



Ministry of New and Renewable Energy



SARAL

STATE ROOFTOP SOLAR ATTRACTIVENESS INDEX

(FOR THE FINANCIAL YEAR 2018-19)



सत्यमेव जयते

Ministry of New and Renewable Energy
Government of India

SARAL

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(for the financial year 2018-19)

आर. के. सिंह
R. K. SINGH



विद्युत एवं नवीन और नवीकरणीय ऊर्जा
राज्य मंत्री (स्वतंत्र प्रभार) एवं
कौशल विकास और उद्यमशीलता राज्य मंत्री
भारत सरकार

Minister of State (Independent Charge)
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and Entrepreneurship
Government of India


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.


19/8
(R. K. Singh)



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सत्यमेव जयते

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ANAND KUMAR



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नवीन और नवीकरणीय ऊर्जा मंत्रालय

SECRETARY

GOVERNMENT OF INDIA

MINISTRY OF NEW AND RENEWABLE ENERGY

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.


[Anand Kumar]



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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

Glossary	Figure name
AT&C	Aggregate Technical and Commercial
C&I	Commercial and Industrial
CAGR	Compound Annual Growth Rate
DISCOMs	Distribution Company
DT	Distribution Transformer
EODB	Ease of Doing Business
GRPV	Grid Connected Solar Rooftop Power Plants
GSDP	Gross State Domestic Product
GW	Gigawatts
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 & Renewable Energy Development Corporation of Andhra Pradesh Ltd.
PAC	Public Affairs Centre
PAI	Public Affairs Index
PM	Particulate Matter
RECAI	Renewable Energy Country attractive
ROI	Return on Investment
RPO	Renewable Purchase Obligation
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SNA	State Nodal Agencies
UDAY	Ujwal DISCOM Assurance Yojana
UT	Union Territories



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SARAL

State Rooftop Solar Attractiveness Index





Executive summary

With the renewable energy market becoming increasingly relevant to the Indian power and utilities sector, the renewable energy segment as a whole (and rooftop solar as a sub-segment) is witnessing substantial interests from entrepreneurs, developers, potential investors, end users and government entities. Government of India (GoI) is striving to support the rapid scale up of renewable products through several initiatives such as policy advocacy, financial assistance schemes and regulatory interventions. At the same time, various states have also adopted state-level guidelines with the aim of creating a conducive ecosystem for rooftop solar installation. 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, creating an avenue for experience sharing and knowledge exchange for the states. At this stage of the sector, it is, therefore, imperative for the states to exchange knowledge and learn from each other in the journey to achieve the country's ambitious target of 40 GW rooftop solar installations 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. This platform could depict the most attractive states, best practices, positive developments, while highlighting the key improvement areas across policy development and implementation, consumer involvement, and investment ecosystem.

Thus, the Ministry of New and Renewable Energy (MNRE) and its partners decided to introduce a measuring scale or an index to evaluate and rank all states according to their performance, growth, level of maturity, policy framework, and implementation environment in the rooftop solar sector. The development of State Rooftop Solar Attractiveness Index - SARAL - 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 after extensive stakeholder consultation. These buckets are:

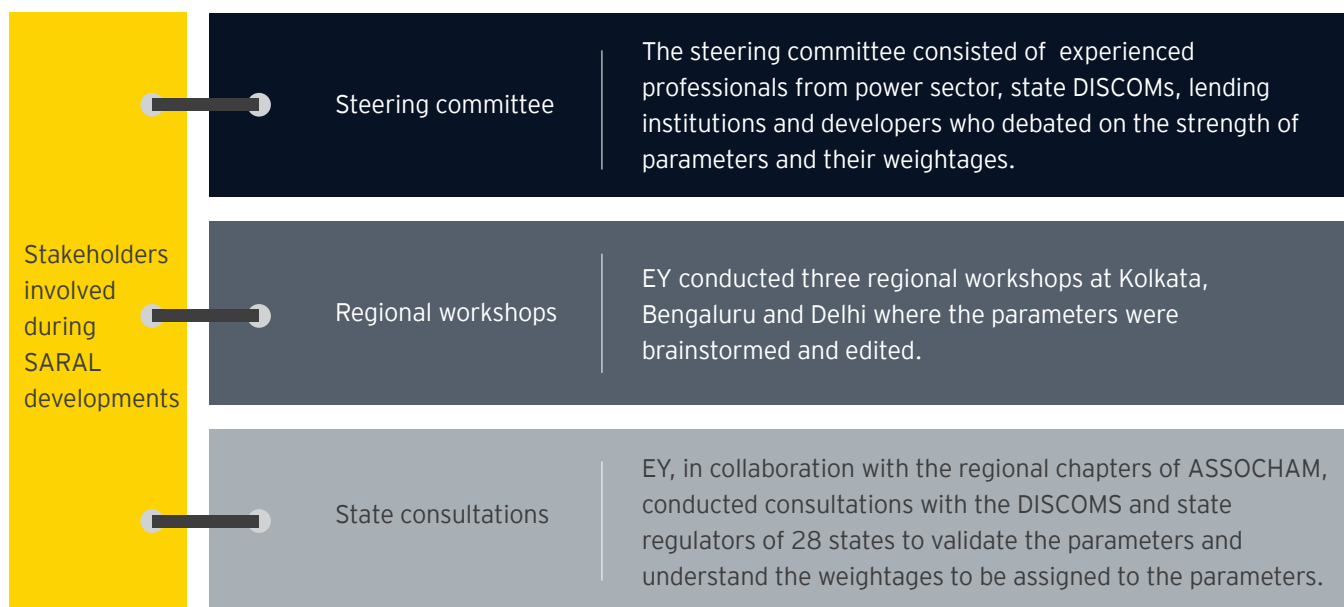
- ▶ Comprehensiveness/robustness of policy framework
- ▶ Ease of implementation/effectiveness of policy support
- ▶ Investment climate for the rooftop solar sector
- ▶ Consumer experience
- ▶ Business ecosystem

The team identified multiple parameters and sub-parameters to quantify those five 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.

Governing mechanism

The team adopted a three-tier stakeholder consultation mechanism during the index preparation to gather inputs and test the parameters being considered so that the final rankings could be as close to the real on-ground picture as possible. The final weightages and parameters were arrived at by considering the inputs from the following three stakeholders:

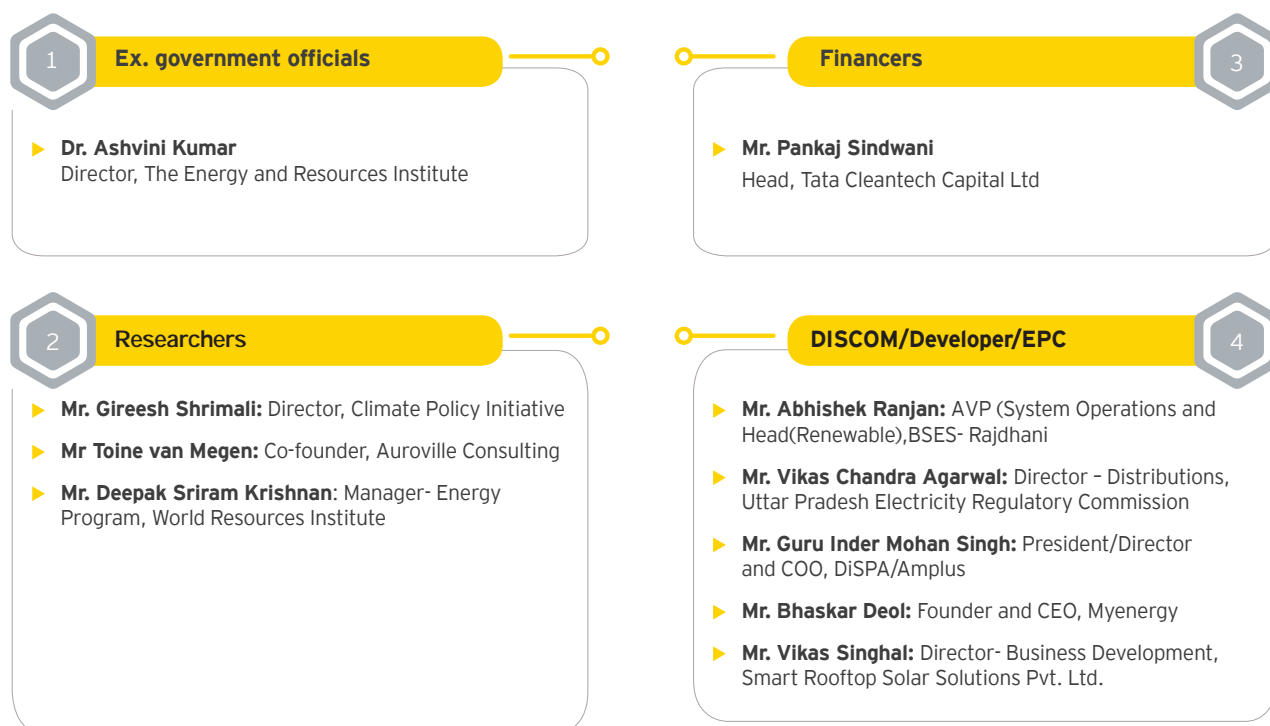
Figure 1: The stakeholders involved in SARAL



Steering committee

The development of this index was a rigorous exercise and had to consider all physical, technical, political, social, institutional, and economic factors that favour/impact rooftop solar development in a state. Therefore, SARAL needed a sounding board comprising experts from relevant fields to ensure that the index is reflective of the real considerations. For this purpose, a steering committee was formed to provide guidance to the team's approach in developing the index.

Figure 2: The members of the steering committee



The team sought feedback on the following building blocks of SARAL from the steering committee:

- ▶ List of parameters
- ▶ Weightages of the parameters
- ▶ Outreach plans
- ▶ Periodic update strategy for SARAL

The steering committee helped establish the guiding principles for this exercise and their inputs and feedback have made the model more concise, succinct, and centric to rooftop solar. For all the parameters, only scoring indicators impacting solar rooftop sector have been finalised, where as the ones impacting utility-scalesolar or other renewable energy sources have been removed.

