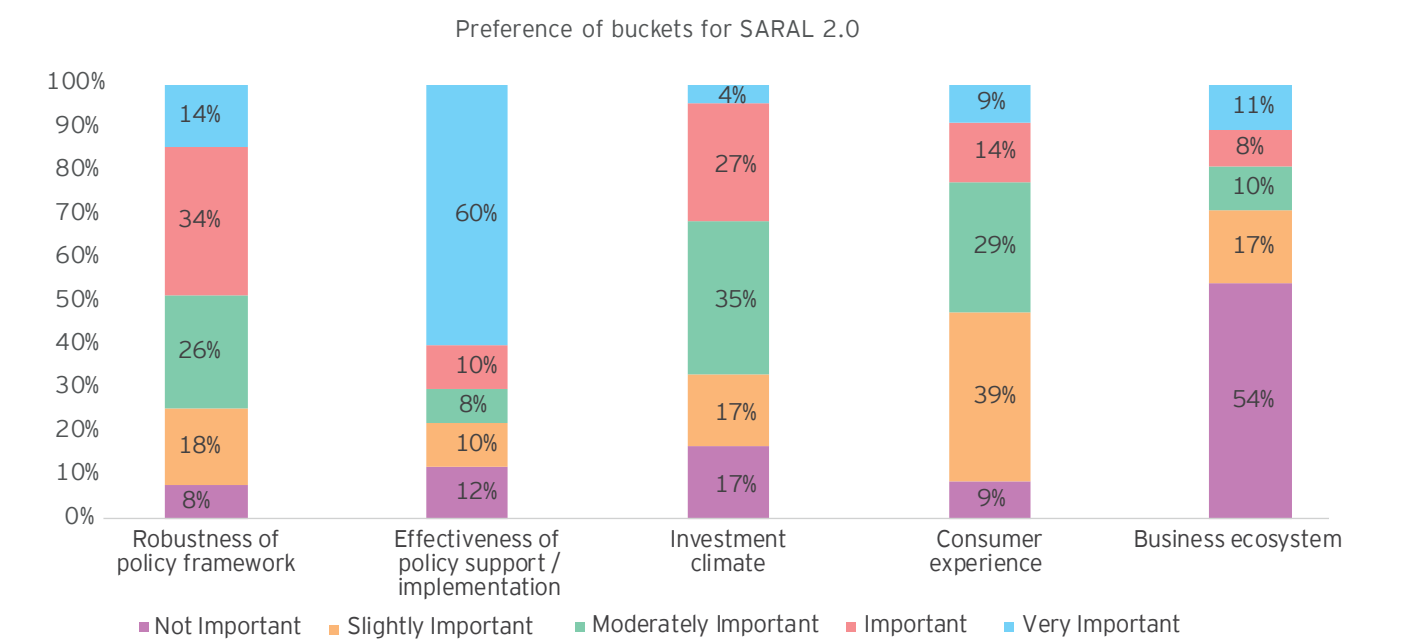
- ▶ The panelists expressed that the buckets “Robustness of policy framework” and “Implementation of policy” can be the guiding parameters for the index.
- ▶ The bucket “state’s business ecosystem” may have the least impact as most of the data collected are from the past years that is not changeable.
- ▶ The participants accorded the following order of preference for the five buckets:
  - ▶ Effectiveness of policy support/implementation
  - ▶ Robustness of policy in the state
  - ▶ Consumer experience
  - ▶ Investment climate
  - ▶ State’s business ecosystem

Moreover, feedback was solicited from participants on key issues by noting their responses to a questionnaire. While garnering this, an online survey form was circulated to understand stakeholders' opinion about various aspects of rooftop solar. Following is the feedback:

1

Which is the most important bucket for evaluating the state ranking for rooftop solar?

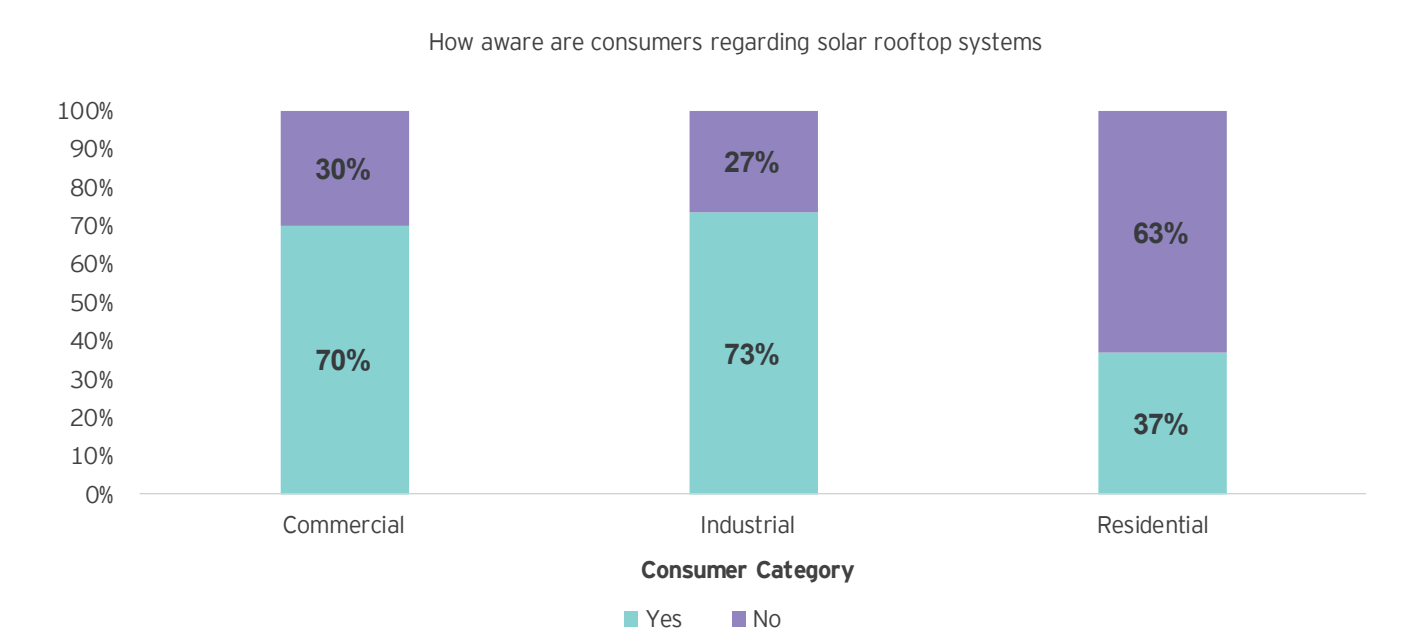
- Seventy percent of the participants said that the effectiveness of state policy implementation in the SARAL 2.0 index is an important bucket. Forty eight percent also said that robustness of policy framework is another important bucket to consider while ranking the states.



Source: EY analysis

2

Are customers in the different consumer categories aware of solar rooftop systems?



Source: EY analysis

- More than 63% of the participants believe that residential rooftop solar sector needs support and beset with challenges such as lack of consumer awareness.

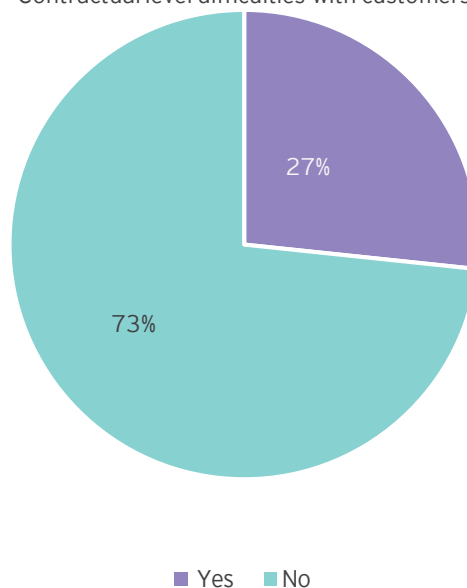


3

### Are there any contractual level difficulties with customers for EPC contract?

- ▶ Around 73% participants believe that there is a contractual level difficulty with customers for EPC contract, the prosumers are mostly not happy with the contractors, which mean lower consumer satisfaction.

Contractual level difficulties with customers

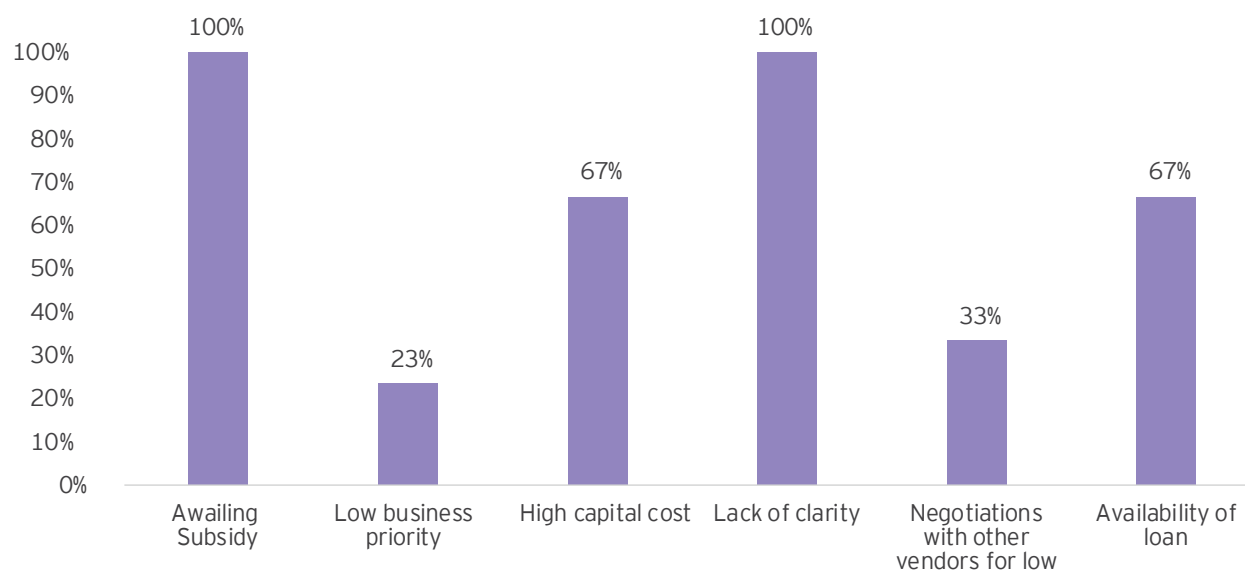


Source: EY analysis

4

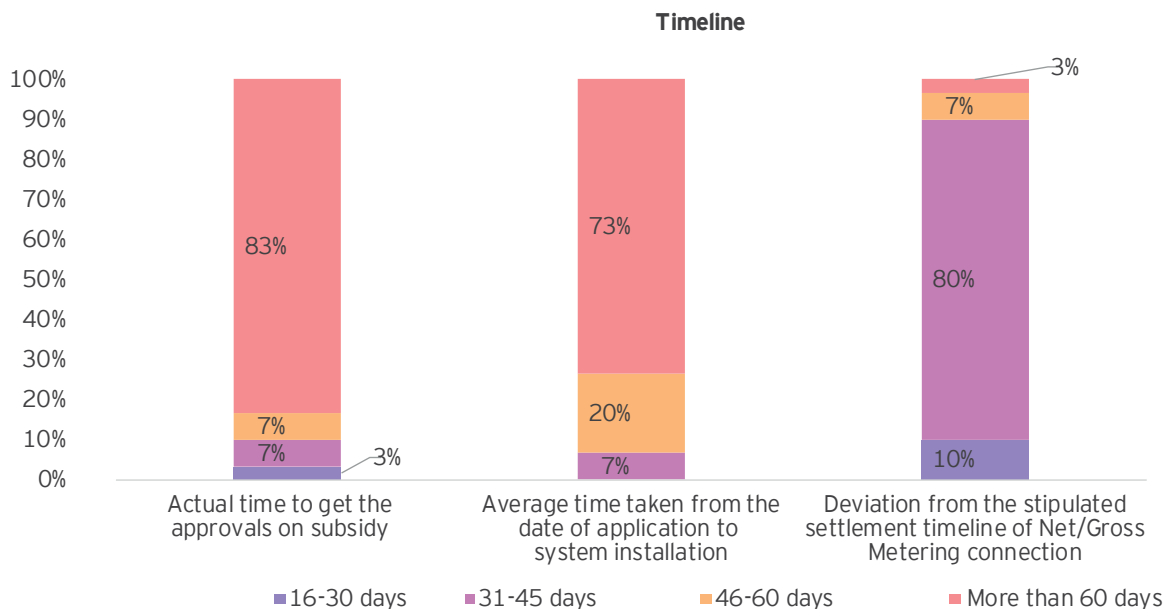
### What are the issues in customer acquisitions?

Issues in customer acquisitions



Source: EY analysis

- ▶ The participants were asked to give feedback on the issues they face in customer acquisitions. The participants ranked "Awaiting subsidy" provided by the state/central governments availed by developers after commissioning the system as the biggest hurdle. "Lack of clarity" in regulations on incentives and timelines was another major issue faced during customer acquisitions.