Regional workshops ●

The team connected with industry bodies, policy makers and leading rooftop players. For this, ASSOCHAM local chapters were reached out in three locations - Kolkata, Bengaluru and New Delhi. The process, approach and methodology was shared with all stakeholders. Soliciting their feedback on the data availability and extent of acceptance level of different scoring indicators were the other two primary objectives of conducting these workshops

Figure 3: The team conducted regional workshops to garner feedback



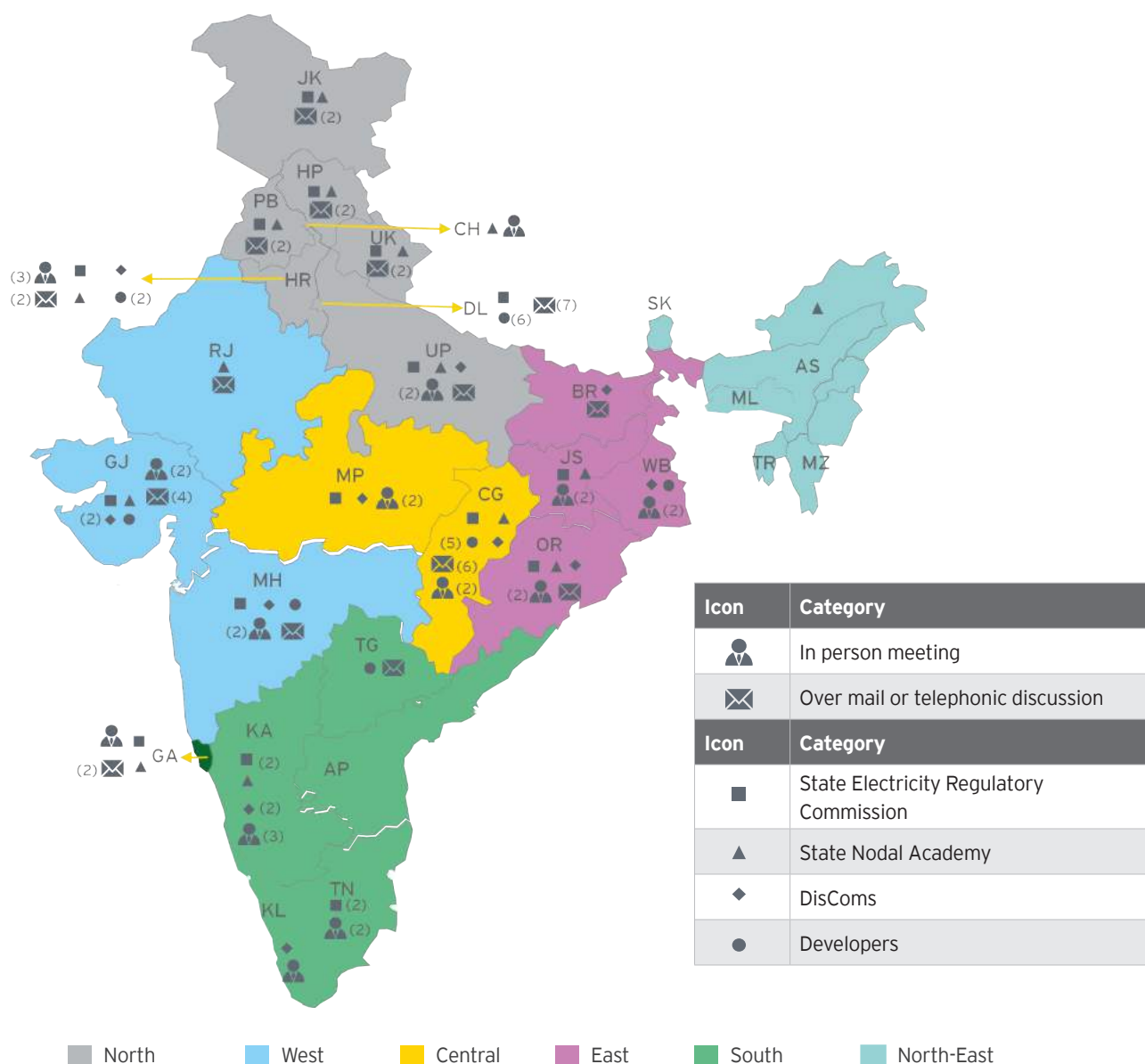
The regional consultation enabled the team to get a perspective of the industry bodies on the identified parameters across five buckets that would collectively determine the attractiveness of a state to drive investment in the solar rooftop space. The industry bodies shared their problems regarding the application procedure, different aspects of net metering, including the roles and the responsibilities of different stakeholders and recommended the representatives of government to ease the procedures as soon as possible. The relative preference expressed by the attendees of the regional workshop helped in arriving at the weightages.

State consultations

With a target to extract 40 GW solar energy from rooftop systems, it is crucial to increase the participation of states and coordination among agencies. A self-sustainable and private-sector driven rooftop solar sector holds key for renewable energy revolution in India. SARAL is a stepping stone of this journey.

In order to achieve its intended benefits, the visibility and acceptance of the SARAL amongst various industry stakeholders is of utmost importance. The stakeholders can provide invaluable insights for building the index. The team reached out to the states to solicit their inputs for developing the index.

Figure 4: The state consultations were held all over the country



The team reached out to 86 stakeholders from 28 states to brief them about the project and collect data for the model through primary research. The inputs from the state consultations were incorporated into the model, wherever feasible, and were also used to form the basis for assigning the weightages to the five main parameters on which the index model is built.

Final SARAL ranking

Based on the states' score, six grades have been assigned on the following scales: A++, A+, A, B++, B+ and B. Grades are derived after using a combination of qualitative and quantitative methods. Top performing state has been assigned A++ and rest of the states have been assigned remaining five grades.

Table 1: Final SARAL ranking

Ranking	State	SARAL Score	Grades
1	Karnataka	78.8	A++
2	Telangana	72.2	A++
3	Gujarat	67.9	A++
4	Andhra Pradesh	66.1	A++
5	Rajasthan	62.2	A+
6	Madhya Pradesh	58.3	A+
7	Delhi	54.6	A+
8	Punjab	53.4	A+
9	Maharashtra	52.0	A+
10	Tamil Nadu	50.9	A+
11	Chandigarh	48.3	A
12	Haryana	43.3	A
13	Kerala	42.9	A
14	Odisha	39.4	A
15	Jharkhand	37.7	A
16	Chhattisgarh	36.5	B++
17	Goa	31.8	B++
18	Uttarakhand	31.6	B++
19	Assam	29.0	B+
20	Uttar Pradesh	26.5	B+
21	Sikkim	22.8	B+
22	Arunachal Pradesh	21.6	B+
23	Himachal Pradesh	20.8	B+
24	Nagaland	20.5	B+
25	Bihar	20.3	B
26	Mizoram	20.3	B
27	West Bengal	19.4	B
28	Manipur	19.3	B
29	Tripura	17.7	B
30	Meghalaya	17.6	B
31	Jammu & Kashmir	14.4	B



01

Introduction to

SARAL



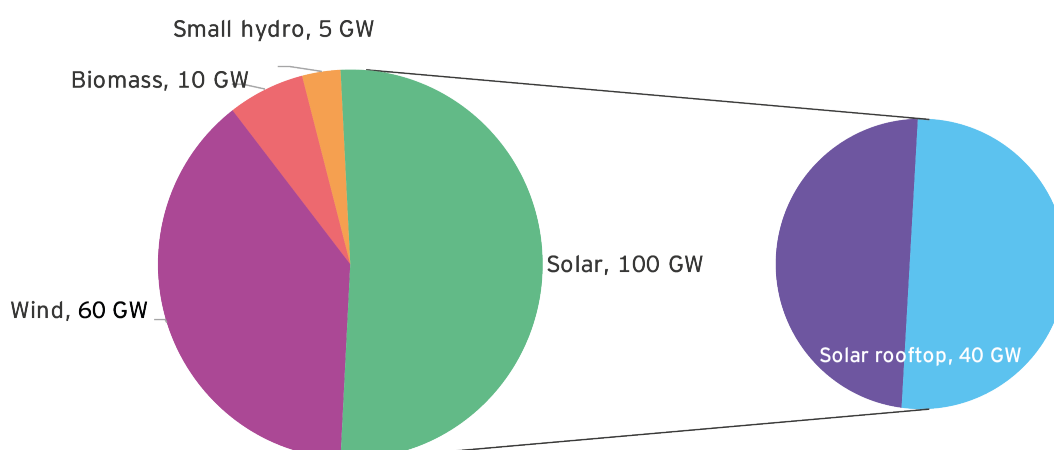
1.1. Context

According to a report by International Monetary Fund (IMF), India is one of the fastest growing economy in the world, with a forecasted growth rate of 7.3% in 2019. The country's road to prosperity is firmly rooted in the ability of its power sector to develop at a faster pace. BP Energy Outlook 2035 estimates that even under the most modest growth assumptions, India's growth ambitions will lead to a 100% increase in energy consumption, thereby requiring double the quantity of energy sources.

The new energy to meet this surge in demand is increasingly coming from renewable energy, with solar energy being an important solution to India's electricity sector challenges¹.

India is making giant leaps in the renewable energy sector, as evident from its consistent rank in top five attractive countries since last three years in "Renewable energy country attractiveness index" (RECAI) report. This is primarily due to strong support from the central as well as the state governments.

Figure 5: Break-up of India's 175 GW renewable energy target for 2022²



1.1.1. Need for SARAL

Rooftop solar market in India is witnessing substantial interest from entrepreneurs, developers, financial institutions, development banks, end users, as well as government entities. Various states have different rooftop solar policies, incentives, metering regulations and rooftop availability. At the same time, their electricity tariffs, consumer mix and the robustness of distribution infrastructure also varies.

Cumulative rooftop solar installation as of March 2019 is 4.37 GW. This has to grow ten-fold so as to achieve the target of 40 GW. For this, states must gear up,

and put in place a robust implementation environment including introduction of clear and detailed regulations, strong monitoring and enforcement mechanisms, new institutional structures, promote innovative discom-centric business models. Also, states should adopt the activities that will spread awareness among consumers and other stakeholders across the value chain. Some states in India have progressed quite well. For example, over the last one year, Maharashtra has added more than 450 MW of rooftop solar capacity. Delhi has introduced the most detailed net metering regulations. Karnataka

has launched a comprehensive e-portal that acts as a single window clearance for all applications. However, there are many other states which need to accelerate the deployment of rooftop solar to collectively reach 40 GW by 2022.

Therefore, a standardised tool that can assess and evaluate various states for their preparedness to support rooftop solar deployment will be highly critical.

State Rooftop Solar Attractiveness Index - SARAL - has been developed as a tool which ranks all states based on an identified set of parameters that are critical to accelerating rooftop solar deployment. SARAL can highlight best practices, weaknesses and strengths, and act as a knowledge sharing platform among states and help investors identify states attractive for investments in rooftop solar space. The solar revolution on Indian rooftops is gaining momentum with substantial interest from entrepreneurs, developers, financial institutions, development banks, end users and government entities. At the same time, various states have different rooftop solar policies, incentives, metering regulations, solar potential, availability of rooftop area, etc. This warrants the requisite for a uniform platform to account for these parameters and rank states based on their rooftop solar attractiveness. Moreover, GoI also has a firm belief of having a healthy competition among states to ease out the avenues of mutual knowledge exchange and learning in different sectors or economic outlook. Such comparisons give an insight to potential investors to form long-term strategies and business operations in different parts of the country.

It is believed that an exercise to evaluate states according to their attractiveness for solar rooftop investments will induce a spirit of positive competition amongst states and encourage them to share experiential learnings. This is likely to create a more conducive environment for solar rooftop installations, encourage investment and lead to accelerated growth of the sector.

1.1.2. Aim

The aim of SARAL index 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

1.1.3. Utility and benefits of SARAL index

The index serves as an important tool to:

- ▶ Benchmark development and deployment of solar rooftop in states.
- ▶ Identify states that require more hand holding 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.

02

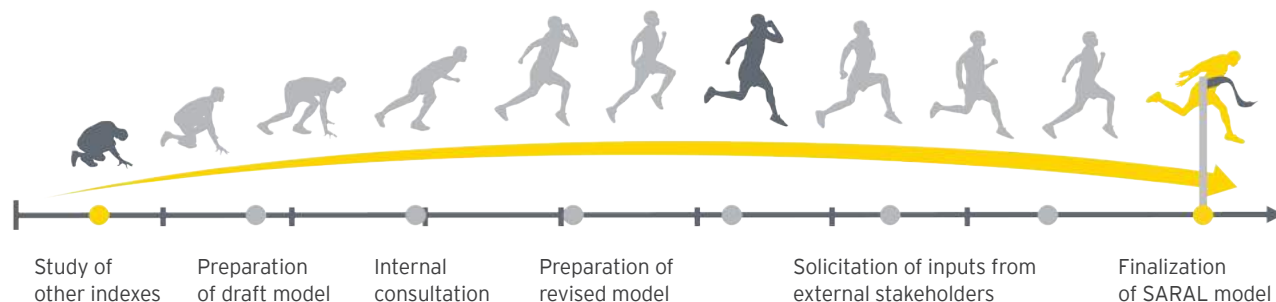
Approach and Methodology for **Developing SARAL**



2.1. 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 6: Evolution of the SARAL



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, Central and State governments are adopting the index as a tool for evaluation in various sectors. Some of these are the Health Index, Liveability Index, Start-up Ranking Framework and Swachh Bharath Index.