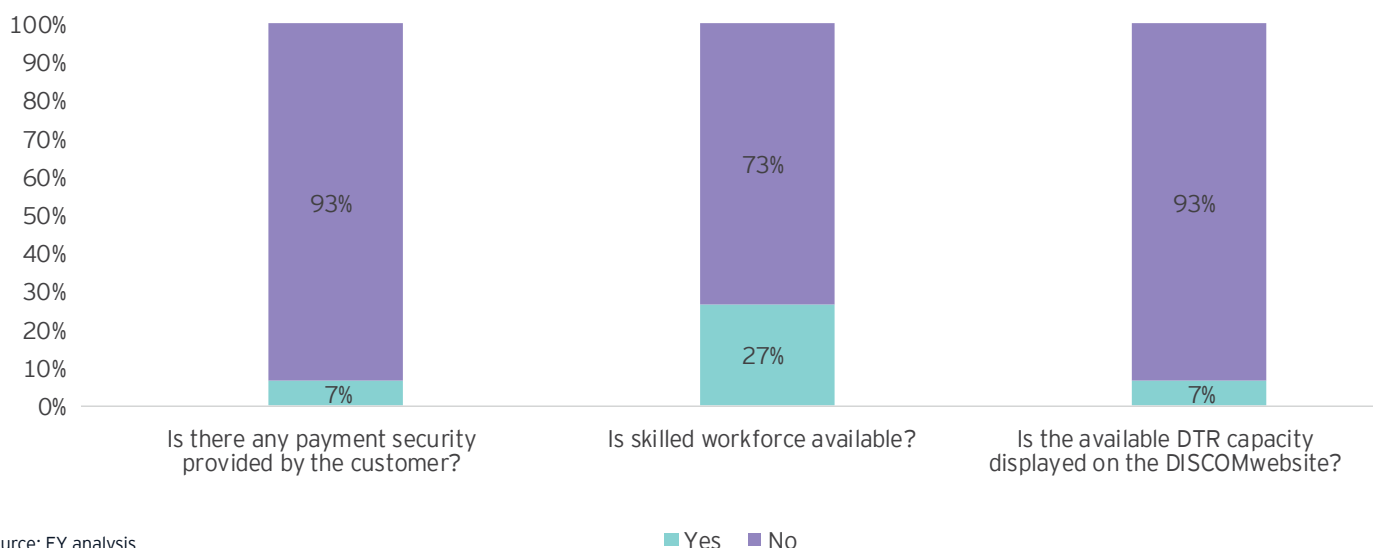
Source: EY analysis

## 5 What is your opinion on delays in following the timeline.

- ▶ Around 83% respondents noted the duration of more than 60 days in “Actual time to get an approval on subsidy”.
- ▶ While 73% said that it takes an average of more than 60 days from applying to installation of the rooftop solar system in the region, irrespective of the system size.
- ▶ Around 80% participants said that there is a “deviation from the stipulated settlement timeline of net/gross metering connection” of 31-45 days.

## 6 Is workforce available in the region, payment security provided by consumers and available DT capacity displayed on a DISCOM’s website?

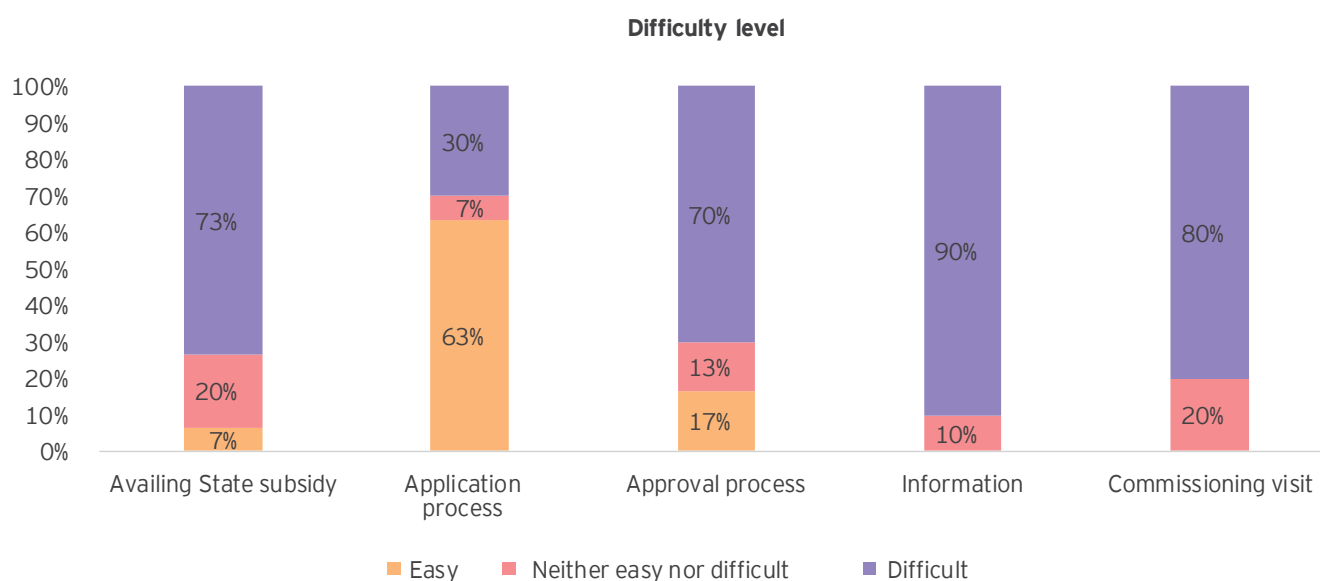
**Availability of payment security, workforce and DTR capacity**



Source: EY analysis

- ▶ As rooftop solar is a consumer-driven sector, majority of the participants believe that having a payment security mechanism may boost trust among the stakeholders. Nearly 93% respondents noted that no payment security is provided by the consumer.
- ▶ Around 73% respondents noted that rooftop solar is still a new technology and solar power developers struggle to get skilled workers.
- ▶ Many states net/gross metering regulations had asked their DISCOMs to display the distribution transformer capacity on their websites but 93% of respondents said DISCOMs do not display the capacity.

## 7 Please rate the following as per the difficulty level.



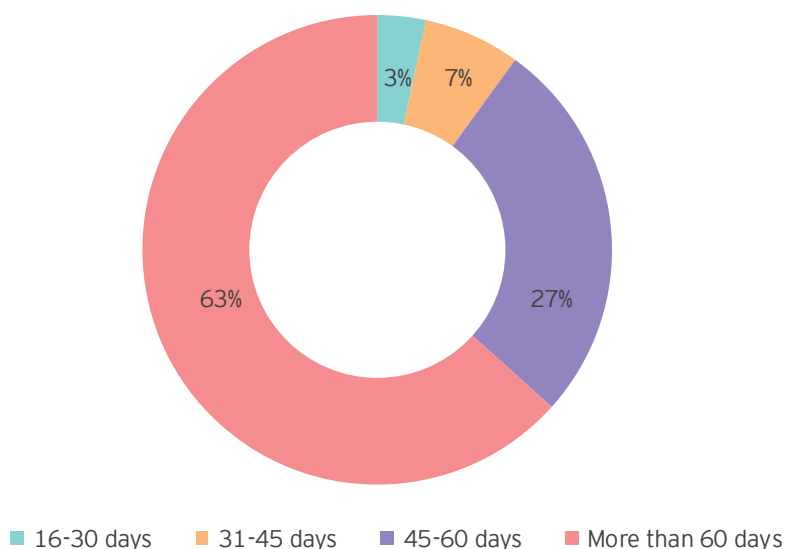
Source: EY analysis

- ▶ Around 73% respondents agree that it is difficult to avail state subsidy.
- ▶ Nearly 63% said that it's easy to apply for solar rooftop installation and added that development of web-based portals, as mentioned in MNRE Phase-II scheme, will infuse scale in the state's solar rooftop project deployment.
- ▶ Around 70% of the respondents said that the approval process is very cumbersome as there are several approvals which are required to install a system.
- ▶ Information availability is an important factor in evaluating offtake potential in a state as solar regulations limit the DT capacity, thus, 90% respondents said it is difficult to get details as DISCOMs never display DT capacity on their websites.
- ▶ Nearly 80% respondents said that the commissioning visit is difficult and sometimes it takes more than a year to commission a small project.

## 8 How much time is taken in loan application process?

- ▶ About 63% respondents opined that a loan application process takes more than 60 days to get approved.

**Time taken to approve a loan application**

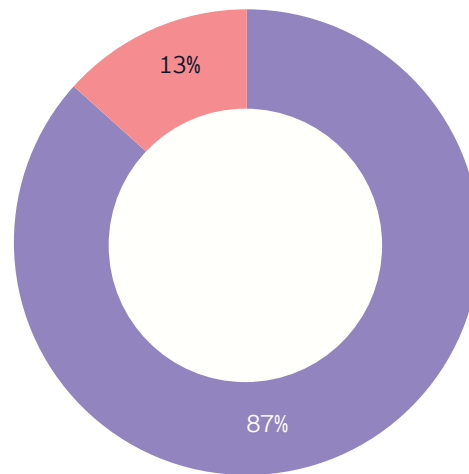


Source: EY analysis

## 9 Should DISCOMs/SNAs or implementing agencies provide trainings on rooftop solar (RTS)?

- ▶ Around 87% respondents agree that DISCOMs should start providing training on rooftop solar aspects.

Trainings on RTS from DISCOMs/SNAs



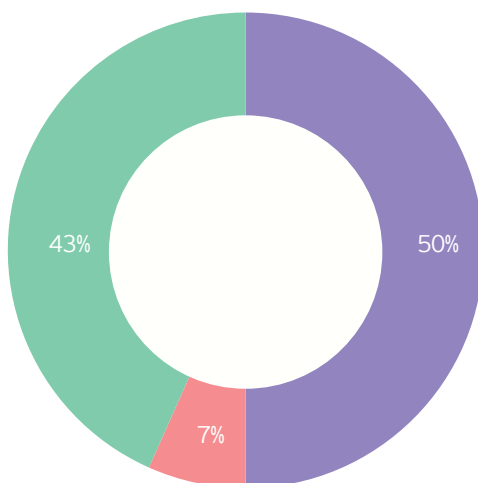
■ Yes ■ No

Source: EY analysis

## 10 Please rate your overall experience of a O&M in rooftop solar in a state.

- ▶ The overall experience of operation and maintenance (O&M) in rooftop solar in the western region is a mixed bag, 43% found the experience to be good and 50% measured it as poor.

Overall experience of O&M



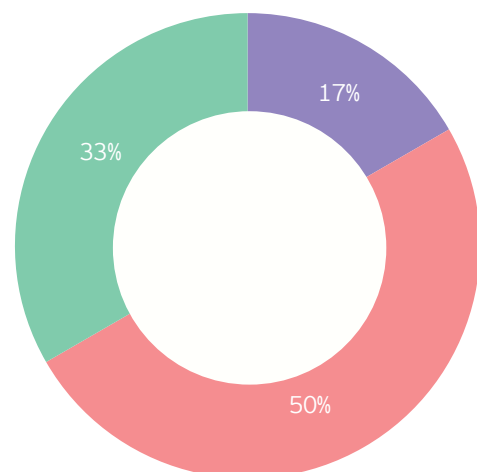
■ Poor ■ Satisfactory ■ Good

Source: EY analysis

## 11 Please indicate the overall warranty and sales experience of a solar rooftop in a state.

- ▶ Around 83% participants said aftersales service and the overall warranty is satisfactory and up to the mark.

Warranty and aftersales experience



■ Poor ■ Satisfactory ■ Good

Source: EY analysis



## Regional workshop: eastern region (virtual)

### SARAL 2.0: The State Rooftop Solar Attractiveness Index

2<sup>nd</sup> Regional Workshop  
(Eastern region)

15 September 2020



The workshop for the eastern region was conducted specifically with participants from the eastern states of India. The workshop saw participation from around 20 participants from states like West Bengal, Odisha and Uttarakhand. Representatives from DISCOMs and developer communities were present in the meeting.

The workshop was structured around the following broad themes:

- ▶ Overview of SARAL and SARAL 2.0
- ▶ Generic discussion on rooftop solar issues with a regional flavor
- ▶ Discussion and feedback session on SARAL 2.0 model and parameters

### Introductory session

The session was opened by the EY team by welcoming the participants and informing them about the agenda for the meeting. The participants were given a brief introduction about the outcomes of SARAL and the work being taken up under SARAL 2.0. The participants were apprised of the following aspects:

- ▶ Market feedback on SARAL and its launch by the Ministry of New and Renewable Energy, Government of India
- ▶ Relevant stakeholders involved in SARAL-2.0, the project's intended objectives and expected outcomes
- ▶ Benefits of SARAL 2.0 on stakeholders across the rooftop solar value chain
- ▶ Overview of the five broad parameters, sub-parameters and scoring indicators that form a part of the index
- ▶ Guidance provided by subject matter experts (SMEs) appointed under the steering committee on various aspects of index development

## Discussion session

The introductory session was followed by a detailed discussion on the issues involving the rooftop solar sector. The session also included a feedback session on the SARAL 2.0 index, and the parameters shortlisted for ranking the states. There was a regional flavor to the discussions as the participants highlighted issues from specific regions in particular. The following were the key highlights of the discussion carried out during this session.