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

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

The parameter list is as comprehensive as possible. Data has been sourced from:

1. Publicly available documents and databases.
2. Interactions with multiple stakeholders in each State for parameters where data was not available.

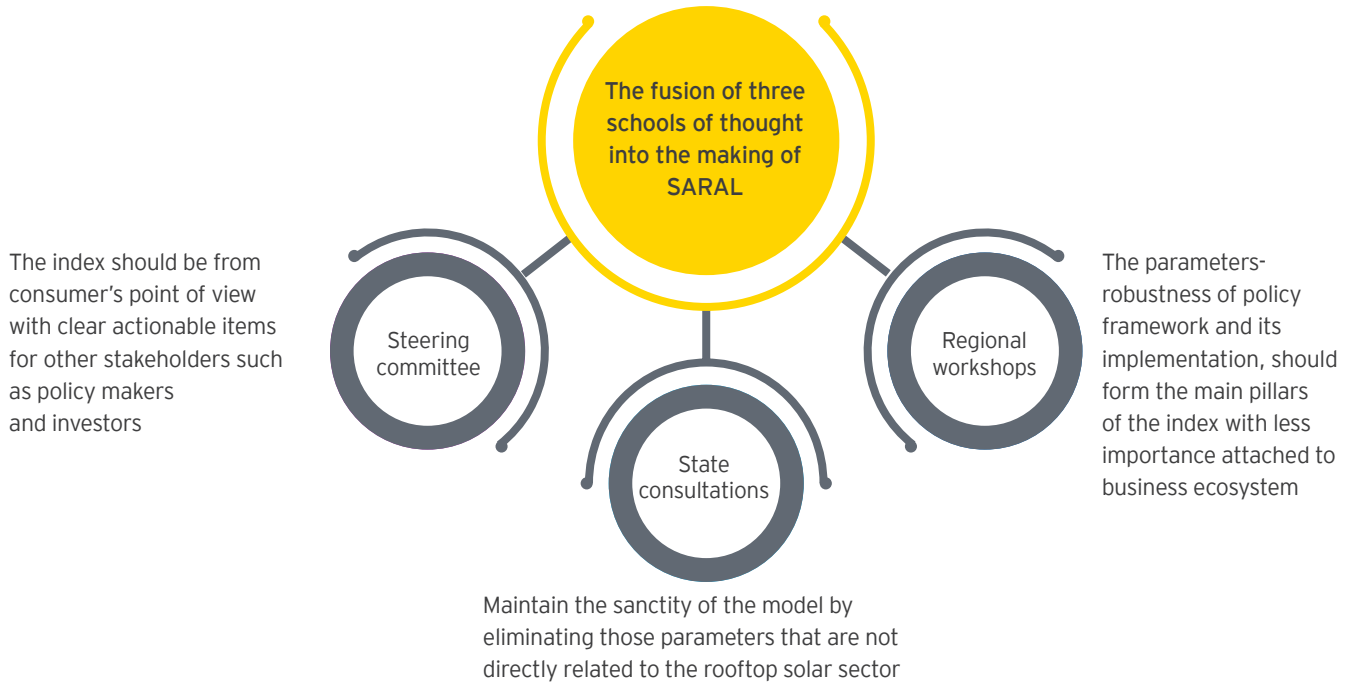
Any resulting subjectivity has been minimized through the scoring methodology. The subjectivity can be further reduced in future iterations if better and more data is available.

2.1.1. The final model

The final model has been arrived at after multiple iterations. Please refer to Annexure 1 for details on the iterative process.

In order to realise 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 sector experts, to ensure that the index is reflective of the real considerations. The perspectives and views expressed during the state consultations and regional workshops were also kept in mind while refining the model

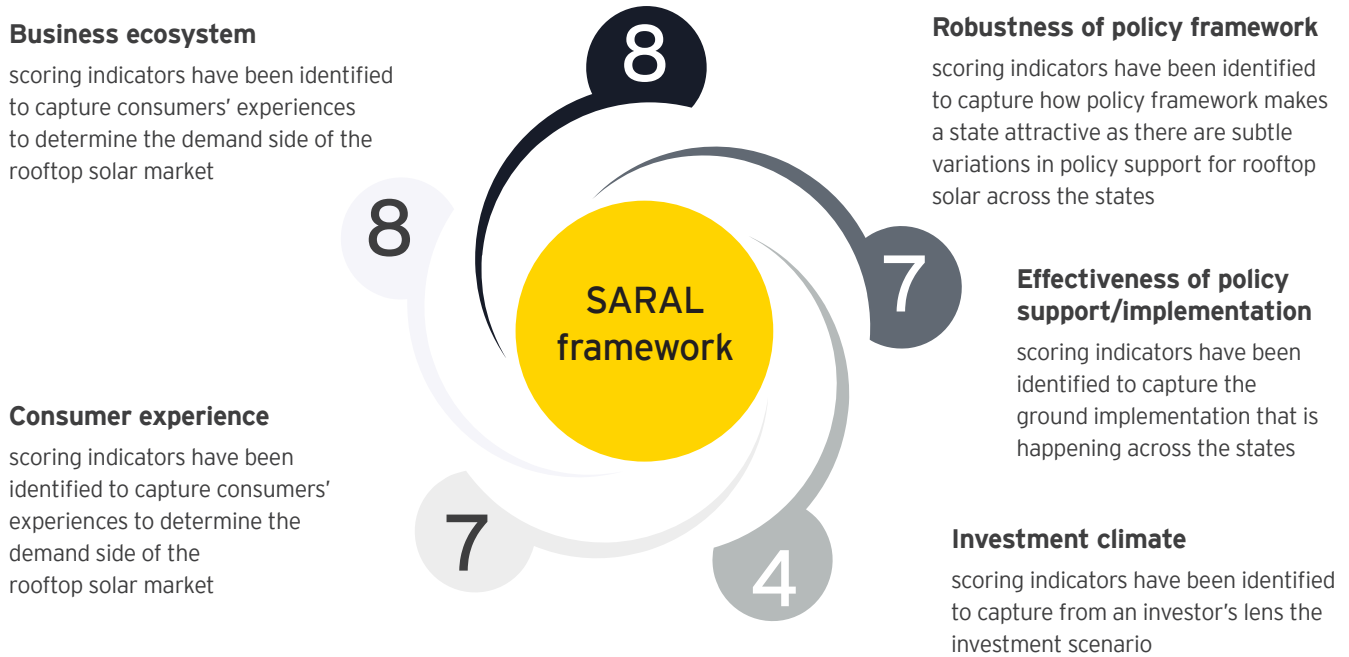
Figure 7: Model refinement methodology



The key takeaway that emerged from these discussions was to include only those scoring indicators that directly impacted the rooftop solar segment and not the overall solar segment. Another proposed suggestion was to club scoring indicators to make the model more compact without losing its comprehensiveness. The attention to semantics was highlighted so that each parameter and its building blocks become all-encompassing.

One such example was the scoring indicator initially termed as “comprehensiveness of net/gross metering policy in the state” but was later changed to “clarity and detailing in metering regulations in the state” so as to ensure that not only the quantity but also the quality of the metering regulations is captured. Through this iterative process, the model was further refined. Finally, the model consists of five buckets with 16 sub-parameters and 34 scoring indicators.

Figure 8: The final SARAL model



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 regulations. It also governs the routes available to prospective prosumers for setting up a rooftop solar system and the financial incentives and non-monetary support available to them for this.

Parameters covered under robustness of policy framework

- ▶ The level of policy support encompasses a complete set of aid extended to the prosumer for the setting up of an rooftop solar systems.
- ▶ Policy covenants refer to the support offered or limitations imposed by the regulatory authority on the prosumer for installing a rooftop solar system.
- ▶ The billing mechanism plays a key role in making rooftop solar attractive for a consumer or prosumer.

Effectiveness of policy support/implementation

What is the level of ground-level implementation and compliance with the policies?

The effectiveness of policy support/implementation bucket highlights how the policy framework actually translates into the 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.

Parameters covered under effectiveness of policy support/implementation

- ▶ **The ease of application**, as the name suggests, captures the ease with which any prospective consumer can get authentic information, apply for setting up a rooftop solar system and the time taken from application to installation.
- ▶ **The ease of availing state subsidies** indicates compliance with the incentives process defined in the policy.
- ▶ During the life cycle of the rooftop solar systems, the user has to consistently interact with the concerned distribution companies (DISCOMs) for billing, connecting to the grid, and for completing

the registration procedure of the system. Therefore, **the state of affairs of the DISCOMs** is a factor in the quality of experience the user has.

- ▶ Power offtake attractiveness captures the ground reality with respect to the net metering **payment settlement time**.
- ▶ **Restrospective changes to the policy** impact investments and investors' confidence.
- ▶ Installed rooftop solar capacity is one of the direct indicators of the effectiveness of solar rooftop implementation environment in the state.

Investment climate ●

What is the investment scenario and market conditions in the state?

The investment climate includes all the factors pertaining to the 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 the investments since the chances of failure are low and the state seems a sure bet to an investor.

Parameters covered under investment climate

- ▶ 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.
- ▶ Maturity of the market covers the existing market conditions regarding number of developers, the industry workforce and the share of C&I consumers in total GRPV installation to judge the stage in which the market is.

Consumer experience ●

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

The experience of the consumer is an important factor in evaluating the offtake potential of any technology, programme or scheme. The more aware and accepting a consumer is, the more likely it is that he/she is going to adopt that technology, 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, the ease of installation and the reliability of supply from the grid.

Parameters covered under consumer experience

- ▶ The experience of the consumer is divided into three chronological phases - before, during and after installation of a rooftop solar system to capture the experience through the journey.
- ▶ Grid reliability and retail tariffs are considered because solar rooftop is a cost-effective and viable alternative. If the consumers receive unreliable electricity at rising tariffs, then the case of installing a rooftop solar system becomes stronger.

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. The business ecosystem encompasses the economic environment in the states and thus helps ascertain the attractiveness of the state for long-term investments. The parameters also determine the presence and strength of the business enablers in the states.

Parameters covered under business ecosystem

- ▶ The current and projected **economic outlook**.
- ▶ The **institutional framework and transparency in policy-making and execution processes**.
- ▶ **Business enablers** account for ease of doing business in that state and the support framework that exists in the state for any business.

All the parameters are described in the table below. However, details of each parameter with respect to what it measures, rationale for inclusion, mode of measurement, scoring criteria and data source are given in the annexure 1.