*Discussion on key barriers hindering uptake of rooftop solar (RTS) in India and measures to mitigate these challenges*

According to the panel, a few key barriers hindering uptake of RTS in India are:

- ▶ **Equipment standards and quality in cyclone-prone coastal regions:** One of the key issues being faced in is that structures are unable to take the strong wind load in case of natural calamities, such as cyclones. This issue makes the case for more stringent or specific specifications for equipment to be deployed in coastal projects. Also proposed was a special subsidy for extra risk involved in rooftop solar projects in coastal areas. The DISCOM officials reverted on the issue by saying that the design of solar module is a bigger concern in this case rather than its mounting structure.
- ▶ **Difficulties in availing subsidies:** stakeholders highlighted that there were difficulties in availing of subsidies, which discourage investors/developers from getting into the rooftop solar space. Monitoring of subsidy disbursal needs to be channelized through widespread use of digital means such as unified web portals.
- ▶ **Lack of awareness:** stakeholders from Uttarakhand highlighted that consumers are hardly aware of rooftop solar program being run by the SNA and a lot needs to be done on the outreach front.
- ▶ **Limits under net metering regulations:** the rather high-connected load limit of 5kW specified under the West Bengal net metering regulation for consumers to be eligible for net metering was quoted as a significant factor behind rooftop solar not reaching its potential in the state. A change in regulation was proposed to incorporate a clause to reduce the limit to at least 2kW.
- ▶ **Smart meter availability:** stakeholders from West Bengal also highlighted issues with the availability of smart meters.
- ▶ **Net meter installation:** another issue projected in Odisha is the difficulty faced by consumers in getting net meters installed. Poor response on the part of DISCOMs was also highlighted as an issue. A standardized directive in the form of plug-and play methodology was sought

from the central ministry to guide DISCOMs to simplify the net meter installation process. DISCOM officials pitched the blame on consumers as they do not submit requisite documents on time leading to delays. Moreover, developers need to be aware of the specific DISCOM offices where documents need to be submitted to avoid delays.

Developers highlighted that they incurred losses due to delays in net metering. This delay has been seen to have extended up to even six to eight months and even beyond.

- ▶ **Creation of asset security:** another issue that developers highlighted while signing a PPA was the need for creation of security by pledging of the equipment by the off taker in the name of the developer.

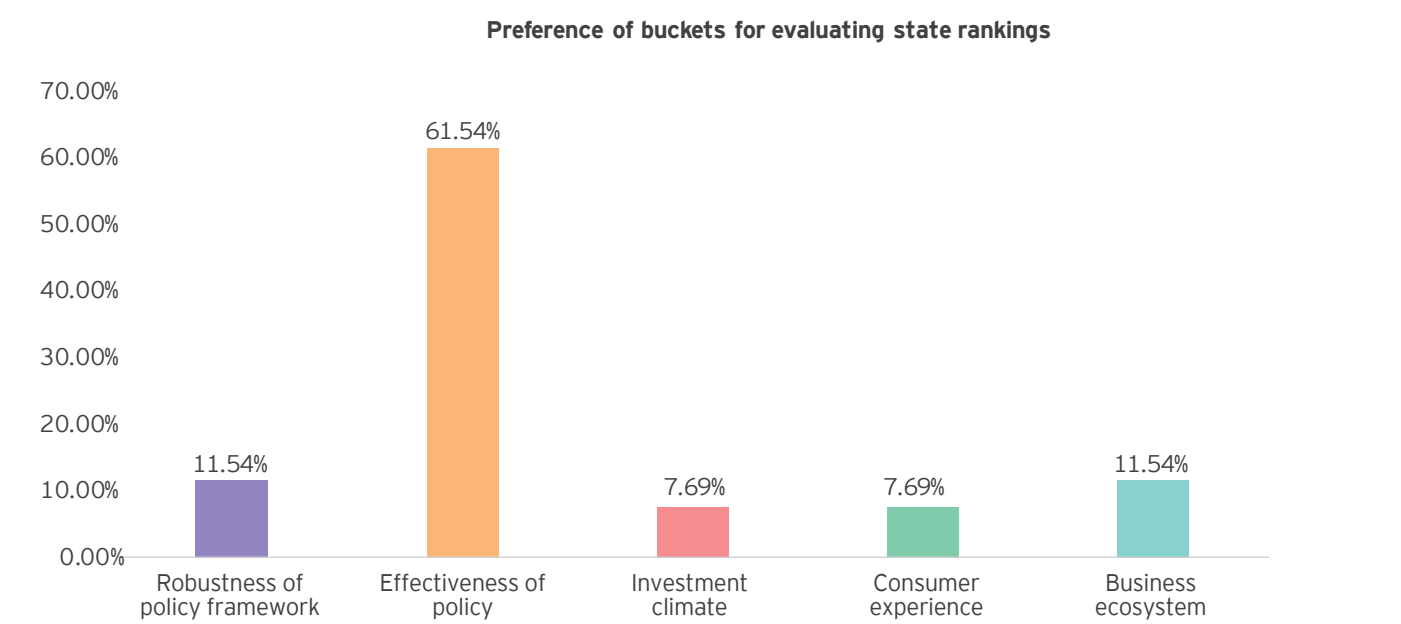
*Discussion on factors to be considered while ranking Indian states on their rooftop solar attractiveness and feedback on the SARAL 2.0 model*

- ▶ Participants opined that an index to rank states on their rooftop solar attractiveness can consider the aspect of political willingness of a state government to implement rooftop solar. The index incorporates this measure to an extent through a scoring indicator covering instances of retrospective or regressive actions/policies imposed by a state on rooftop solar.
- ▶ Another feedback was that the index could study and cover the particulars of successful DISCOMs across the country and bring out insights that can be adopted by DISCOMs in the lesser-performing states. It was clarified that the index already has an entire sub-parameter on the state of affairs of DISCOMs which benchmarks the performance of DISCOMs.
- ▶ Mapping of stakeholder-wise scoring indicators was also suggested so that the issues pertaining to specific stakeholders such as DISCOMs, financial institutions, regulators etc. are well projected.

Moreover, feedback was solicited from participants on key issues by noting their responses to a questionnaire. While garnering this feedback, an online survey form was circulated to understand stakeholders’ opinion about various aspects of rooftop solar. Following is the feedback received from the respondents:

1 Which is the most important bucket for evaluating the state ranking for rooftop solar?

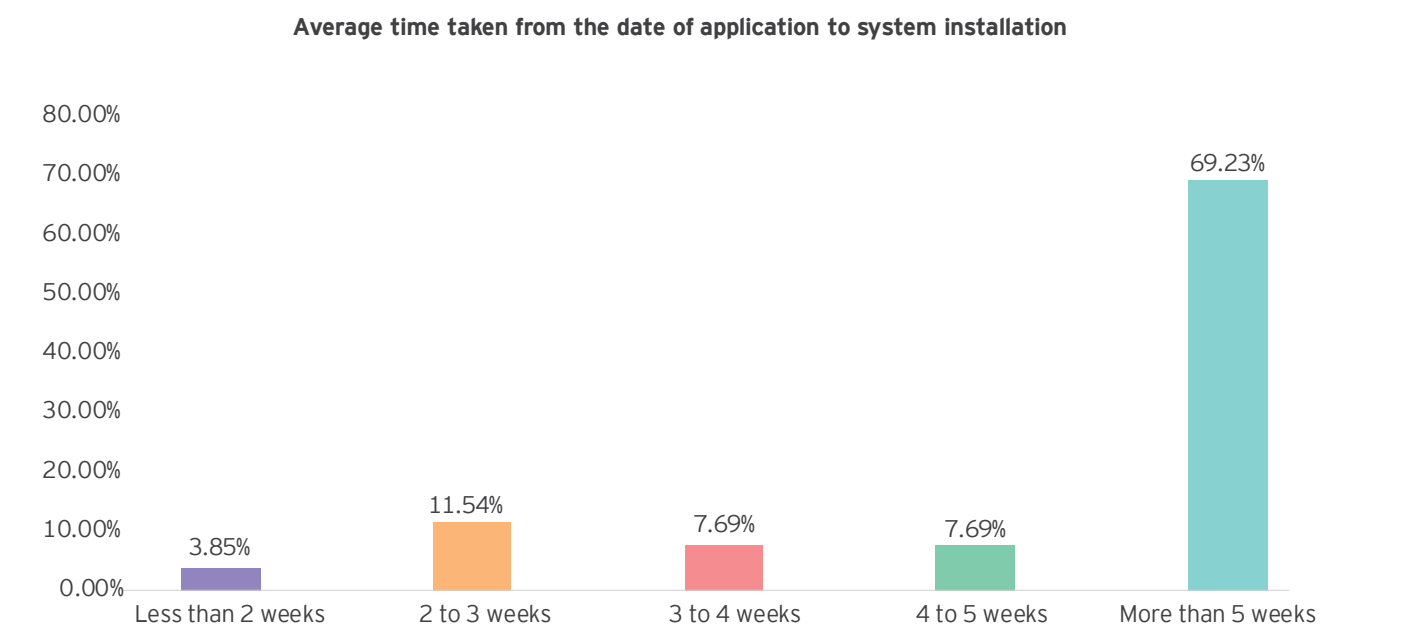
- ▶ An overwhelming 61% of the participants projected the importance of considering the effectiveness of state policy implementation in the SARAL 2.0 index as the most important bucket.



Source: EY analysis

2 What is the average time taken from the date of application to system installation in the concerned DISCOM territory?

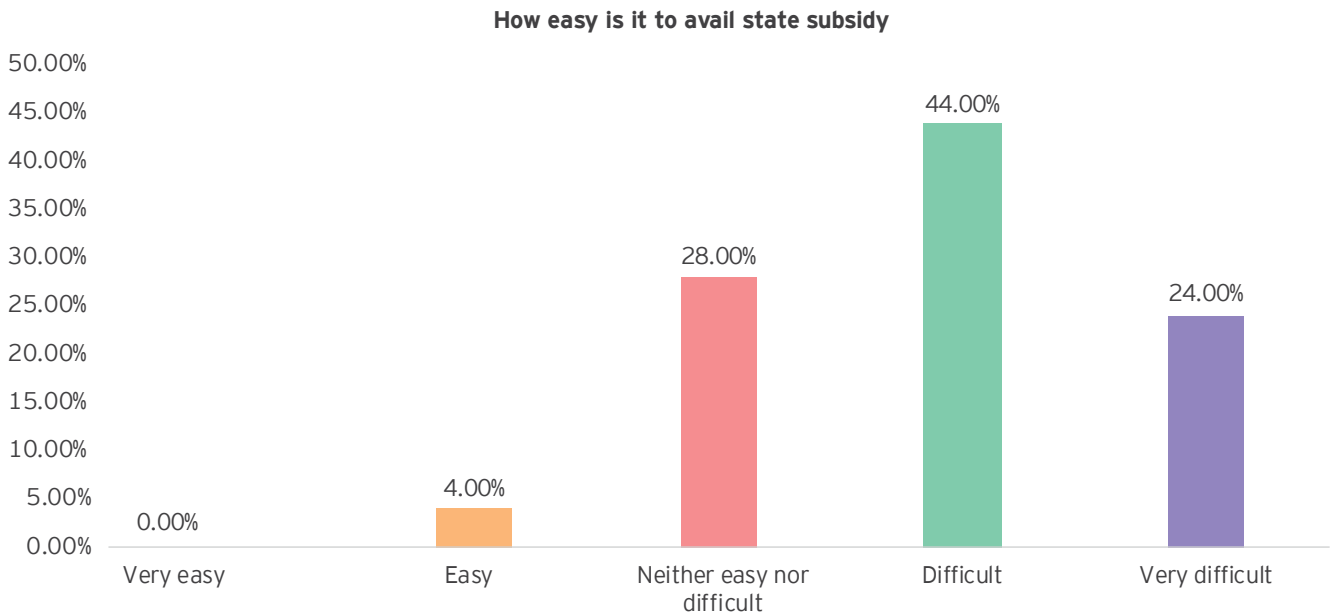
- ▶ Around 70% participants opined that average time taken from the date of application to system installation in the concerned DISCOM territory is more than five weeks, signifying the hurdles they face in going through the process.



Source: EY analysis

### 3 How easy is it to avail state subsidy?

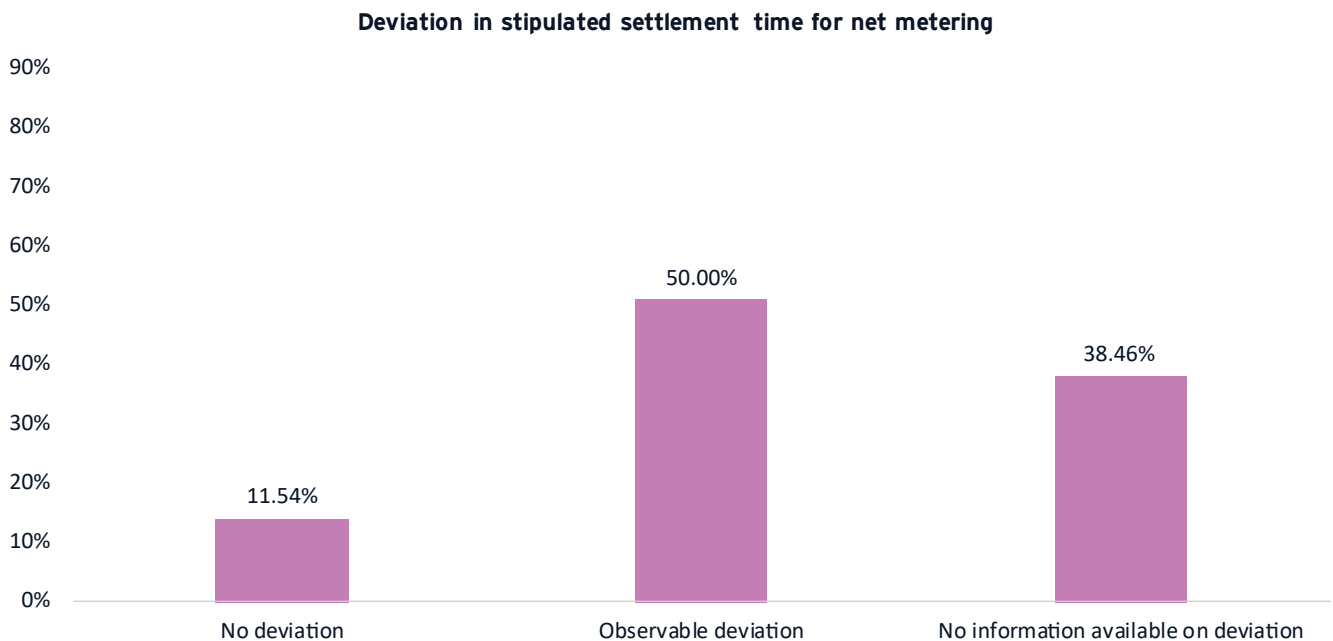
- ▶ Around 68% respondents opined in that it is either difficult or very difficult to avail of state subsidies.