Table 2: The SARAL framework

Parameters	Weightage	Sub-parameters	Weightage	Description	Weightage
Robustness of policy framework	20%	Level of policy support	33.3%	Clarity and detailing in metering regulation	25.0%
				Availability of other state schemes to promote solar rooftop	25.0%
				Provision of single window mechanism	25.0%
				Provision of deemed approval process	25.0%
		Covenants	33.3%	Minimum GRPV system size allowed in the state	33.3%
				Maximum GRPV system size allowed in the state	33.3%
				Cumulative capacity of solar vis-à-vis regional DT capacity	33.3%
		Billing mechanism	33.3%	Permissible settlement time	100.0%
Effectiveness of policy support/ implementation	26.3%	Ease of application	60.0%	Presence of interactive consumer interfaces	33.3%
				Average time taken from date of application to system installation	33.3%
				Ease of availing state subsidies	33.3%
		Power offtake attractiveness	10.0%	Deviation from the stipulated settlement period	100.0%
		State of affairs of discoms	20.0%	Credit rating of Discoms	100.0%
		Impact of policy	10.0%	Instances of retrospective changes to the policy	50.0%
				The rooftop target achieved so far (in %)	50.0%
Investment climate	16.8%	Driver for rooftop solar uptake	33.33%	Share of C&I consumers in total GRPV installation	100.0%
		Ease of financing	33.33%	Ease of securing loans	50.0%
				Availability of insurance providers for GRPV projects	50.0%
		Maturity of market	33.33%	Availability of project developers/installers/ material suppliers	100.0%
Consumer experience	26.3%	Pre-installation consideration	30.0%	Consumer awareness	43.0%
				Tariff rise for end consumers	43.0%
				System Average Interruption Duration Index	8.0%
				System Average Interruption Frequency Index	8.0%
		During installation	40.0%	Ease of execution - from application to installation	100.0%
		Post-installation experience/ costs	30.0%	O&M cost	50.0%
				Warranty and aftersales experience	50.0%

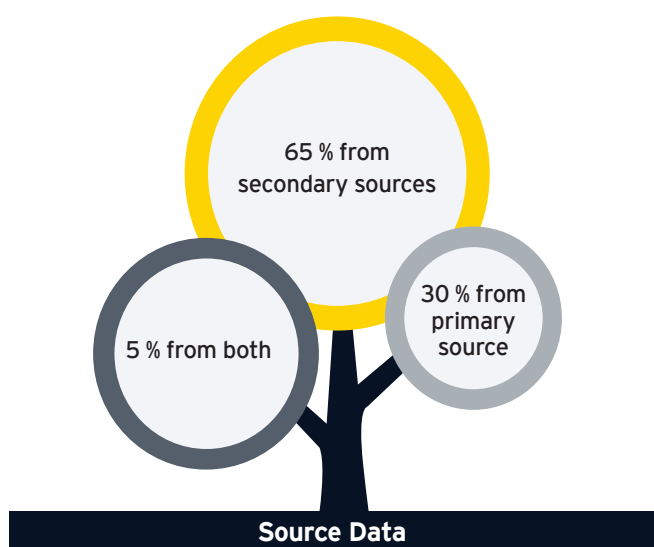
Parameters	Weightage	Sub-parameters	Weightage	Description	Weightage
Business ecosystem	10.6%	Business enablers	37.5%	Ease of doing business index	33.3%
				NCAER economy rating of the state	33.3%
				MSME 5 year growth rate	33.3%
		Fiscal and Regulatory environment	37.5%	Credit rating of the state	33.3%
				Transparency in policy making	33.3%
				Institutional architecture	33.3%
		Economic Outlook	25.0%	GSDP per capita	50.0%
				GSDP growth	50.0%

2.2. Feedback received from stakeholders

To involve states in development of the Index and to provide a platform for dialogue between different government institutions, industry, think tanks and other agencies, feedback was solicited from:

- ▶ Steering committee members
- ▶ Regional workshops
- ▶ State consultations

Figure 9: The data sources for building the SARAL model



Below is the feedback received from each of these.

2.2.1. Steering committee

The steering committee was entrusted with the task of ensuring independence and fairness in the development process, so that SARAL is comprehensive and reflective of all the important aspects of rooftop solar sector.

- ▶ The steering committee members deliberated on the primary purpose that the index must fulfil.
- ▶ After extensive discussions, the team came to a consensus that the index should be from consumers' perspective. However, it should depict clear actionable items for other stakeholders such as state-level policy makers, implementation authorities, investors, and the industry.
- ▶ The members further elaborated that some parameters that do not directly affect the consumers and investors, such as Renewable Purchase Obligation (RPO) met by a state, can be ignored or clubbed with other parameters.

- ▶ They highlighted the need to focus on semantics and hence proposed to the scoring indicator - Comprehensiveness of net/gross metering policy in the state. Suggestion was to change it to comprehensiveness and clarity of policy for on-site grid connected solar.
- ▶ They proposed to club a few scoring indicators into one to make the model more compact without losing its comprehensiveness. For example, single window mechanism and deemed approval process can be clubbed into one.
- ▶ According to them, scoring indicators with a direct bearing on consumer acceptance/experience will have a larger impact on offtake potential of rooftop solar. Therefore, more inclusive scoring indicators like payback period, after sales experience/O&M services need to be incorporated in the model.
- ▶ The members also suggested to revamp the model to list down the scoring indicators in either chronological order or descending order of the impact or in some other alternative way so that a flow is maintained in the list.
- ▶ They also assigned relative importance to the five buckets which were then used to determine the weightages of these buckets.

2.2.2. Regional workshops

The purpose of regional consultations was to get a perspective of industry bodies on identified five buckets that collectively determine the potential of a state to attract investments in the solar rooftop space. Industry bodies shared their problems regarding the application procedure, different aspects of net metering including roles and responsibilities of different stakeholders and requested the representatives of government to ease the procedures as soon as possible.

Challenges identified:

- ▶ Consumer awareness is a barrier. Today, consumers are not aware of the rooftop solar systems' benefits, costs and different models associated with it.
- ▶ Lack of financing solutions is also a major hurdle market. This needs an urgent attention as upfront costs are high for residential consumers and many consumers may not have sufficient liquidity to pay for system. However, the panel agreed that an easy access to finance instead of providing subsidies will be key for rooftop solar systems to take off.

- ▶ Another major challenge is the cost of storage. Currently, the cost of a rooftop solar system with battery storage ranges between INR90,000- INR1,35,000 per kW (without subsidy). Lower cost of solar plus storage will drive rooftop solar as it will make the consumers more independent.
- ▶ Undertaking such an activity was appreciated because it can help present a holistic view of the solar rooftop attractiveness in the states, making it easier for the wider audiences to understand.

The three regional consultations were held in (details in Annexure 1):

- ▶ 1. Bengaluru - 13th July 2018
- ▶ 2. Kolkata - 17th August 2018
- ▶ 3. New Delhi - 18th October 2018

2.2.3. State consultations

One of the main objectives of state consultations was to confirm the validity of five buckets on which the SARAL model is built and to capture the relative importance of these buckets. Basis the importance given by different stakeholders, the weightages to these parameters was decided.

The consumer experience and effectiveness of policy support/implementation were given utmost importance in assessing a state for its attractiveness for solar rooftop. Most states have given either the rank of four or five on a scale of five to these two parameters with a few exceptions. The weightages for these two parameters are very close with consumer experience at 30% while the effectiveness of policy support/implementation at 29%. Together these two have a combined weightage of 59%. The least important parameter, i.e., business ecosystem, was consistent throughout all the zones with an overall weightage of just 8%.

The robustness of policy framework has been given an overall weightage of 18% by the stakeholders. Only a few states have given it the rank of four but no state assigned it the rank of five. Delhi, Punjab, Haryana and Maharashtra have ranked it one. This shows that this parameter is moderately important in the overall picture.

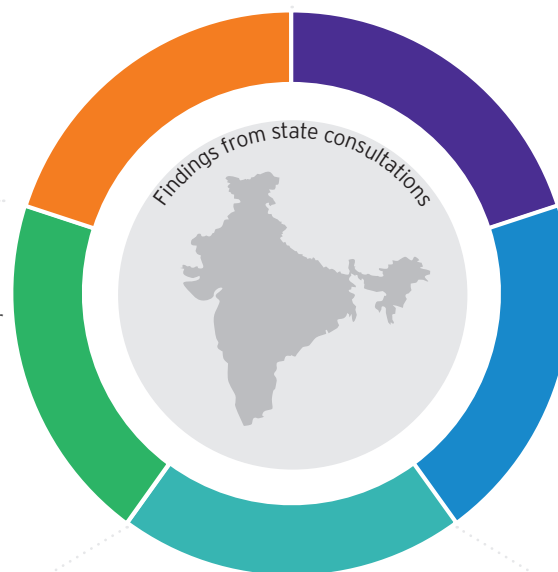
Figure 10: The findings from state consultations

Business ecosystem

- ▶ Overall weightage of 8%
- ▶ With the sole exception of Haryana, no other states has given it the rank of 3 or more
- ▶ A large majority - 80% of the states has given this parameter the lowest rank of 1

Consumer experience

- ▶ Overall weightage of 30% - it is the most important parameter
- ▶ None of the states has given it the rank of 2 or less
- ▶ Over three-fifth of the states keeps it at the rank of 5



Robustness of policy framework

- ▶ Overall weightage of 18%
- ▶ Only few states like UP, Chhattisgarh have given it the rank of 4 with non giving it the rank of 5
- ▶ On the other hand, states like Delhi, Haryana and Maharashtra has given it a rank of 1

Effectiveness of policy support/ Implementation

- ▶ Overall weightage of 29% - it has emerged as the one of the most influential parameters
- ▶ None of the states has given it the rank of 3 or less
- ▶ Gujarat has given it the highest rank of 5

Investment climate

- ▶ Overall weightage of 15%
- ▶ Only few states such as Delhi, HP and AP have given it the rank of 3
- ▶ None of the states have given it the rank of 4 or higher
- ▶ Few states such as J&K and Uttarakhand has given it a rank of 1

2.3. Data Selection and Collection

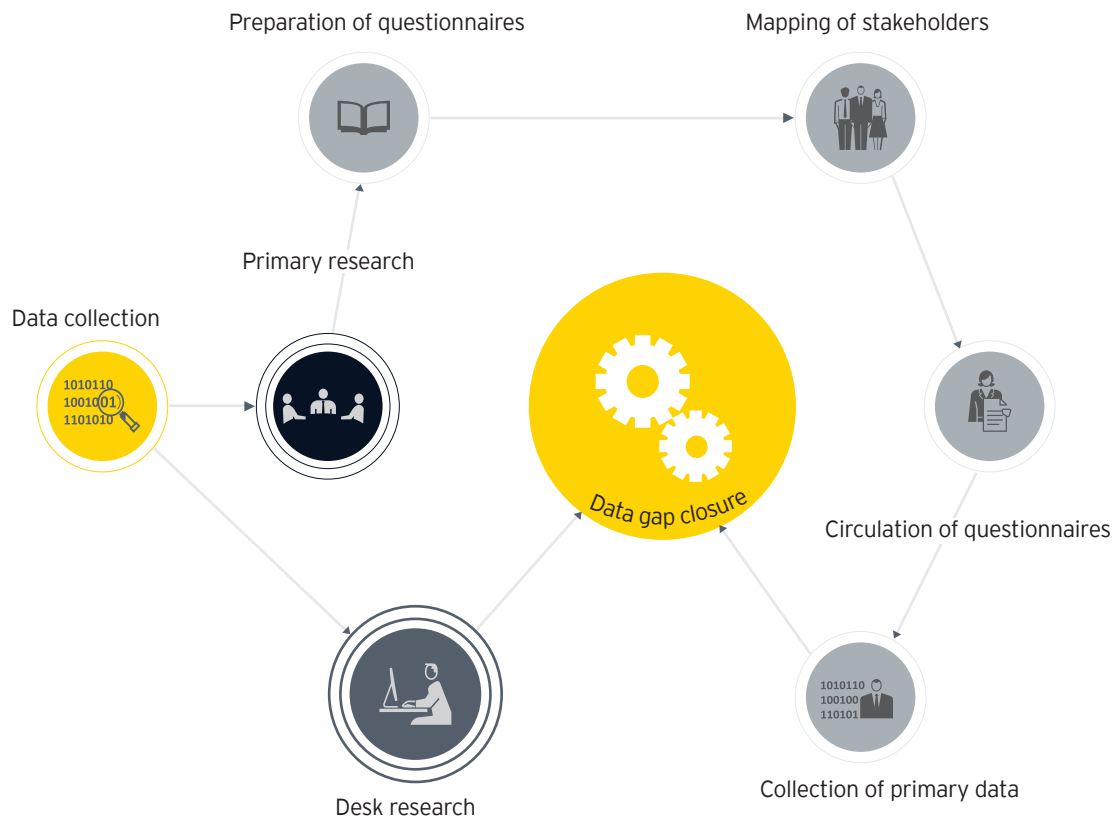
The SARAL is the first-of-its-kind in the sector. It is in a nascent stage. The robustness of data can improve in future iterations. In this iteration, the data is collected from primary and secondary resources. However, there were challenges in this process.