Source: EY analysis

### 4 Is there any deviation in stipulated settlement time for net metering?

- ▶ Half of the respondents recorded that there was observable deviation in stipulated settlement time for net metering in their states.

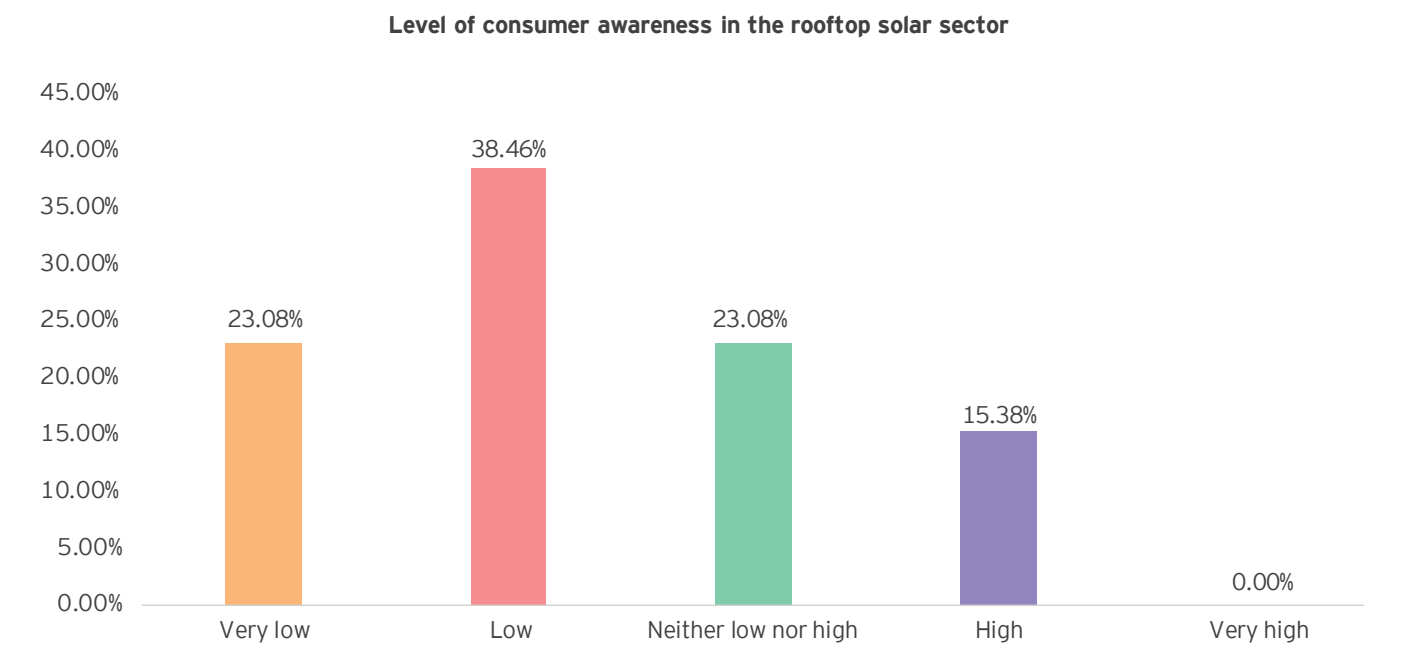


Source: EY analysis



5

What is level of consumer awareness in the rooftop solar sector?



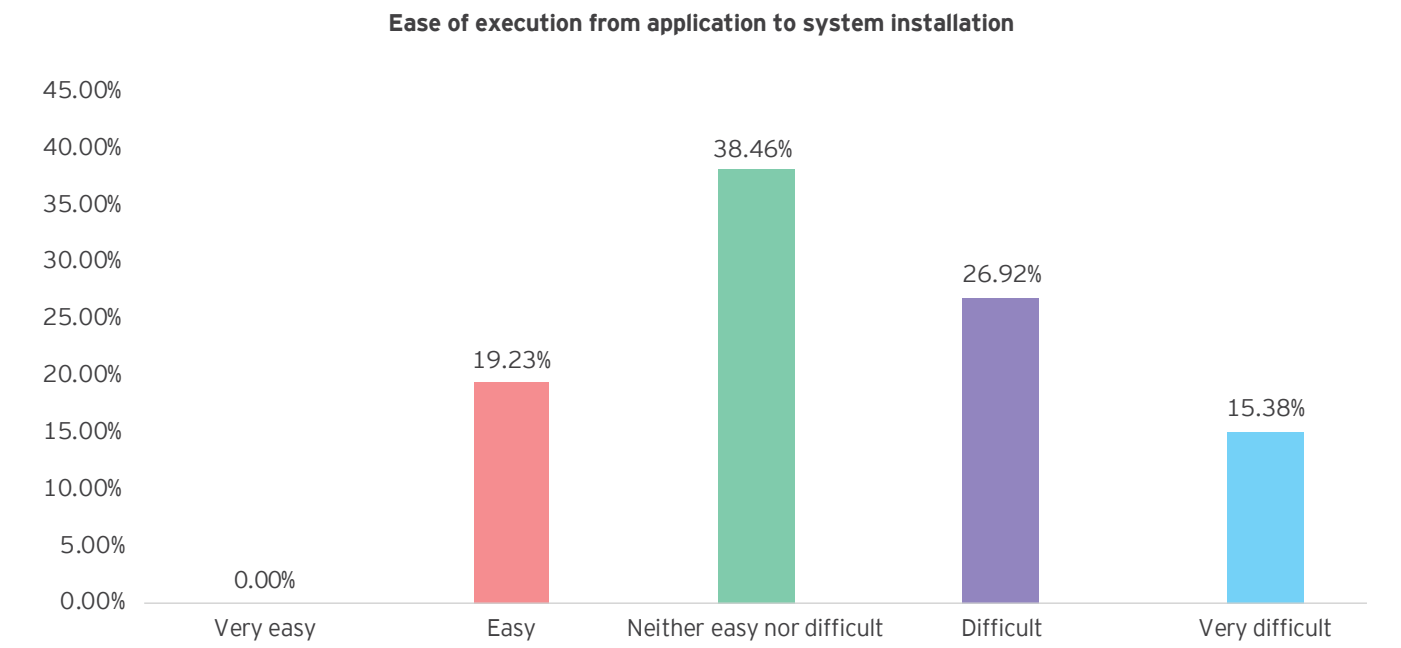
Source: EY analysis

- ▶ Sixty-one percent respondents noted that awareness levels about rooftop solar ranges from low to very low.

6

Please rate the ease of execution from application to system installation

- ▶ Forty-two percent respondents felt that the process of execution from application to system installation is fraught with difficulties.



Source: EY analysis

## Regional workshop: southern region (virtual)

### SARAL 2.0: The State Rooftop Solar Attractiveness Index

3<sup>rd</sup> Regional Workshop  
(Southern region)

24 September 2020



### Introductory session

The session was inaugurated by the EY team by welcoming the participants and informing them about the agenda for the meeting. The participants were given a brief introduction about the regional workshops, outcomes of SARAL and the work being taken up under SARAL 2.0.

At the very outset, the EY team presented a brief outline of the activities that were undertaken during development of SARAL and further extended activities being executed under SARAL 2.0. EY apprised the participants on the following points:

- ▶ Brief introduction of SARAL-2.0 and its strategic context
- ▶ Market feedback on SARAL and its launch by the Hon'ble Minister (I/C) of Power and NRE Shri R.K. Singh, Government of India.
- ▶ Relevant stakeholders involved in SARAL-2.0, its intended objectives and outcome.
- ▶ Benefits from SARAL 2.0 for stakeholders across rooftop solar value chain.
- ▶ Overview of the five broad parameters, sub-parameters and scoring indicators that form an integral part in defining the SARAL 2.0 index
- ▶ Guidance provided by subject matter experts (SMEs), appointed under the steering committee, on various aspects of index development.

## Discussion session

The introductory session was followed by a discussion session on rooftop solar issues and thereafter, a feedback session was opened with the participants on the SARAL 2.0 model, parameters and scoring indicators. The workshop was dedicated for southern region's issues and feedback was mainly centric to the same region. The following section is a session preceding carried out during the workshop.

*Discussion on key barriers hindering uptake of rooftop solar (RTS) in India and measures to mitigate these challenges:*

- ▶ **Unstable solar policy:** stakeholders from the workshop highlighted that southern region has suffered due to unstable solar policies and lack of awareness among consumers about the benefits of the schemes.
- ▶ **Ministry of Power's proposal to permit gross metering for installations above 5kWp:** participants expressed that gross metering will hinder future rooftop solar deployments, as it is not consumer friendly like net metering.
- ▶ **Concern of DISCOMs fearing revenue loss:** concerns of DISCOMs of losing the revenue due to deployment of rooftop solar was also projected. On one hand, DISCOMs have been mandated by the MNRE to lead the way in rooftop solar, while on the other hand, they fear loss of revenue. This thus makes them evoke mixed signals about rooftop solar. The participants agreed that the concerns of DISCOMs need to be assuaged too for the success of rooftop solar. They were in support of the Maharashtra government's decision to impose grid access charges to support DISCOMs taking up installation of rooftop solar.
- ▶ **Residential sector under Phase-II Rooftop Solar Scheme:** stakeholders expressed their views on the scope of residential sector by stating that the growth of sector will depend on the market. If players are willing to take up small ticket size RTS plants, they will present good scope in the future.
- ▶ **Technical overcommitment by the vendors:** stakeholders emphasized that some vendors overcommit to consumers and fail to deliver on the ground. The participants suggested to blacklist the vendors who were installing sub-standard equipment.
- ▶ **Lack of installer expertise:** stakeholders highlighted that most of vendors had lack of expertise for ground installation and emphasized introducing standardized installation manuals to guide installers.
- ▶ **Net meter installation:** The participants also highlighted that the region is mostly doing well in providing timely net metering connections and supply without hampering the overall installation time frame.



## Discussion five major bucket lists and scoring indicators under SARAL 2.0 index

The participants were shown the five major buckets, namely, i. Robustness of policy framework, ii. Effectiveness of policy support/implementation, iii. Investment climate, iv. Consumer experience and v. Business ecosystem along with the scoring indicators underneath them. The new scoring indicators that have been added under SARAL 2.0 against SARAL were also highlighted to the participants.

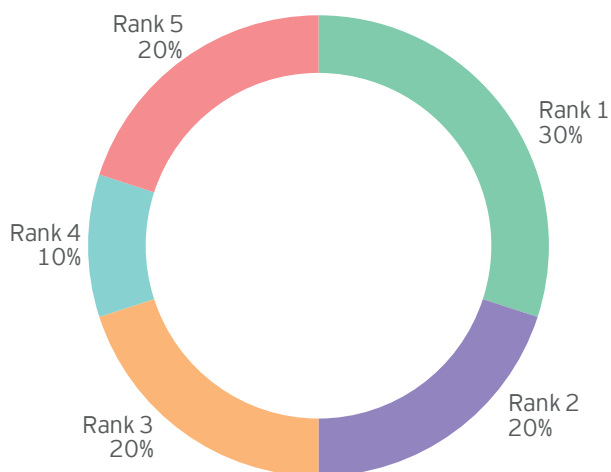
Following some trough process, the participants stressed the importance of the policy as well as its implementation as being important towards measuring the attractiveness of states in rooftop solar.

Following this session, they were asked to fill in a survey for their feedback on the index as well as on aspects around rooftop solar.

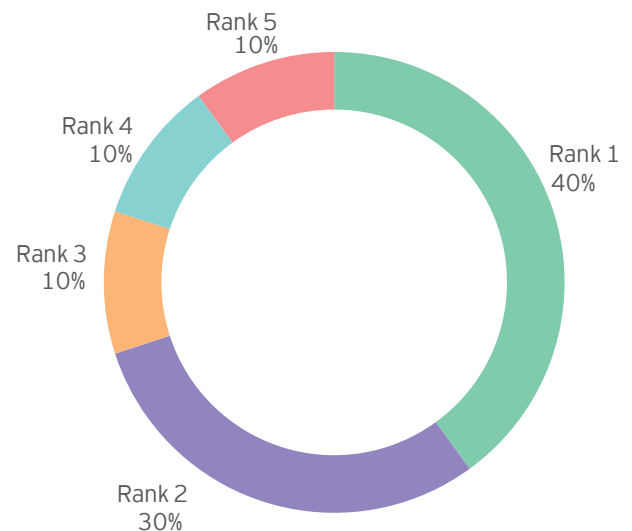
### 1 Which is the most important bucket for evaluating the state ranking for rooftop solar?

- An overwhelming 70% of the participants projected the importance of considering the robustness of policy framework and effectiveness of state policy implementation in the SARAL 2.0 index.