Data was collected from all the reliable and credible sources. The main sources include government sources such as net/gross metering policy/regulations, solar policy documents, government/SNA's websites, tariff orders, Ministry of Power's State Distribution Utilities Sixth Annual Integrated Rating report, etc.

In the next stage, primary research was conducted for closing any data gaps and for reviewing/updating the data collected from secondary sources. The primary data was collected in the following manner:

- ▶ Preparation of questionnaires for data collection
- ▶ Mapping of the stakeholders in the rooftop solar sector in states
- ▶ Circulation of questionnaires with the relevant stakeholders in the states
- ▶ Collection of data for all the 29 Indian states and two union territories (UTs), either through face-to-face interaction, telephonic conversation or e-mail communication.

Figure 11: The data collection and collation process



A detailed questionnaire was prepared by the SARAL team, sample of which is attached as Annexure 1. The meetings or the interviews were guided by the questionnaire and the team analyzed the responses to derive insights.

Out of the 34 scoring indicators, 22 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. For details, please refer to the Annexure 1.

2.4. Scoring Process

2.4.1. Assigning of weightages

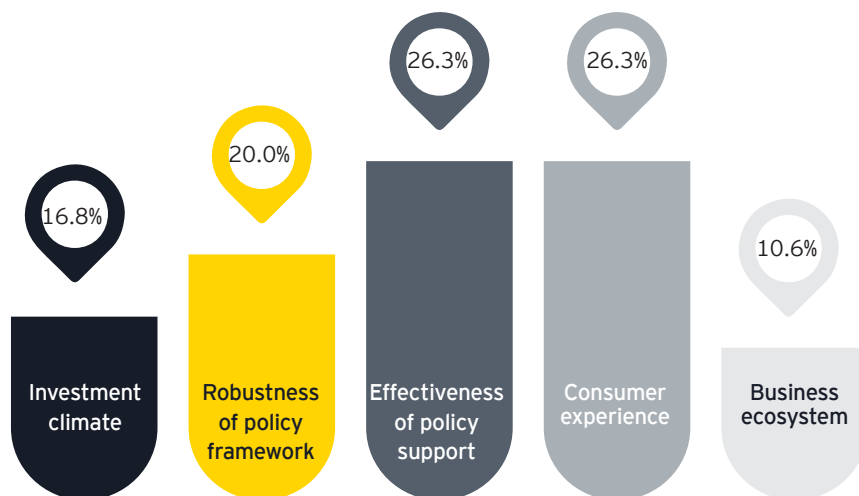
Parameters

The five drivers, the robustness of the policy framework, the effectiveness of that policy support, the investment climate of a state, the consumer experience and the business ecosystem were allocated the following weights W_a , W_b , W_c , W_d and W_e , respectively:

- ▶ Robustness of the policy framework - 20.0% (W_a)
- ▶ Effectiveness of the policy support - 26.3% (W_b)
- ▶ Investment climate - 16.8% (W_c)
- ▶ Consumer experience- 26.3% (W_d)
- ▶ Business ecosystem - 10.6% (W_e)

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

Figure 12: The final weightages of the five parameters



Sub-parameters

The five drivers are further segregated into 16 sub-drivers. Each parameter in itself is of 100 points. The weights allocated to each sub-parameter within a parameter will add to 100%. For e.g., under the robustness of the policy framework parameter, the four sub-parameters will be allocated weights W_{ai} , W_{aii} , W_{aiii} and W_{aiv} , respectively such that $W_{ai} + W_{aii} + W_{aiii} + W_{aiv} = 100\%$. The weightage of the sub-parameter - level of policy support in the state will be W_{ai} .

Thus, the effective weight of each sub-parameter will be a function of the weight of both the parameters and the sub-parameters within the universe of that parameter. By this logic, the effective weightage of the level of policy support in the model will be equal to $W_a * W_{ai}$.

Scoring indicator

The 16 sub-parameters are further divided into 34 scoring indicators. These are the measuring rods against which each state will be scored in terms of their attractiveness for the solar rooftop. Here again, a similar process is followed for assigning the weightage. The weights for all the four scoring indicators under the level of policy support in be $W'1$, $W'2$ to $W'4$, respectively. The weight of the scoring indicator - clarity and detailing in net metering regulations in the state will be $W'1$, which is 25% in the model. The summation of these weights should be equal to 100%.

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

Illustration: The robustness of policy framework has an overall weightage of 20% and the sub-parameter measuring level of policy support has a weightage of 33.3%. This means that this parameter accounts for 6.9% ($20\% * 33.3\%$) of the total score obtained by a state in this model.

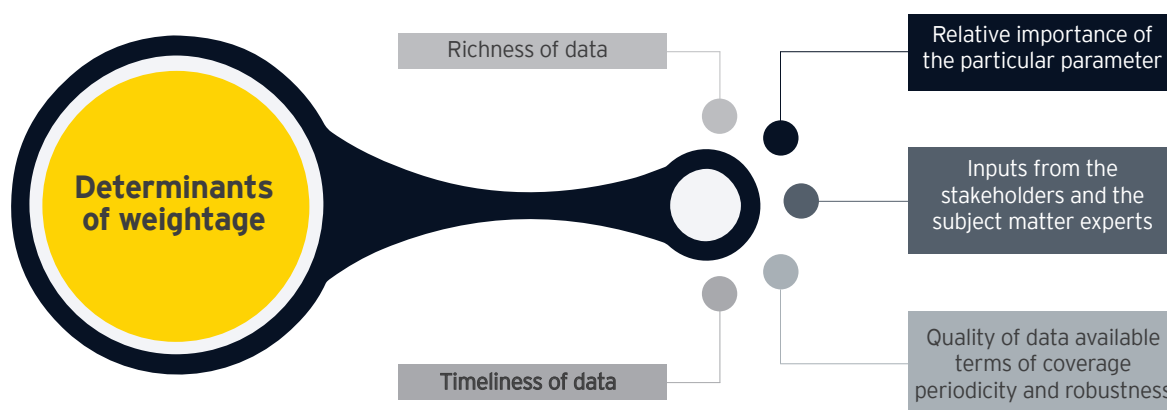
Going to the next level of individual scoring indicators, the effective weightage of clarity and detailing in net metering regulations comes out to be $20\% * 33.3\% * 25\%$ ($W_a * W_{ai} * W'1$) which comes out to be 1.6%. In other words, if the states are scored out of 100, 1.6 marks of the total 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.

2.4.2. Factors considered for assigning the weightages

The allocation of the weightages has been based on the amalgamation of inputs received from all stakeholders. Thus, the final weightage is based on:

- ▶ **The inputs from the stakeholders and the 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 1 to 5) the main five 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 created a consensus for policy action. The weightage preferences for the 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 the experts and can produce inconsistencies in the analysis. The details are given in the next section.
- ▶ **The importance or the relevance of a parameter:** the importance or relevance of a parameter is the qualitative assessment of the value contributed by it in determining the rooftop attractiveness solar of a state. The value is characterized by the degree to which it meets current and potential needs of the users.
- ▶ **The timeliness of data:** the 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:** the quality of basic data chosen to build the composite indicator strongly affects its accuracy and credibility. Weights were chosen to reflect the 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.

Figure 13: Factors considered for assigning the weightages



2.4.3. Methodology for assigning weightages to the five core drivers

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

Out of the five drivers, please rank (in a scale of 1 to 5) according to the importance of each of them in assessing state attractiveness for rooftop solar.

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	

The purpose of this question was to gauge the mind-set of the stakeholders and their perceived importance of the different drivers/parameters with respect to the solar rooftop sector in their states. The inputs collated for this question were used for analysis to arrive at the weightages for the drivers/parameters.

These 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, a modified version of the Borda's scoring rule was adopted for each group mentioned above:

- ▶ The ranks 1 to 5 were given points of 1 to 5 respectively, that is, rank 1 has 1 point and rank 2 has 2 points and so forth.
- ▶ The stakeholders gave a rank to each of the five parameters.
- ▶ The points, based on the ranks, for each parameter are summed.
- ▶ The sum of the points for all the 5 parameters were again added to arrive at the grand sum.
- ▶ For each parameter, its sum was divided by the grand sum to arrive at its relative importance.
- ▶ The process was repeated for all the five parameters.
- ▶ The relative importance was calculated to act as the weightages for the drivers in the index model.

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

No. of response						
Ranking	Robustness of policy framework	Effectiveness of policy support	Investment climate	Consumer experience	Business ecosystem	Points
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
Total	86	86	79	78	58	387

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

2.4.4. Scaling and normalization process

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

Out of the five drivers, please rank (in a scale of 1 to 5) according to the importance of each of them in assessing state attractiveness for rooftop solar.

Scale transformation prior to normalization

To have an 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 the smaller states and providing a level playing field for all the states. One of the scoring indicators pertain to the installed rooftop solar capacity. Taking the absolute number would have been unfair to the smaller states like Goa and north-eastern states. Instead, the installed capacity as a fraction of the rooftop solar targets, 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 the correctness of the approach followed in the normalization phase. Thus, the normalization method should consider the data properties, as well as the objectives of the index. The SARAL 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 the benchmarking of states but also can be used to compare the 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 for each economy 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 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 GRPV 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 GRPV installation range from the 93.68% (for Maharashtra) to 35.71% (for Himachal Pradesh). The higher the value on this scoring indicator, more is the attractiveness of a state. As per this calculation, Maharashtra will get a score of 100 while it will be 0 for the state of Himachal Pradesh. The other states will lie in between which will represent the distance to the best value. For Delhi, with 44.44% of C&I consumers share, the distance to frontier will come out to be 15.06 $((0.3571 - 0.4444) / (0.3571 - 0.9368) * 100)$.

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

2.4.5. 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.

Illustration: to continue with the above example on the share of commercial and industrial (C&I) consumers in total GRPV installation, each dataset adds up to reach an overall scoring in the following way:

	Maharashtra	Delhi
Normalized distance to frontier score	100	15.06
Score adjusted for scoring indicator weight of 33%	$100 \times 100\%$	$15.06 \times 100\%$
Score adjusted for sub-parameter weight of 25%	$100 \times 100\% \times 33.3\%$	$15.06 \times 100\% \times 33.3\%$
Score adjusted for parameter weight of 16%	$100 \times 100\% \times 33.3\% \times 16.8\%$	$15.06 \times 100\% \times 33.3\% \times 16.8\%$

So out of the 5.60 marks attributed to share of C&I consumers in total GRPV installation, Maharashtra scores 5.60, Delhi gets 0.84 and Himachal Pradesh. The same process is reiterated for all the 34 scoring indicators and sum of all these gives the overall SARAL score. The states have been ranked based on their SARAL scores.

03

Final results and key takeaways for

States



3.1. Key learnings

There are several success stories across states in India which provide enormous learning to remove the existing barriers. Some of the successful initiatives and critical challenges that are need to be overcome are discussed below. The following facts have helped assign scores for the defined parameters, sub-parameters and indicators.

1. Robustness of policy framework

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

Successful initiatives:

- ▶ Bihar's new policy aims for energy sufficiency by adding 3,433 MW of power from renewable energy sources into its generation capacity by 2022 with a dedicated rooftop solar target of 1,000 MW with having both net metering and gross metering mechanisms. Notable provisions in the policy are include the conversion of roof spaces of all the state government buildings in the state as "roof bank" for solar rooftop projects that highlights focus on creating strong policies that will channelize rooftop solar deployment.
- ▶ In January 2018, the Joint Electricity Regulatory Commission (JERC) introduced the state sSolar pPolicy for Goa that has set a clear framework for ground mounted solar as well as solar rooftop. It has introduced both the capital expenditure (CAPEX) model and the renewable energy supply company (RESCO) model CAPEX and RESCO model for ownership and is encouraging encourages the consumers to opt for solar rooftop by installing a solar rooftop over all government buildings.
- ▶ In January 2018, the Odisha Electricity Regulatory Commission (OERC) passed an amended to its 2016 regulations on net metering and their connectivity with respect to solar PV projects. The OERC has raised the cumulative solar energy capacity at distribution transformer level to 75% of from the transformer capacity from of 30%. There is no cap on the capacity of solar installation at the consumer level if it is within the limit of the connected load.

What is holding the sector back?:

- ▶ Many state-level policies and regulations have gaps such as lack of guidelines for interconnection with the grid, guidelines for meter technology to be used, and set timelines for benefits or subsidies, etc.
- ▶ In a few states, there are several sites that are spacious and can enough for install a plant with

capacity as high as 20 MW, . However, but the government policies only allow only 1 MW-2 MW of maximum installed capacity for grid-connected rooftop plants.

- ▶ There is a lack of single window facility for project clearances in several states.

2. Effectiveness of policy support/implementation

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

Successful initiatives:

- ▶ Telangana New and Renewable Energy Development Corporation Limited (TSREDCO) has signed an MoU with Telangana State Road Transport Corporation (TSRTC) for establishing 5 MW of solar PV energy capacity. Several urban local bodies are in the process of applying to set up roof-top solar energy systems in the on-grid method.
- ▶ Maharashtra has put aside INR2,682 crore for installing rooftop solar systems on government buildings (with 100% subsidy). The state also offers 15% subsidy to people below the poverty line for installing rooftop solar systems (15% subsidy). Applicants can apply for the net metering program in Maharashtra by filling a simple online form.
- ▶ The Haryana Government plans to make it mandatory for all public buildings, like schools, health centers, and offices to have rooftop solar panels as part of their state-wide initiative.

What is holding the sector back?:

- ▶ In many states, projects face delay in approvals and other regulatory processes.
- ▶ In many states, there is slow progress in deployment of solar panels due to inadequate policy frameworks, passive opposition from DISCOMs and insufficient capacity at the local utility level.
- ▶ Many state regulations impose a cap on size of rooftop solar PV due to limitations transformers' capacity anctioned load, and consumer inertia.

3. Investment climate for rooftop solar sector

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

Successful initiatives:

- ▶ Punjab exhibits a positive investment climate towards rooftop solar. In May 2018, the state opened the world's largest single rooftop facility with the capacity to produce 11.5 MW electricity. A power purchase agreement (PPA) was signed between the Beas and the Punjab State Power Corporation Limited (PSPCL) for 25 years. The project is expected to generate 27 million units of electricity per annum which may be enough to cater to the electricity needs of about 8,000 households in Punjab.
- ▶ The Uttarakhand Government is promoting the use of small-scale rooftop under grid Interacted rooftop scheme in Uttarakhand where applicants are provided with a 30% subsidy under National Solar Mission of MNRE.
- ▶ In 2018, on behalf of the Energy Department of the Government of Bihar, Bihar Renewable energy Development Agency (BREDA) invited bids for 40 MW worth of grid-connected solar rooftop for various locations across Bihar.

What is holding the sector back?:

- ▶ Funding of initiatives like National Solar Mission is a constraint given India's inadequate financing capabilities. The finance ministry has explicitly raised concerns about funding an ambitious scheme like National Solar Mission (NSM).
- ▶ Since rooftop solar market has not picked up and there is only a meagre 10%-12% share of the overall solar capacity, banks/financiers perceptions of high risks and suspicion about their future performances which makes them unwilling to lend money for solar rooftop projects.
- ▶ Financial institutions lack technical expertise to carry out due diligence for solar roof top.

4. Consumer experience

It measures the perception, acceptance and experience of the consumers of this sector.

Successful initiatives:

- ▶ Andhra Pradesh's dedicated rooftop solar portal, Unified Solar Rooftop Transaction Portal (USRTP) serves as an integrated platform for multiple solar rooftop stakeholders in the state. The USRTP displays comprehensive information pertaining to installation of solar rooftop PV system in the state and enables interactions between multiple stakeholders. Through this platform, it is possible for consumers to submit interconnection applications and also apply for subsidies to appropriate DISCOM and New&Renewable Energy Development Corporation of Andhra Pradesh Ltd. (NREDCAP), respectively. USRTP enables tracking the progress of both the submitted applications.
- ▶ The Government of Goa has installed a solar rooftop plant over Raj Bhavan and have identified 13 offices of Goa Power Department that will host solar rooftop in a bid to increase awareness among people.
- ▶ In July 2018, Directorate of New and Renewable Energy (DNRE) invited bids for empanelment of firms for supply, erection, testing and commissioning including warranty, operation and maintenance for five years of grid interactive rooftop solar power plants having capacities up to 1000 kWp in Nagaland.

What is holding the sector back?:

- ▶ A major challenge being faced by almost all states is the ownership structure of residential complexes. Large cities with high income households have limited rooftop solar space for installation and with multi-family apartment complexes and rented houses, the ownership rights become a major hindrance of rooftop solar.
- ▶ The lack of a common e-platform to keep customers updated about the information on the incentives, documentation and process of implementation of solar rooftop projects impacts customer awareness, especially in residential areas.
- ▶ Volatilities in solar equipment's prices (especially modules) and ambiguities related to policy measures result in fluctuations in systems' costs, which in turn compel customers to wait and watch for further reduction in prices.

5. Business ecosystem

It measures how supportive is the law and order, market demand institutions, and infrastructure for any business in the state.

Successful initiatives:

- ▶ In 2018, a two-day workshop on "Outreach of solar rooftop" was conducted in Assam in order to create a positive business ecosystem in the state. The workshop was organized on how to run an integrated campaign to drive demand for solar rooftop at the state level.
- ▶ The Ministry of Power in Kerala directed Kerala State Electricity Board (KSEBL) to provide rooftop solar training to its field-level employees.

What is holding the sector back?

- ▶ Complexity of institutional framework due to involvement of too many agencies like MNRE, IREDA, SNA, electricity board and electricity regulatory commission makes the development of solar PV projects difficult.
- ▶ Difficult environment for businesses due to lack of close industry-government cooperation in several states hinder the rooftop solar market to achieve success.

3.2. SARAL state scores in five broad drivers

Table 3: SARAL state scores in five broad drivers

Ranking	States	Saral score	Robustness of policy framework	Effectiveness of policy work/ implementation	Investment climate	Consumer Experience	Business ecosystem
1	Karnataka	78.76	99.54	76.77	80.79	67.02	70.50
2	Telangana	72.21	61.48	68.08	81.79	80.59	66.63
3	Gujarat	67.87	31.25	81.11	83.28	75.25	61.06
4	Andhra Pradesh	66.10	79.17	66.84	72.08	54.50	58.95
5	Rajasthan	62.25	66.67	64.29	80.76	51.53	46.03
6	Madhya Pradesh	58.27	12.50	63.10	77.98	78.00	52.10
7	Delhi	54.61	31.25	68.61	60.52	56.86	48.76
8	Punjab	53.42	45.83	48.08	78.51	55.75	35.25
9	Maharashtra	52.01	31.25	50.57	74.93	52.07	58.09
10	Tamil Nadu	50.87	40.97	46.82	65.98	51.72	53.43
11	Chandigarh	48.33	4.17	53.40	56.37	71.68	48.09
12	Haryana	43.35	14.58	50.55	72.28	30.34	66.01
13	Kerala	42.92	27.08	46.81	42.87	50.49	44.35
14	Odisha	39.44	25.00	46.23	40.99	45.94	31.15
15	Jharkhand	37.68	40.28	38.72	38.24	27.26	55.27
16	Chhattisgarh	36.52	10.42	39.35	44.24	43.07	50.17
17	Goa	31.83	45.83	31.22	20.18	23.85	45.38
18	Uttarakhand	31.58	30.56	33.50	52.92	14.00	38.54
19	Assam	29.00	62.50	13.04	11.80	25.90	40.61
20	Uttar Pradesh	26.54	40.28	26.83	23.18	12.79	39.51
21	Sikkim	22.80	25.00	13.75	11.80	34.04	30.72
22	Arunachal Pradesh	21.58	33.33	11.15	11.80	24.82	32.94
23	Himachal Pradesh	20.75	29.17	15.60	0.00	25.60	38.69
24	Nagaland	20.46	25.00	13.73	11.80	27.75	24.29
25	Bihar	20.32	34.72	11.24	31.19	5.10	36.41
26	Mizoram	20.28	20.83	16.24	11.80	31.99	13.64
27	West Bengal	19.39	20.83	13.10	14.72	17.35	44.88
28	Manipur	19.31	25.00	6.16	11.80	33.39	18.23
29	Tripura	17.66	27.08	3.64	11.80	24.33	27.52
30	Meghalaya	17.59	25.00	3.75	11.80	28.21	20.93
31	Jammu & Kashmir	14.38	20.83	13.73	4.10	10.82	29.07

04



Annexure 1



4.1. Scoring indicators



01

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, technical standards and incentives provided.				
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 Central Electricity Regulatory Commission model regulations of 2013. However, there are subtle variations in each state's policy and regulations that this parameter attempts to capture. The comprehensiveness of regulations addresses the questions that may arise in minds of the prosumer or any other interested party. It gives a clear directive to the 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 for grading the states.				
Mode of measurement:	<p>An exhaustive checklist was prepared including scope of regulations, extent of application, detailing in procedure of application and detailing in interconnection with distribution system. 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 1 to 5.</p> <p>Score 5: Very clear and detailed policy that contains more than three items from checklist (listed above)</p> <p>Score 4: Policy that contains two from checklist</p> <p>Score 3: Policy contains less than two items from checklist</p> <p>Score 2: Policy has no items as per checklist</p> <p>Score 1: No clear policy document available in public domain</p>				
Scoring criteria:	Higher is better;	Unit of measurement:	Scale of 5	Range:	Lowest: 3 Highest: 5
Data source: (Secondary)	<ul style="list-style-type: none"> ▶ Respective state's net/gross metering policy/ regulations ▶ State's solar policy documents ▶ Subsequent amendments and other announcements ▶ Government/SNA's websites 			Time period: FY19	