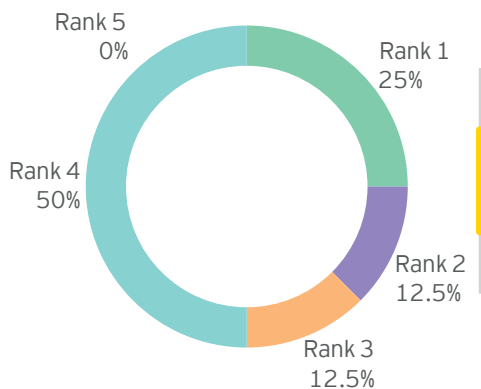
**Robustness of policy framework**



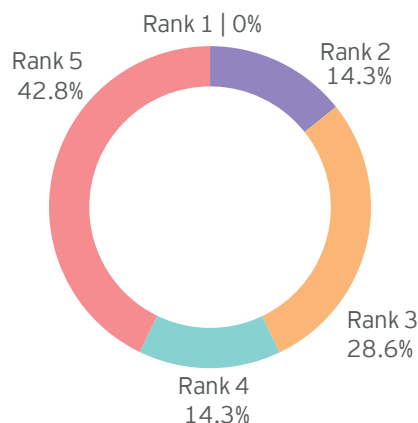
**Effectiveness of policy support/implementation**



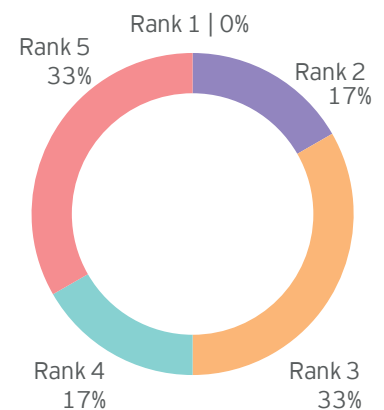
**Investment climate**



**Consumer experience**



**Business ecosystem**



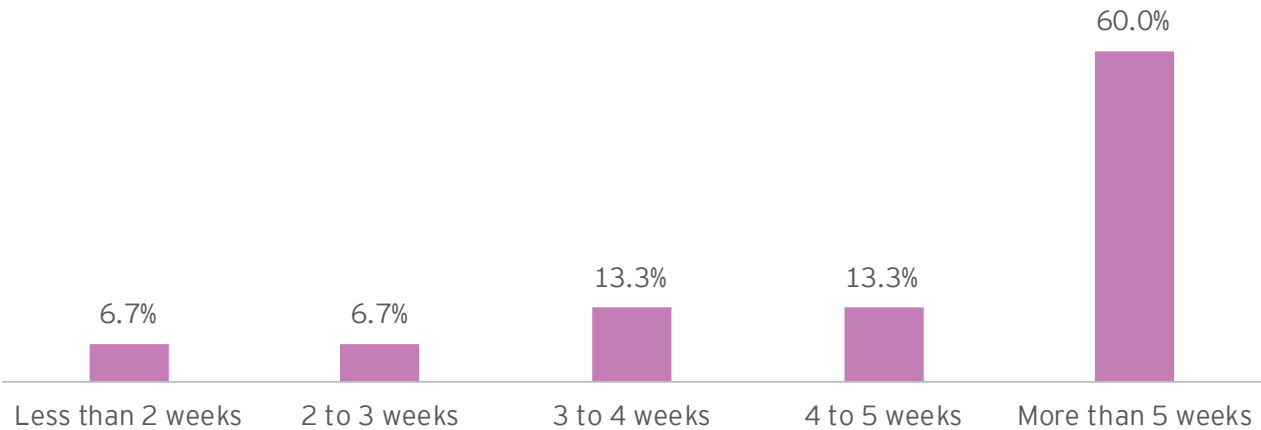


2

What is the average time taken from the date of application to system installation in the concerned DISCOM territory?

- Around 60% participants opined that the average time taken from the date of application to system installation in the concerned DISCOM territory satisfaction is more than five weeks, signifying the difficulty in installation and inter connection of systems.

Average time taken from the date of application to system installation

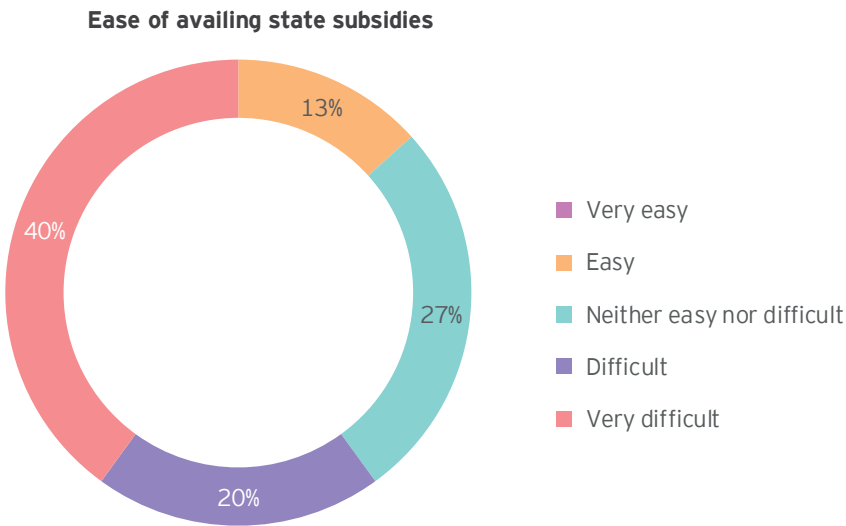


Source: EY analysis

3

How easy is it to avail state subsidy?

- Nearly 67% of the respondents opined in that it is difficult or easy to avail of state subsidies in the southern region.



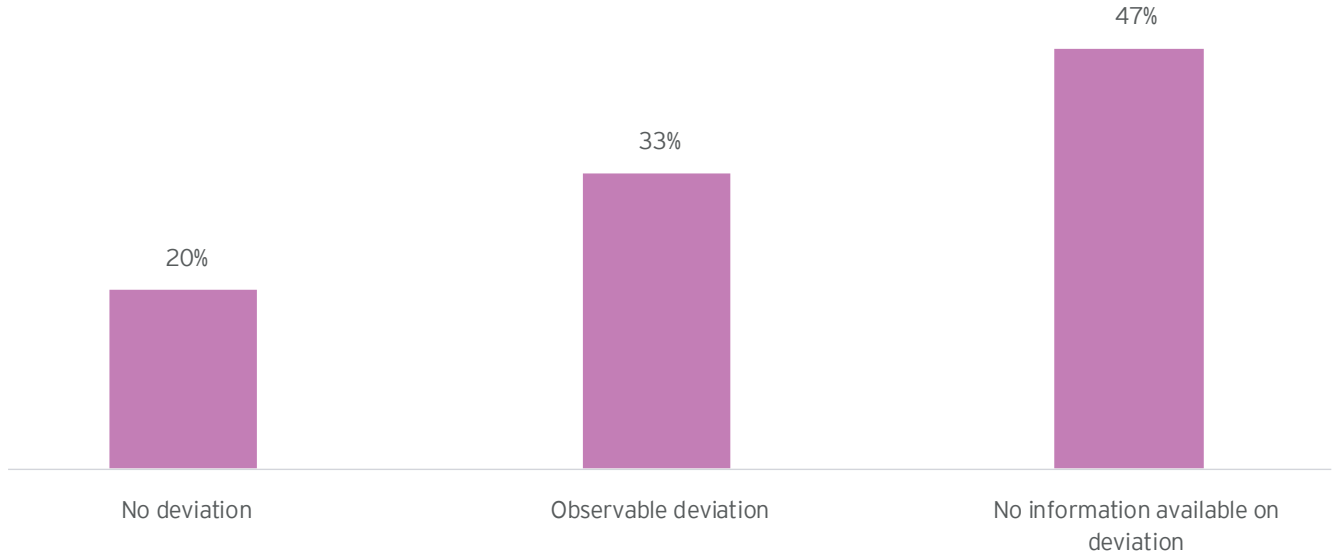
Source: EY analysis

4

## Is there any deviation in stipulated settlement time for net metering?

- ▶ Around 47% of the respondents shared that there was no information available in stipulated settlement time for net metering in their states.

Deviation in stipulated settlement time for net metering



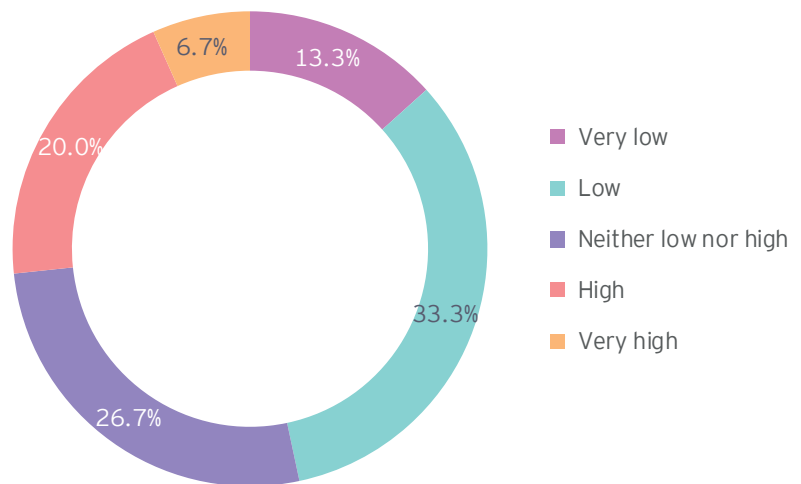
Source: EY analysis

5

## What is level of consumer awareness in the rooftop solar sector?

- ▶ Around 47% of the respondents noted that awareness levels about rooftop solar ranges from low to very low in the southern region.

Level of consumer awareness

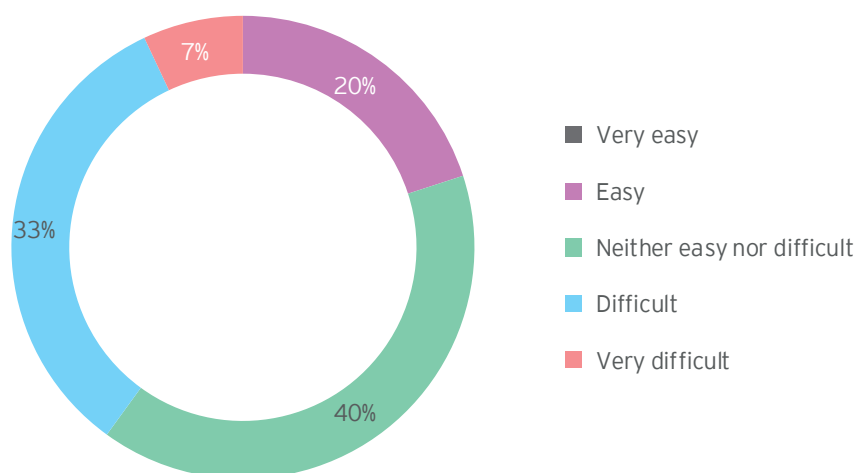


Source: EY analysis

## 6 Please rate the ease of execution from the date of application to system installation.

- ▶ Around 33% of the respondents feel that the process of execution from the date of application to system installation is fraught with difficulties.

**Ease of execution from date of application to system installation**

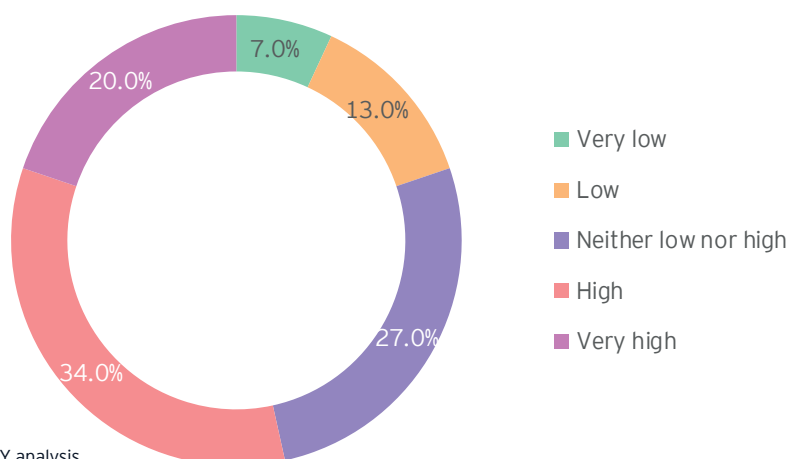


Source: EY analysis

## 7 Please rate consumers' views about O&M cost.

- ▶ Around 34% of the respondents indicated that rate of O&M cost of rooftop solar system in the southern region is high in reference to the consumers' view.

**Consumers' views on O&M cost**

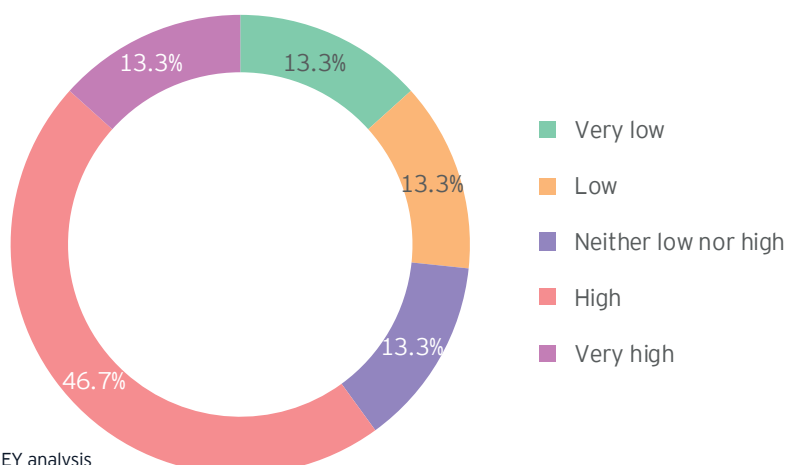


Source: EY analysis

## 8 Please rate the level of satisfaction among consumers regarding the warrantee and after sales experience.

- ▶ Nearly 47% of the respondents are highly satisfied with the warrantee and after sales service provided by the vendors on rooftop solar systems in the southern region.