Robustness of
policy framework

Level
of policy support

Availability of other state schemes
to promote solar rooftop

What it measures:	The various exemptions, subsidies and other schemes provided by the state governments are documented by a policy framework checklist to capture both the exhaustiveness and the comprehensiveness of the exemptions.				
Rationale for inclusion:	To achieve the renewable energy targets set by the government, the central as well as the state governments have incorporated various exemptions, subsidies and other facilities. These effectively bring down the costs and risks associated with a rooftop solar system. The exemptions, subsidies and other such schemes vary from one state to another. The extent of these support schemes and incentives also varies. Thus, these play a key role in determining the attractiveness of a state towards solar rooftops because most of them directly benefit the prosumers by creating an environment most propitious for the success of rooftop solar.				
Mode of measurement:	<p>An exhaustive checklist (as stated in Clarity and detailing in metering regulations parameters) was prepared to enumerate number of incentives and the value of incentives. The data points collected from below mentioned sources was mapped against each state to arrive at a score. The qualitative data has been quantified on a scale of 1 to 3.</p> <p>Score 3: Score given to states that had maximum value and number of incentives</p> <p>Score 2: Score given to states that had maximum value of incentive but lesser number of incentives compared to score 3 states</p> <p>Score 1: Given to states with no announced incentives</p>				
Scoring criteria:	Higher is better	Unit of measurement:	Scale of 5	Range:	Lowest: 1 Highest: 3
Data source: (Secondary)	<ul style="list-style-type: none"> ▶ Respective state's net metering policy/ regulations ▶ State's solar policy documents ▶ Subsequent amendments and other announcements ▶ Government/SNA's websites ▶ News articles ▶ Research articles 			Time period: FY19	

Provision of single window mechanism

Robustness of
policy framework

Level
of policy support

Provision of single
window mechanism

What it measures:	Single window mechanism captures the provisions for a single location and/or single entity for the consumer 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 the requisite approvals, permissions and consents required at a single point of contact. The provisions for such a system streamlines 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 reduces its attractiveness driving away the interested party. But a single window mechanism can overcome this perception.				
Mode of measurement:	<p>Checked presence of single window mechanism in regulation or its subsequent revisions. The qualitative data has been quantified on a scale of 1 to 3.</p> <p>Score 1: Presence of single window mechanism and evidence of its implementation</p> <p>Score 2: Presence of single window mechanism but no evidence of its implementation status</p> <p>Score 3: Absence of single window mechanism</p>				
Scoring criteria:	Lower is better	Unit of measurement:	Scale of 3	Range:	Lowest: 3 Highest: 1
Data source: (Secondary)	<ul style="list-style-type: none"> ▶ Respective state's net metering policy/ regulations ▶ State's solar policy documents ▶ Subsequent amendments and other announcements ▶ Government/SNA's websites ▶ News articles ▶ Research articles 			Time period: FY19	

Provision of deemed approval process

Robustness of
policy framework

Level
of policy support

Provision of deemed
approval process

What it measures:	Provision of deemed approval process captures if such a provision is in place or not, and if yes then the number of days specified is taken into consideration.				
Rationale for inclusion:	If a deemed approval process is in place, it ensures the responsiveness of the DISCOMS to applications for setting up rooftop solar systems by prosumers. With this system, DISCOMs cannot claim delays in the approval process without proper justification or without intimating the applicant of the shortcomings in the application and of the corrective measures to be adopted. This boosts the applicants' confidence resulting in a more mature market.				
Mode of measurement:	<p>Enumeration of presence or absence or proposal for provision of deemed approval process. In case the process is in place then relative comparison was made based on the number of days lag before deemed approval is given. In absence of such a provision, the default value of 100 days was given.</p> <p>Score to the individual state was assigned by normalizing the data on a scale of 0 to 100.</p>				
Scoring criteria:	Lower is better	Unit of measurement:	Number of days	Range:	Lowest - 100 Highest - 10
Data source: (Secondary)	<ul style="list-style-type: none"> ▶ Respective state's net metering policy/ regulations ▶ State's solar policy documents ▶ Subsequent amendments and other announcements ▶ Government/SNA's websites ▶ News articles ▶ Research articles 			Time period: FY19	

Maximum GRPV system size allowed in the state

Robustness of
policy framework

Covenants

Maximum GRPV 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:	The state policy makers impose covenants on the interest party with respect to the maximum size of a rooftop solar system that can be installed in that state. The larger projects benefits from scale of economies and increases the return on the investment. This is most relevant to the C&I sector since they often have huge energy requirements and have the means of going for 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 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 1 to 3.</p> <p>Score 3: More than 1 MWp</p> <p>Score 2: 1 MWp</p> <p>Score 1: Less than 1 MWp</p>				
Scoring criteria:	Higher is better	Unit of measurement:	Scale of 3	Range:	Lowest: 1 Highest: 3
Data source: (Secondary)	<ul style="list-style-type: none"> ▶ Respective state's metering policy/ regulations ▶ State's solar policy documents ▶ Subsequent amendments and other announcements ▶ Government/SNA's websites ▶ News articles ▶ Research articles 			Time period: FY19	

Minimum system size allowed

Robustness of
policy framework

Covenants

Minimum system
size allowed

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 policy makers impose covenants on the interest party 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 the prosumers which 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:	<p>Enumeration of minimum 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 1 to 3.</p> <p>Score 3: Less than 1 KWp</p> <p>Score 2: 1 KWp</p> <p>Score 1: More than 1 KWp</p>				
Scoring criteria:	Lower is better	Unit of measurement:	Scale of 3	Range:	Lowest - 3 Highest - 1
Data source: (Secondary)	<ul style="list-style-type: none"> ▶ Respective state's net metering policy/ regulations ▶ State's solar policy documents ▶ Subsequent amendments and other announcements ▶ Government/SNA's websites ▶ News articles ▶ Research articles 			Time period: FY19	

Cumulative capacity of solar vis-à-vis regional DT capacity

Robustness of
policy framework

Covenants

Permissible cumulative capacity of
solar vis-à-vis 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 a restriction 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 itself. This restriction limits the extent of proliferation of rooftop solar in a state. If the cumulative capacity is low, it directly affects the 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:	<p>Enumerated the given permissible cumulative capacity of solar vis-à-vis distribution transformer and then gave scores according to maximum allowed to minimum allowed capacity. The qualitative data has been quantified on a scale of 1 to 3.</p> <p>Score 3: Maximum allowed capacity more than 60% of transformer capacity</p> <p>Score 2: Allowed capacity between 30% to 60% of transformer capacity</p> <p>Score 1: Allowed capacity less than 30% of transformer capacity</p>				
Scoring criteria:	Higher is better	Unit of measurement:	Scale of 3	Range:	Lowest: 1 Highest: 3
Data source: (Secondary)	<ul style="list-style-type: none"> ▶ Respective state's net metering policy/ regulations ▶ State's solar policy documents ▶ Subsequent amendments and other announcements ▶ Government/SNA's websites ▶ News articles ▶ Research articles 			Time period: FY19	

Settlement time

Robustness of
policy framework

Billing
mechanism

Settlement
time

What it measures:	The payment settlement time denotes the payback time taken by the DISCOMs for the 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 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 hoped that this parameter creates a competitiveness among states to improve their billing time frame, thereby winning stakeholder's confidence. The related provisions such as mode of payment, the minimum electricity bill to be borne and such other provisions too have been factored in.				
Mode of measurement:	<p>Enumerated settlement time mentioned in the policy and gave scores accordingly. Minimum score was given to states with no mention of settlement time. The qualitative data has been quantified on a scale of 1 to 3.</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
Data source: (Secondary)	<ul style="list-style-type: none"> ▶ Respective state's net metering policy/ regulations ▶ State's solar policy documents ▶ Government/SNA's websites ▶ News articles ▶ Research articles 			Time period: FY19	





02

Effectiveness of policy support/ implementation

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

Presence of interactive consumer interfaces

Effectiveness of
policy support

Ease of application

Presence of interactive
consumer interfaces

What it measures:	Whether or not an interactive consumer interface is available that might provide consumers with information regarding the policies, incentives, exemptions etc. along with case by case profitability analysis.				
Rationale for inclusion:	The uptake of rooftop solar is greatly dependent on its profitability as perceived by the potential consumers and investors. An interactive and user friendly interface helps in spreading awareness and helps these stakeholders in profitability analysis greatly helps to increase the number of willing consumers. The availability of such a system in a state promotes rooftop solar uptake and makes the state more attractive. In addition to these, presence of a grievance redressal portal simplifies the process and wins the confidence of the interested parties.				
Mode of measurement	<p>The qualitative data has been quantified on a scale of 1 to3.</p> <p>Score 3: Presence of user-friendly interactive platforms for consumers</p> <p>Score 2: Presence of online tools but there are evidences that the tools are not consumer friendly</p> <p>Score 1: No online tools available for interaction with consumer</p>				
Scoring criteria:	Higher is better	Unit of measurement:	Scale of 3	Range:	Lowest: 1 Highest: 3
Data source: (Secondary)	<ul style="list-style-type: none"> ▶ SNA website ▶ The online portal itself ▶ Survey responses from questionnaires developed by SARAL team for state consultations ▶ Answered by: DISCOMs, SNA and developers 			Time period: N/A	

Average time taken from date of application to system installation

Effectiveness of
policy support

Ease of application

Average time taken from 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 the state's attractiveness as a whole.				
Mode of measurement	The qualitative data has been quantified on a scale of 1 to 5. Score 5: States that take the most time to process application to installation (more than a month) Score 4: Time taken is 4 weeks Score 3: Time taken is less than 4 weeks Score 2: Time taken is between 3-4 weeks Score 1: Minimum time taken to process and install rooftop solar				
Scoring criteria:	Lower is better	Unit of measurement:	Scale of 5	Range:	Lowest: 5 Highest: 1
Data source: (Secondary)	▶ Survey responses from questionnaires developed by SARAL team for state consultations ▶ Answered by: DISCOMs; SNA; Developers			Time period: N/A	

Ease of availing state subsidies

Effectiveness of
policy support

Ease of application

Average time taken from date
of application to system installation

What it measures:	It measures the ease with which subsidy provided by the state governments can be availed by a user of the rooftop solar system.				
Rationale for inclusion:	Every state comes out with solar/renewable energy policies from time to time. These policies differ from each other in a way that some of them can prove to be more efficient and effective creating an environment more supportive or lucrative for solar rooftops. This parameter documents such aspects of these policies. The existence of subsidies being offered in the state enhances the profitability and speeds up the process of reaching grid parity for the prosumer. It encourages people from all economic classes to set up the solar system, thereby maximising the penetration of the technology.				
Mode of measurement	<p>The qualitative data has been quantified on a scale of 1 to 5 based on responses of the following question:</p> <p>What is the normal procedure to avail Central Financial Assistance (CFA) scheme subsidy? How long normally does it take to avail the subsidy by developers/end users? How easy/difficult to avail the subsidy? Please rate in a scale of 1 -5 where</p> <p>1- Very difficult 2- Difficult 3- Neutral 4- Easy 5- Very Easy</p>				
Scoring criteria:	Higher is better	Unit of measurement:	Scale of 5	Range:	Lowest - 1 Highest - 5
Data source: (Secondary)	<p>► Survey responses from questionnaires developed by SARAL team for state consultations</p> <p>► Answered by: SNA and developers</p>			Time period: N/A	