**Level of satisfaction among consumers regarding the warrantee and after sales experience**



Source: EY analysis

## Regional workshop: northern region (virtual)

### SARAL 2.0: The State Rooftop Solar Attractiveness Index

4<sup>th</sup> Regional Workshop  
(Northern region)

06 October 2020



The workshop was organized to solicit views of the key stakeholders in the region. More than 34 participants from different backgrounds and expertise, including solar power developers (SPDs), DISCOM officials and state nodal agencies (SNAs) deliberated on the northern region-specific issues and voiced their thoughts on the scoring indicators. They also discussed major issues behind the installation of grid connected solar rooftop plants in the region not reaching its full potential.

### Discussion session

*Discussion on key barriers hindering uptake of rooftop solar (RTS) in the northern region and measures to mitigate these challenges*

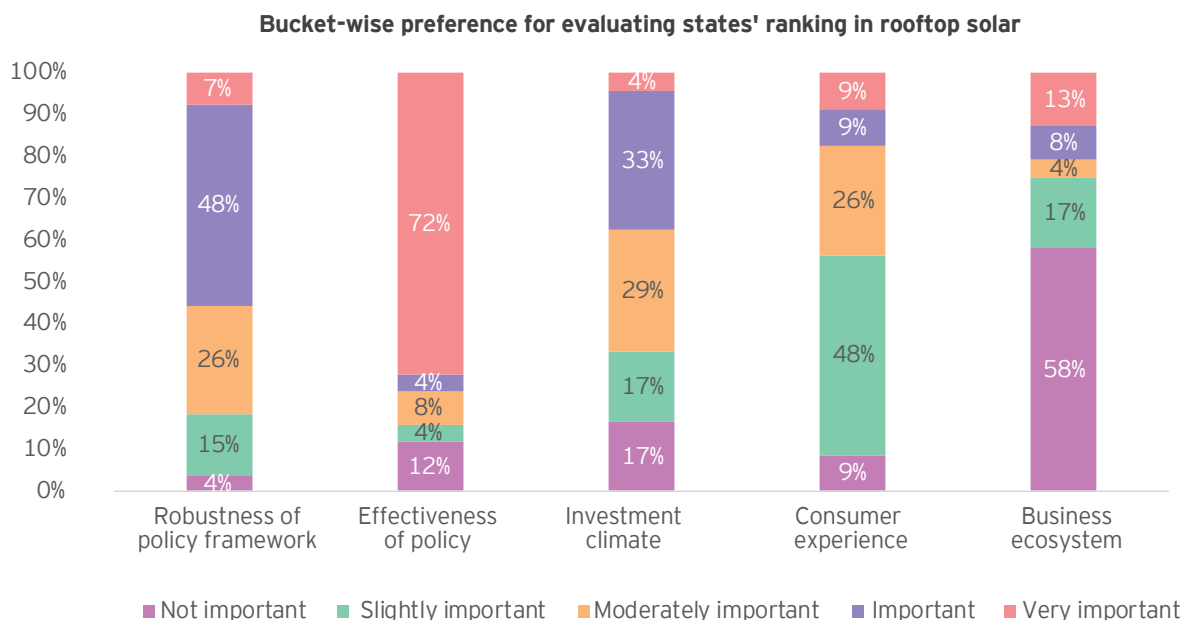
- ▶ Stakeholders from Uttar Pradesh expressed that the region lacks consumer awareness. They cited the following reasons for low awareness:
  - ▶ Lack of clear information on various aspects, such as knowledge about solar panels and battery quality, availability of reliable vendors and process of installation and approval process
  - ▶ Misinformation regarding mortgaging of home for availing loans from banks.
- ▶ Hence, there is a need to address disconnect between government efforts to digitize the information and dissemination process.
- ▶ One of the stakeholders from Uttarakhand added that in order to meet the lofty target of deploying 40GW of rooftop solar by 2022, it is imperative to take measures to provide easy accessibility through media and outreach activities and encourage the state's DISCOMs to standardize approval process across the country.
- ▶ Retrospective change in the regulations, non-availability of net meters and extended duration from date of application to system installation are also some of the major issues in the sector as suggested by some of the stakeholders.



Following are the feedback received from the participants on the online survey form circulated to gain further perspective on the sector:

## 1 Which is the most important bucket for evaluating state ranking in rooftop solar?

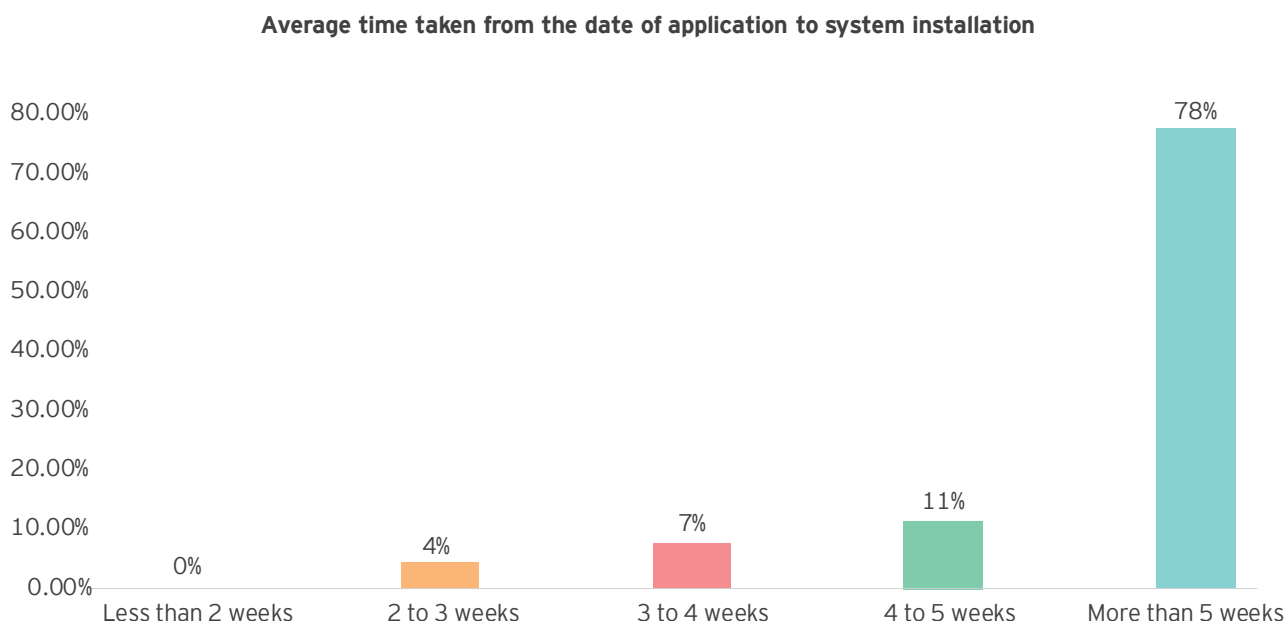
- ▶ Seventy-two percent of the participants said that the effectiveness of state policy implementation in the SARAL 2.0 index holds maximum weightage and considered this bucket to lead the index.



Source: EY analysis

## 2 What is the average time taken from the date of application to system installation in a concerned DISCOM's territory?

- ▶ Around 78% participants said that the average time taken from the date of application to system installation in the concerned DISCOM territory satisfaction is more than five weeks.

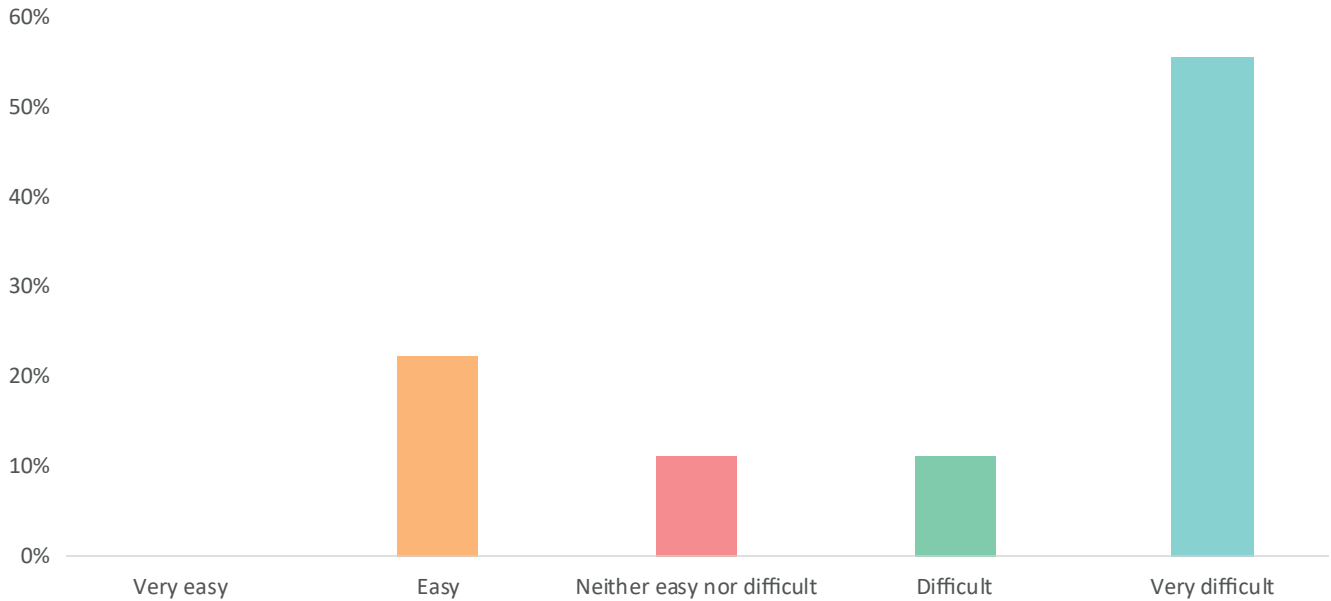


Source: EY analysis

### 3 How easy is it to avail state subsidy?

- ▶ Nearly 67% of the respondents opined in that it is difficult or easy to avail of state subsidies in the southern region.

**HOW EASY IS IT TO AVAIL STATE SUBSIDY**

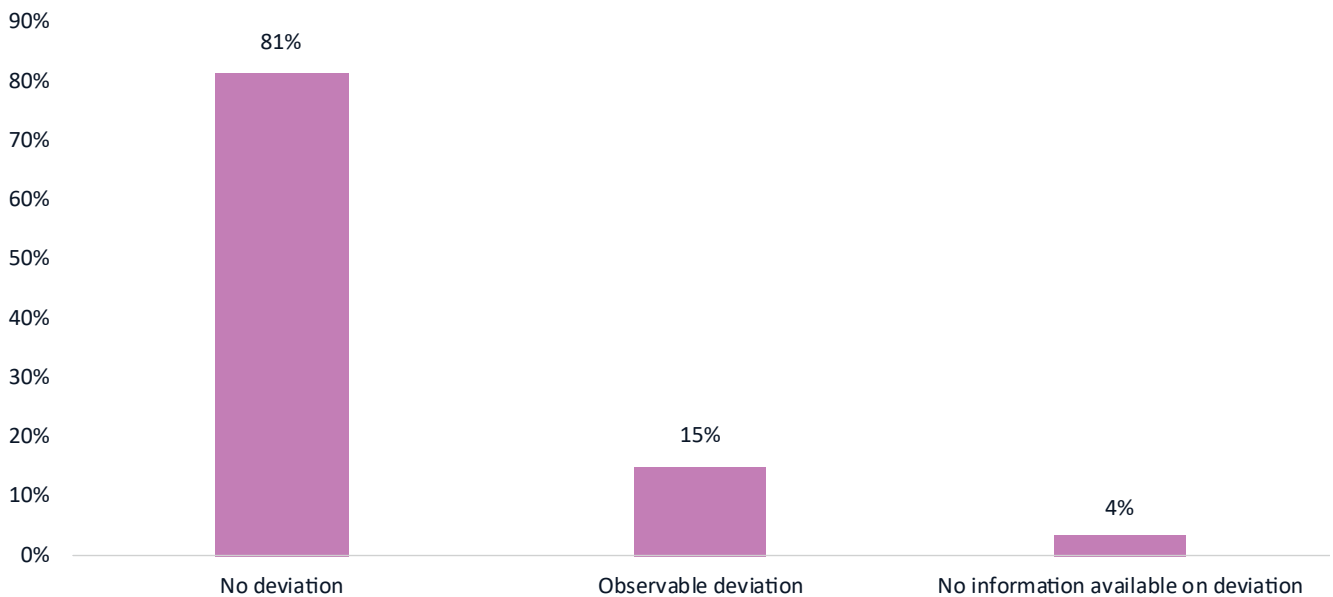


Source: EY analysis

### 4 Is there any deviation in stipulated settlement time for net metering?

- ▶ About 81% respondents recorded that there was no deviation in stipulated settlement time for net metering in their states.

**Deviation in stipulated settlement time for net metering**



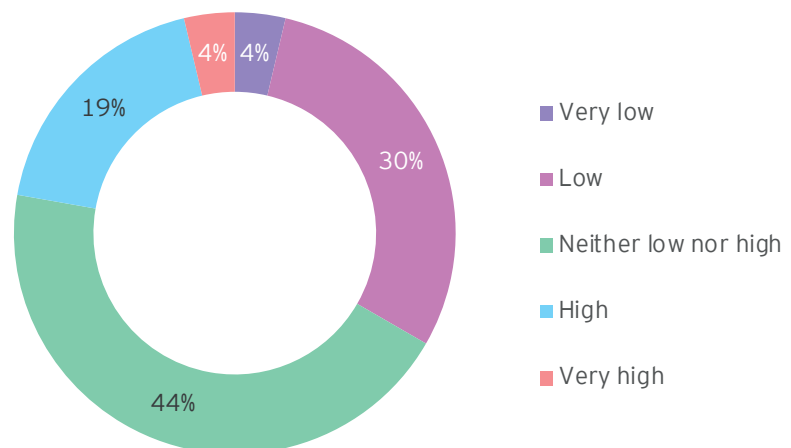
Source: EY analysis

5

## What is level of consumer awareness in the rooftop solar sector?

- ▶ Thirty four percent respondents have shown concern about consumer awareness in the sector.

Level of consumer awareness in the rooftop solar sector



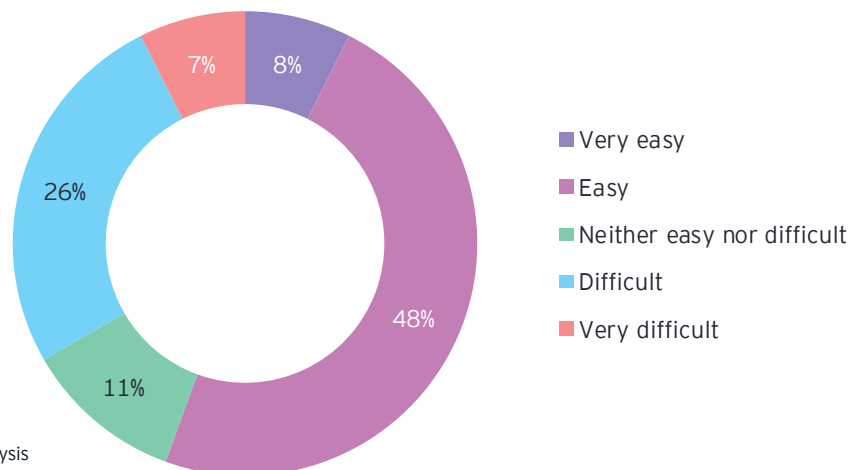
Source: EY analysis

6

## Please rate the ease of execution from application to system installation.

- ▶ Around 48% respondents felt that the process of execution from application to system installation was easy in their region.

The ease of execution from application to system installation



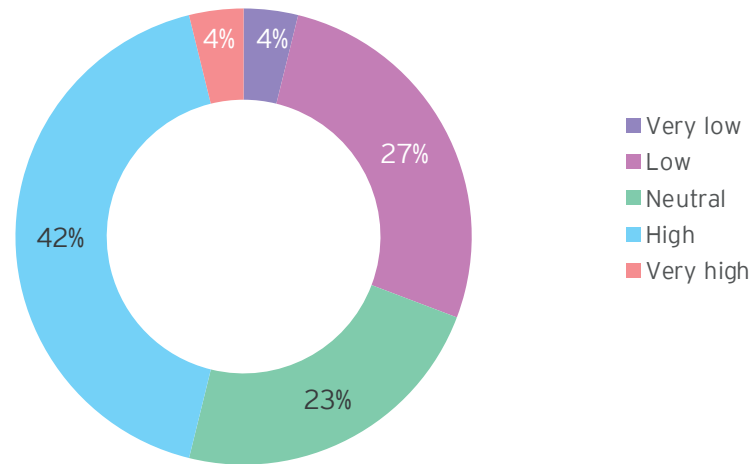
Source: EY analysis

7

Please rate the level of satisfaction among consumers regarding the warrantee and after sales experience?

- ▶ About 42% respondents reported that consumers are satisfied with after sales services.

**Level of satisfaction among consumers regarding the warrantee and after sales experience**



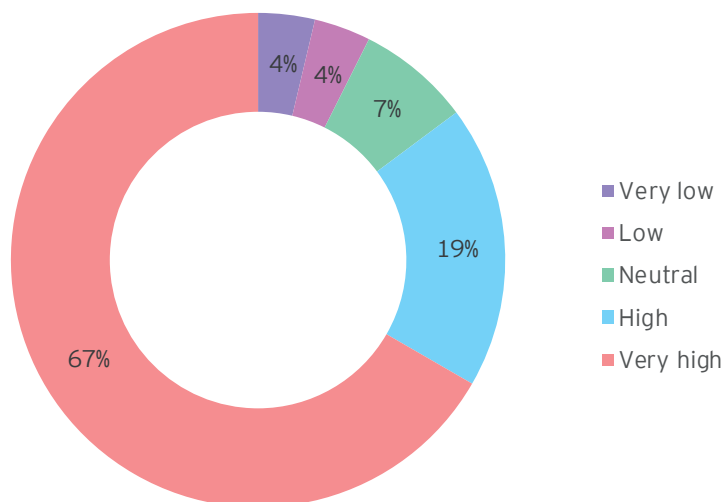
Source: EY analysis

8

Please rate consumers' views about the O&M cost.

- ▶ Nearly 86% respondents said that consumers' view of O&M costs is high in case of rooftop solar systems.

**Consumers' views about the O&M cost**



Source: EY analysis

# Annexure III:

## *SARAL basics*



## Aim of SARAL

The aim of the SARAL index (both versions) is to evaluate Indian states based on their preparedness to support rooftop solar deployment. The index aims to objectively assess states based on several parameters critical for establishing strong solar rooftop markets. These parameters belong to five broad categories:

- ▶ Robustness of policy framework
- ▶ Effectiveness of policy support/implementation environment
- ▶ Consumer experience
- ▶ Investment climate for rooftop solar sector
- ▶ Business ecosystem

## Utility and benefits of the SARAL index

The index serves as an important tool to:

- ▶ Benchmark development and deployment of solar rooftop in states.
- ▶ Identify states that require more handholding in terms of policy and investment push.
- ▶ Identify investment opportunities.
- ▶ Recognize the states that need financing support for development of solar rooftop.
- ▶ Gradually, establish a knowledge sharing platform where the progressive states can share their experiences with the other states.

The index can accrue multiple benefits to stakeholders such as:

### Central and state governments can use SARAL to:

- ▶ Initiate dialogues with potential investors.
- ▶ Attract investment from domestic and foreign players as well as from development banks.
- ▶ Facilitate collaborations with states looking to develop their solar rooftop capacities.
- ▶ Compare and benchmark performance of states in regulatory and ease of setting up rooftop projects.
- ▶ Identify areas of improvement, as well as their counterparts with whom they can engage in knowledge sharing.

### Institutional investors can use SARAL to:

- ▶ Identify states that need credit.
- ▶ Measure the impact of financial assistance in terms of loans for the growth of rooftop solar.

### Businesses can use SARAL to:

- ▶ Identify states which can yield better returns on investment in solar rooftop.
- ▶ Provide input to their capital budgeting process.

## Data selection and collection

Both secondary and primary research has helped in collecting the data for the scoring indicators used in developing the index. The COVID-19 pandemic has affected the process of primary research, but efforts have been made to reach out to stakeholders through workshops, mails and telephone calls. Data was collected from reliable and credible sources. The main sources include government sources such as net/gross metering policy/regulations, solar policy documents, government/SNAs' websites, tariff orders, and the Ministry of Power's State Distribution Utilities Annual Integrated Rating report.

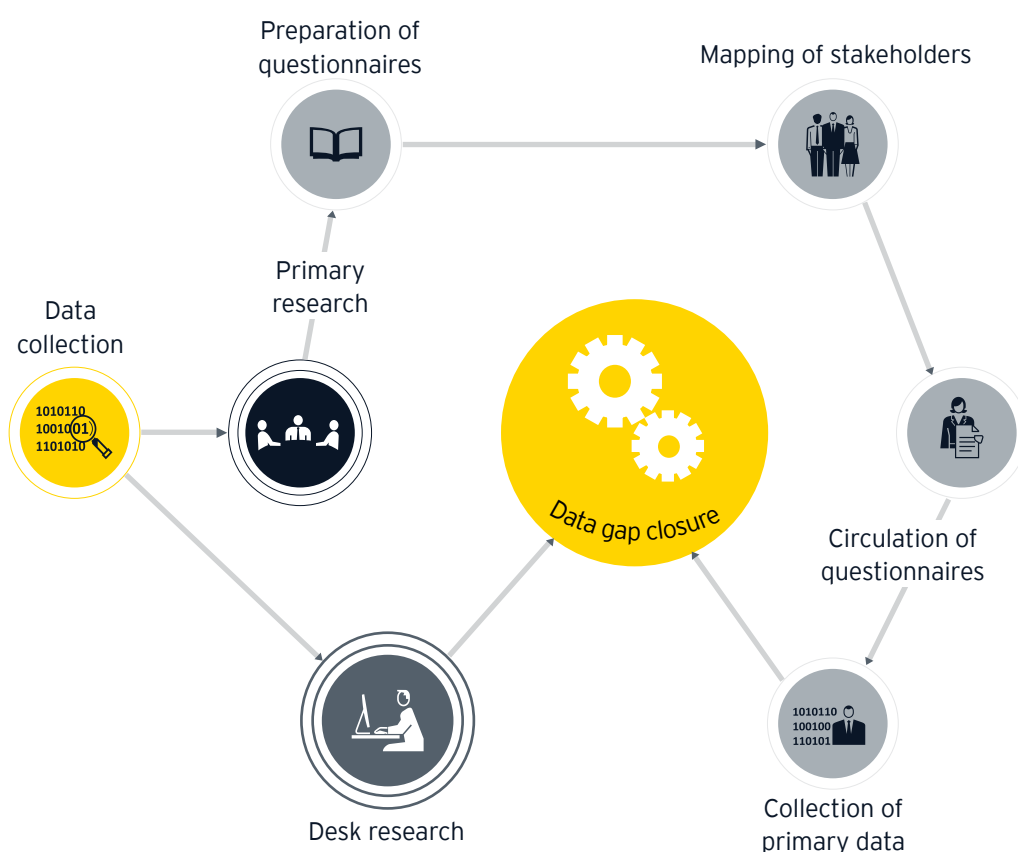
Primary research was conducted for closing data gaps and reviewing/updating the data collected from secondary sources. The primary data was collected in the following manner:

- ▶ Preparation of questionnaires
- ▶ Mapping of the stakeholders in the rooftop solar sector in states
- ▶ Circulation of questionnaires with relevant stakeholders in the states
- ▶ Collection of data for all the Indian states and two union territories (Delhi and Chandigarh), either through telephonic conversation or e-mails.

Detailed questionnaires were prepared by the SARAL 2.0 team. The meetings or interviews were guided by the questionnaire and the team analyzed the responses to derive insights.

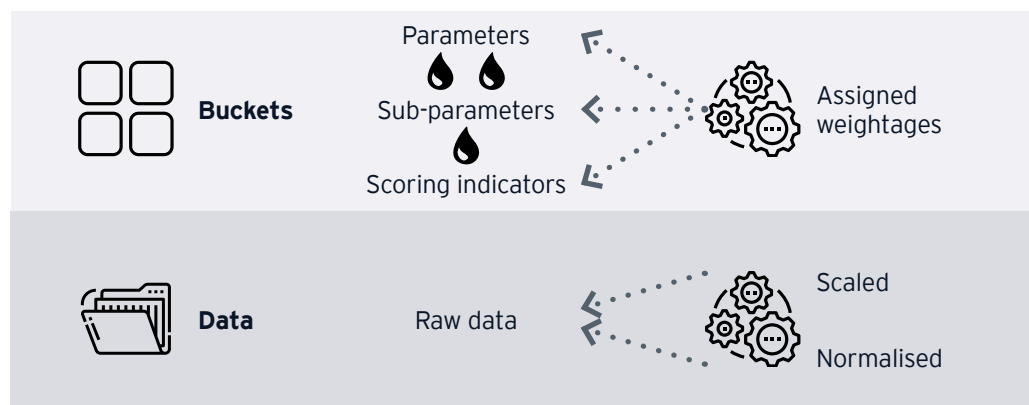
Out of the 33 scoring indicators, 21 were collected from secondary sources, 10 from primary sources and the remaining two were collected and verified from both primary as well as secondary sources.

**Figure 11: Data collection and collation process**



Source: EY analysis

**Figure 12: Scoring process**



Source: EY analysis

The scoring process for the index basically involved assigning weightage to entities at all levels, that is to parameters, sub-parameters and finally to base level of scoring indicators. This granularity in assigning weightages ensured that the final weightage for scoring indicators was a reflection of significance of each scoring indicator to the model, the importance of the sub-parameter groups as well as the bucket under which they reside.

The data collected against the scoring indicators had to be treated before using them in the model to avoid bias and to create a level measuring scale against which scoring parameters from highly-varying domains could be compared. The data was treated through the process of scaling and normalization before using it in the model.

## Assigning of weightages

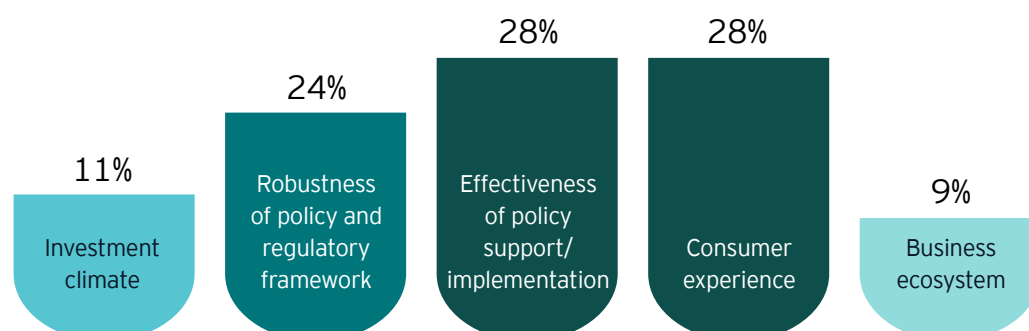
### Parameters

The five drivers (referred to as parameters here) include robustness of the policy framework, effectiveness of the policy support, investment climate of a state, consumer experience and business ecosystem. These parameters were allocated the following weightages  $W_a$ ,  $W_b$ ,  $W_c$ ,  $W_d$  and  $W_e$ , respectively:

- ▶ Robustness of the policy framework - 24.0% ( $W_a$ )
- ▶ Effectiveness of the policy support - 28.0% ( $W_b$ )
- ▶ Investment climate - 11.0% ( $W_c$ )
- ▶ Consumer experience- 28.0% ( $W_d$ )
- ▶ Business ecosystem - 9.0% ( $W_e$ )

The sum of all the weights amounts to 100% ( $W_a + W_b + W_c + W_d + W_e = 100\%$ )

**Figure 13: Final weightages of the five parameters**



Source: EY analysis

## Sub-parameters

The five parameters are further segregated into 14 sub-parameters. Each sub-parameter  $u$  is given its own weightage. This weightages has been distributed based on their relative importance and the volume of scoring indicators they hold under them. The cumulation of weightages of sub-parameters under a parameter add up to 100%. For instance, under the parameter 'robustness of the policy framework', the four sub-parameters are allocated weights  $W_{ai}$ ,  $W_{aii}$ ,  $W_{aiii}$  and  $W_{aiv}$  respectively, such that  $W_{ai} + W_{aii} + W_{aiii} + W_{aiv} = 100\%$ .

Thus, the effective weight of each sub-parameter will be a function of its own weight as well as the weight of the parameter bucket to which it belongs. By this logic, the effective weightage of the sub-parameter 'level of policy support' will be equal to  $W_a * W_{ai}$  (where  $W_a$  is the weightage of the parameter 'robustness of the policy framework' and  $W_{ai}$  is the weightage of the sub-parameter 'level of policy support').

## Scoring indicator

The 14 sub-parameters are further divided into 33 scoring indicators. These are the measuring rods against which each state is scored in terms of its attractiveness for solar rooftop. Here again, a similar process is followed for assigning the weightage. The weights for all the six scoring indicators under "the level of policy support" in be  $W'1$ ,  $W'2$  to  $W'6$ , respectively. Considering equal weightages for each scoring indicator, the weight  $W'1$  of the scoring indicator 'clarity and detailing in net metering regulations in the state' will be 25% in the model.

The effective weightage of any scoring indicator will be a function of:

- ▶ Weight of the parameter, i.e.,  $W_a$
- ▶ Weight of the sub-parameter, i.e.,  $W_{ai}$
- ▶ Weight of the scoring indicator itself, i.e.,  $W'1$

Thus, the effective weight of the scoring indicator 'clarity and detailing in net metering regulations' in the overall scoring of states will be  $W_a * W_{ai} * W'1$ .

**Illustration:** the robustness of policy framework has an overall weightage of 24% and the sub-parameter measuring level of policy support has a weightage of 37.5%. This means that this parameter accounts for 9% ( $24\% * 37.5\%$ ) of the total score obtained by a state in this model.

Going to the next level of individual scoring indicators, the effective weightage of clarity and detailing in net metering regulations comes out to be  $24\% * 37.5\% * 25\%$  ( $W_a * W_{ai} * W'1$ ) which amounts to 2.25%. In other words, if states are scored out of 100.00, then 2.25 marks of the total will be attributed to the level of clarity and detailing in net metering regulations that exists in a state viz.-a-viz. the other states.

Figure 14: Effective weight of scoring indicator



Source: EY analysis

## Factors considered for assigning the weightage

The allocation of weightages has been based on amalgamation of inputs received from all stakeholders. The final weightages are based on:

- ▶ **Inputs from stakeholders and subject-matter experts:** from a methodological point of view, opinion polls focus on the notion of "concern." That is, stakeholders from the steering committee, regional workshops and state consultations were asked to rank (on a scale of one to five) the five main parameters of the SARAL according to the importance of each of them in assessing state attractiveness for rooftop solar. This allowed all stakeholders to express their preferences and create a consensus for policy action. The weightage preferences for sub-parameters and scoring indicators were not solicited in this manner because statistical evidence suggests that if too many indicators are involved, this method can induce serious cognitive stress among experts and can produce inconsistencies in the analysis. The details are given in the next section.

- **Importance or relevance of a parameter:** the importance or relevance of a parameter is the qualitative assessment of the value contributed by it in determining rooftop attractiveness solar of a state. The value is characterized by the degree to which it meets current and potential needs of the users.

**Figure 15: Effective weight of scoring indicator**



Source: EY analysis

- **Timeliness of data:** timeliness of data reflects the length of time between the availability of data and the event or phenomenon they describe. Another aspect of this is the periodicity of update of data to reflect the change in ranking, going forward.
- **Quality of data availability in terms of coverage, periodicity and robustness:** quality of basic data chosen to build the composite indicator strongly affects its accuracy and credibility. Weights were chosen to reflect statistical quality of the data. Higher weights were assigned to statistically reliable data with broad coverage. However, caution was exercised as this method could be biased towards the readily available indicators, penalizing the information that is more problematic to identify and measure.
- **The richness of data:** this refers to the expanse of data points available across states for each sub indicator representing the comprehensiveness of data availability.

## Methodology for assigning weightage to the five core drivers

As part of the questionnaire, each stakeholder answered the following question:



*Out of the five drivers, please score (on a scale of one to five) according to the importance of each of the drivers in assessing state attractiveness for rooftop solar. The higher the importance, higher is the score. A parameter scored four is more important compared to the one scored two.*

**Table 4: Ranking the five scoring indicators**

S. no.	Bucket/Parameter	Score (1-5)*
1	Robustness of policy framework	
2	Effectiveness of policy support	
3	Investment climate	
4	Consumer experience	
5	Business ecosystem (Micro parameters)	
* 1 being the lowest and 5 being the highest		

Source: EY analysis

The purpose of this question was to gauge the mindset of stakeholders and their perceived importance in terms of different drivers/parameters with respect to the solar rooftop sector in their states. The inputs collated for this question were used to arrive at the weightages for the drivers/parameters. Stakeholders were part of one of the following:

- Steering committee
- Regional workshops
- State consultations

To arrive at the weights for each of the five drivers, the following methodology was adopted for each group mentioned above:

- The stakeholders gave a score to each of the five parameters (a parameter with higher importance got a higher numerical score).
- The scores received for each parameter from the participants were summed.
- The sum of the scores for each of the five parameters were added to arrive at the grand sum.
- For each parameter and its sum was divided by the grand sum to arrive at their relative importance.
- The process was repeated for all five parameters.
- The relative importance was calculated to act as the weightage for the drivers in the index model.



**Illustration:** For simplification purposes, assume that the stakeholders under consideration are only 20. Below is the frequency matrix of the responses:

**Table 5: Frequency matrix of the responses**

Ranking	No. of response					Points
	Robustness of policy framework	Effectiveness of policy support	Investment climate	Consumer experience	Business ecosystem	
1	0	0	0	1	3	1
2	1	1	2	1	0	2
3	3	2	5	6	14	3
4	5	7	5	3	2	4
5	11	10	8	9	1	5
<b>Total</b>	<b>86</b>	<b>86</b>	<b>79</b>	<b>78</b>	<b>58</b>	<b>387</b>

As seen from the table, the parameter - robustness of policy framework received a score of 86 out of the grand sum of 387. This translates into the weightage of 22% for this parameter. The weightages for other parameters are arrived in a similar fashion. This process was iterated for all the three groups and later simple average of the weightages, so arrived, were calculated. This became the final weightages of the five parameters.

## Assigning of weightages

### Scale transformation prior to normalization

To have objective comparison across small and large states, scaling of variables by an appropriate size measure, for e.g., population, income, trade volume and populated land area, etc. is required. This ensures non-penalization of smaller states and provides a level playing field to all the states. One of the scoring indicators pertain to the installed rooftop solar capacity. Taking the absolute number would have been unfair to smaller states like Goa and north-eastern states. Instead, the installed capacity as a fraction of the rooftop solar target, expressed in percentages, was taken as the input for this scoring indicator.

### Normalization of data: avoid adding up apples and oranges

Normalization of data is required prior to any data aggregation as the indicators in a data set often have different measurement units. The normalization phase is crucial both for the accuracy and the coherence of results. An inappropriate normalization procedure can give rise to unreliable or biased results. On the other hand, the interpretability of the index relies heavily on correctness of the approach followed in the normalization phase. Thus, the normalization method should consider data properties, as well as the objectives of the index. The SARAL index is envisioned to be normative with actionable key points for the various stakeholders of the rooftop solar segment. This warrants the use of distance to the frontier methodology for normalization of the data set.

### Distance to the frontier

Distance to the frontier measures the relative position of a given indicator viz.-a-viz. a reference point. The score illustrates the distance of a state to the "frontier", which represents the best performance observed on each scoring indicator. A state's distance to frontier is indicated on a scale from 0 to 100, where 0 represents the lowest performance and 100 the frontier. Another reason to choose this methodology was that not only does it allow benchmarking of states but also can be used to compare improvement across the years. It can show how much the state has changed over time in absolute terms with respect to the scoring indicators. Calculating the distance to frontier score involves normalization of individual component (y) using the linear transformation (worst - y)/(worst - frontier).

$$\text{Distance to the frontier score} = \frac{(\text{Worst} - y)}{(\text{Worst} - \text{frontier})} * 100$$

The frontier and the worst value depends on the scoring criteria of the scoring indicator such as:

- **Higher is better:** where higher the value, better the performance (say share of C&I consumers in total rooftop solar installation)
- **Lower is better:** where lower the value, better the performance (say O&M cost)

**Illustration:** the values for share of C&I consumers in total rooftop solar installation range from the 100% (for Himachal Pradesh) to 46.71% (for Delhi, due to higher government sector installations). The higher the value on this scoring indicator, more is the attractiveness of a state. As per this calculation, Himachal Pradesh is likely to get a score of 100 while it is likely to be 0 for Delhi. The other states will lie in between which represents the distance to the best value. For Jharkhand, with 63.04% of C&I consumers share, the distance to frontier will come out to be 30.64 (i.e.,  $(0.4671 - 0.6304) / (0.4671 - 0.1000) * 100$ ).

Thus, this method of transformation warrants that each data point has a unique score thus this method effectively captures the difference among the states against their scoring indicators.

## Computation of the overall score

The scores are calculated at every level, i.e., scoring indicator, sub-parameters and parameters. The states' ranking is also done at all the levels. This allows comprehensive comparison of the states' performance.

	Himachal Pradesh	Jharkhand
Normalized distance to the frontier score	100	30.64
Score adjusted for parameter weight of 11%	$100 * 11\%$	$30.64 * 11\%$
Score adjusted for sub-parameter weight of 50%	$100 * 11\% * 50\%$	$30.64 * 11\% * 50\%$
Score adjusted for scoring indicator weight of 50%	$100 * 11\% * 50\% * 50\%$	$30.64 * 11\% * 50\% * 50\%$

**Table 6: Computation of the overall score**

**Illustration:** to continue with the above example of share of commercial and industrial (C&I) consumers in total rooftop solar installation, we can see below how each dataset adds up to reach an overall scoring:

So, for the sub-indicator, 'share of C&I consumers in total rooftop solar installation', Himachal Pradesh scores 5.75, Jharkhand gets 0.84 and Delhi gets zero. The same process is reiterated for all the other scoring indicators and sum of all these give the overall SARAL score. All states have been ranked based on their SARAL scores.

# Annexure IV:

*Final rankings under  
SARAL 2.0*

**Table 7: Final rankings under SARAL 2.0**

Ranking	State/UT	SARAL 2.0 score	Grade	SARAL Ranking	Change in Ranking
1	Gujarat	70.9	A++	3	▲
2	Delhi	69.2	A++	7	▲
3	Telangana	65.6	A++	2	▼
4	Karnataka	62.7	A++	1	▼
5	Madhya Pradesh	60.4	A+	6	▲
6	Punjab	60.2	A+	8	▲
7	Kerala	59.9	A+	13	▲
8	Rajasthan	59.8	A+	5	▼
9	Haryana	59.7	A+	12	▲
10	Maharashtra	58.5	A+	9	▼
11	Chandigarh	58.1	A	11	◀▶
12	Chhattisgarh	55.5	A	16	▲
13	Tamil Nadu	55.4	A	10	▼
14	Goa	54.2	A	17	▲
15	Andhra Pradesh	54.1	A	4	▼
16	Jharkhand	53.6	A	15	▼
17	Uttar Pradesh	53.1	B++	20	▲
18	Bihar	53.1	B++	25	▲
19	Himachal Pradesh	51.0	B++	23	▲
20	Odisha	50.5	B++	14	▼
21	Assam	46.5	B++	19	▼
22	Sikkim	43.0	B+	21	▼
23	Meghalaya	43.0	B+	30	▲
24	West Bengal	42.3	B+	27	▲
25	Uttarakhand	41.2	B+	18	▼
26	Mizoram	40.3	B	26	◀▶
27	Nagaland	38.3	B	24	▼
28	Manipur	37.1	B	28	◀▶
29	Jammu and Kashmir	31.1	B	31	▲
30	Tripura	28.5	B	29	▼
31	Arunachal Pradesh	27.5	B	22	▼

Source: EY analysis


Climb in ranking  
under SARAL 2.0

Fall in ranking  
under SARAL 2.0

Status quo  
in ranking









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