Deviation from the stipulated settlement period

Effectiveness of
policy support

Power offtake
attractiveness

Deviation from the stipulated
settlement period

What it measures:	This captures the ground level reality of when the settlement payment actually happens for a prosumer as against what is written in the policy document.				
Rationale for inclusion:	The deviation from the stipulated settlement period will be a critical factor in determining the overall pecuniary benefit of rooftop solar system for a rational prosumer. Greater the deviation, lesser is the faith of the prosumers in the economic advantage of the rooftop solar. The deviation from what is specific in the regulations represents a loss to the prosumer and thereby reduce the attractiveness of the state.				
Mode of measurement	<p>The qualitative data has been quantified on a scale of 1 to 5.</p> <p>Score 1: No deviation</p> <p>Score 2: Observable deviation</p> <p>Score 3: No information available on deviation</p>				
Scoring criteria:	Lower is better	Unit of measurement:	Scale of 3	Range:	Lowest - 3 Highest - 1
Data source: (Secondary)	<ul style="list-style-type: none"> ▶ Survey responses from questionnaires developed by SARAL team for state consultations ▶ News articles ▶ Answered by: DISCOMs; SNA; Developers 			Time period: N/A	

Credit rating of DISCOMs

Effectiveness of
policy support

State of affairs
of DISCOMs

Credit rating
of DISCOMs

What it measures:	This indicator evaluates the DISCOMs on three broad categories - operational and reform parameters, external parameters, and financial parameters which culminates in a single ranking for the DISCOM.				
Rationale for inclusion:	MNRE has been making continuous efforts to bring DISCOMs to the forefront in accomplishing the ambitious target of installing 40 GW from solar rooftop. However, DISCOMs may prove to be the principal stumbling block in India realising its rooftop solar power goals. As more C&I users, who bring the maximum revenues to state DISCOMs, take to solar power, the revenues of electricity generators and distributors would fall. The DISCOMs are already in the bad financial position and solar rooftop may further hurt their revenue. The credit rating thus play an important role in capturing the ability and willingness of the DISCOMs to support this budding sector.				
Mode of measurement	<p>For the states with multiple DISCOMs, the highest of the individual scores was taken to represent the state's score.</p> <p>Score to the individual state was assigned by normalizing the data on a scale of 0 to 100.</p>				
Scoring criteria:	Higher is better	Unit of measurement:	Scores out of 100	Range:	Lowest - 10 Highest - 90
Data source: (Secondary)	<ul style="list-style-type: none"> ▶ Ministry of Power's State Distribution ▶ Utilities Sixth Annual Integrated Rating report 			Time period: N/A	

Instances of retrospective changes to the policy

Effectiveness of
policy support

Impact
of policy

Instances of retrospective
changes to the policy

What it measures:	This attempts to capture the frequency of changes in the policy and the evidence of policy confusion among investors through media reports.				
Rationale for inclusion:	The rooftop solar sector is in its nascent stage and needs support of regulatory authorities, DISCOMs and other stakeholders to grow. A supportive policy framework becomes necessary for proliferation of rooftop solar. The frequent changes in policies, misleading statements in the media reports and ambiguity in the regulation itself can confuse the interested parties and drive away the demand.				
Mode of measurement	<p>Maximum score was given to those states that have clarified their policies or has reinforced the existing policies. Minimum score was given to states with has made misleading comments or has turned their back on their initial schemes. The qualitative data has been quantified on a scale of 1 to 3.</p> <p>Score 3: Evidence of favourable changes in policy</p> <p>Score 2: No evidence of favourable changes in policy</p> <p>Score 1: No information available</p>				
Scoring criteria:	Lower is better	Unit of measurement:	Scale of 3	Range:	Lowest - 3 Highest - 1
Data source: (Secondary)	► News articles			Time period: N/A	

The 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 the solar rooftop in a state.				
Rationale for inclusion:	The rooftop target achieved so far explains the current status of the state in terms of the installation of rooftop solar panel system. A high target achieved implies technology that has been long enough present in the state and that most of the hurdles, which crops up in the initial stage, has 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, favourable policies for interested stakeholders. This could also serve as a source of information/indication for the stakeholders for untapped areas having high potential.				
Mode of measurement	<p>The installed capacity as a fraction of the rooftop solar targets, expressed in percentages, have been taken for analysis.</p> <p>Score to the individual state was assigned by normalizing the data on a scale of 0 to 100.</p>				
Scoring criteria:	Higher is better	Unit of measurement:	%	Range:	Lowest - 0.02% Highest-28.37%
Data source: (Secondary)	<p>► Bridge to India's India solar rooftop map</p> <p>► Grid connected Solar Rooftop and Small Solar Power Plants Programme documents as published by Ministry of New and Renewable Energy</p>			Time period: FY19	



03

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 GRPV installation

Investment climate
for rooftop solar

Driver for rooftop
solar uptake

Share of C&I consumers in
total GRPV installation

What it measures:	The share of C&I consumers denotes the fraction of the total consumer base that is comprised of C&I consumers in the total GRPV installation in the state.				
Rationale for inclusion:	The electricity bill comprises of the majority of the operational costs for any commercial and institutional (C&I) player. The unreliable supply of electricity and the high electricity tariffs are the major reasons for this high cost. The tariffs are on a higher side for C&I consumers as compared to residential consumers. Thus, installing a rooftop solar system makes more economical sense for C&I consumers to not just cut cost but to also explore solar energy as another revenue stream. The more the proportion of C&I consumers of the total consumers more is the scope for installing the rooftop solar systems.				
Mode of measurement	The rooftop solar capacity installed by C&I consumer divided by overall rooftop solar installed capacity and expressed as a %. 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- 42.86% Highest-93.68%
Data source: (Secondary)	► Bridge to India's India solar rooftop map			Time period: FY19	

Ease of securing loans

Investment climate
for rooftop solar

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 one's power directly. Since the initial investment required for the setting up of this system is high, this emerges as an important parameter in gauging how the existing infrastructure is placed to support anyone planning on moving to solar rooftop systems.				
Mode of measurement	The qualitative data has been quantified on a scale of 1 to 5 based on responses of the following questions: Do you know which are the banks giving loans for rooftop solar installations in your state? How is their presence? Is it tagged to home loan? What is the interest rate %? How easily loans can be availed for rooftop solar installations compared to other loans such as home/car/education? 1-Very Low 2-Low 3-Medium 4-High 5-Very High				
Scoring criteria:	Higher is better	Unit of measurement:	Scale of 5	Range:	Lowest - 1 Highest - 5
Data source: (Secondary)	► Survey responses from questionnaires developed by SARAL team for state consultations ► Answered by: Developers and lenders			Time period: N/A	

Availability of insurance providers for GRPV projects

Investment climate
for rooftop solar

Ease of
financing

Availability of insurance
providers for GRPV projects

What it measures:	Insurance providers attempt to portray the scenario for getting insurance for RTS by an interested party.				
Rationale for inclusion:	For most of the MSMEs the energy costs comprise of the majority of the operational costs. The unreliable supply of electricity and the high electricity tariffs are the major reasons for this high cost. The scoring indicators such as insurance providers gives 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 schemes provided by the Govt. in each state, SIDBI and NBFC's involvement, loan disbursement time etc. Each state shall then be ranked based on all these variables favouring investments in rooftop solar.				
Mode of measurement	<p>The qualitative data has been quantified on a scale of 1 to 5 based on responses of the following questions:</p> <p>Are there any specialised insurance companies providing insurance services especially in rooftop segment 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
Data source: (Secondary)	<p>► Survey responses from questionnaires developed by SARAL team for state consultations</p> <p>► Answered by: Developers</p>			Time period: N/A	

Availability of project developers/ installers/ material suppliers

Investment climate
for rooftop solar

Maturity
of market

Availability of project developers/
installers/ material suppliers

What it measures:	Availability of project developers/ installers/ material suppliers is indicative of the ease of installing a rooftop solar system by an interested party.				
Rationale for inclusion:	MNRE had initially handed out licenses to some of the solar rooftop panel developers to execute such projects. Since the scrapping of empanelled developers list and simplification of the process, many players have started to come into the system for implementation services. States that already had players from the beginning shall have a more mature market and by new players coming in prices are expected to get competitive. A state with many players also indicate the potential for rooftop solar there in terms of ease of doing business, cost of implementation, policies and most importantly demand. The same rationale goes for contractors and other material. The higher number of developers and contractors or the abundance of material would reduce the search costs and contract costs for an average party.				
Mode of measurement	<p>The qualitative data has been quantified on a scale of 1 to 3 based on responses of the following questions:</p> <p>Are there any specialised insurance companies providing insurance services especially in rooftop segment in your state? How is their presence?</p> <p>1. Low 2. Medium 3. High</p>				
Scoring criteria:	Higher is better	Unit of measurement:	Scale of 5	Range:	Lowest - 1 Highest - 3
Data source: (Secondary)	<p>► Survey responses from questionnaires developed by SARAL team for state consultations</p> <p>► Answered by: SNA and developers</p>			Time period: N/A	





04

Consumer behaviour

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

Consumer awareness

Consumer
experience

Pre-installation
consideration

Consumer
awareness

What it measures:	Level of consumer awareness captures the acceptance and readiness of the consumer for installing 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. The awareness of the benefits, procedure and approvals for rooftop solar systems is a key determinant for the offtake of this alternative sources of energy. Hence this is one of the key consideration for the index.				
Mode of measurement	<p>The qualitative data has been quantified on a scale of 1 to 5 based on responses to the following questions:</p> <p>Are there any specialised insurance companies providing insurance services especially in rooftop segment in your state? How is their presence?</p> <p>How consumers are cognizant of rooftop solar technology?</p> <p>If any consumer is interested in rooftop solar installations, what route normally he/she does follow?</p> <p>Do consumers see rooftop solar a value proposition or they are not convinced still in your state?</p> <p>5. Very high level of consumer awareness</p> <p>4. High level of consumer awareness</p> <p>3. Medium level of consumer awareness</p> <p>2. Low level of consumer awareness</p> <p>1. Very Low level of consumer awareness</p>				
Scoring criteria:	Higher is better	Unit of measurement:	Scale of 5	Range:	<div>Lowest - 1</div> <div>Highest - 5</div>
Data source: (Secondary)	<div>▶ Survey responses from questionnaires developed by SARAL team for state consultations</div> <div>▶ Answered by: DISCOMs; SNA; Developers</div>			Time period: N/A	

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 in last four years for a unit of electricity for the end consumer.				
Rationale for inclusion:	With surge in tariffs, the attractiveness and affordability of grid electricity starts to decrease for the end consumer. This is particularly true for C&I consumer 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	<p>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 number of consumers served as weights.</p> <p>Score to the individual state was assigned by normalizing the data on a scale of 0 to 100.</p>				
Scoring criteria:	Higher is better	Unit of measurement:	%	Range:	Lowest - 9% Highest - 53%
Data source: (Secondary)	▶ State's tariff order for respective years			Time period: FY15 - FY18	

System Average Interruption Duration Index

Consumer
experience

Pre-installation
consideration

System Average Interruption
Duration Index

What it measures:	System Average Interruption Duration Index (SAIDI) is measured as the average duration in an interval of time for which a customer faces an outage of power.				
Rationale for inclusion:	SAIDI accounts for the unreliability of the grid to provide uninterrupted power to its consumers. The more is this unreliability, the more will be the willingness of consumers to go for decentralised source of power generation. The consumer can not only meet one's power requirement but also sell the extra units produced in the market. No longer has the consumer had to be dependent on the inefficient and unreliable distribution network and can enjoy power 24*7 by installing a rooftop solar system.				
Mode of measurement	<p>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 The data here is tabulated as the Lowest performance of a state in a year in terms of average number of hours of power outage in a month.</p> <p>Score to the individual state was assigned by normalizing the data on a scale of 0 to 100.</p>				
Scoring criteria:	Higher is better	Unit of measurement:	Hrs./month	Range:	Lowest 1.35 Highest- 95.21
Data source: (Secondary)	▶ Ministry of Power's Urban Jyoti Abhiyaan (URJA) app under Integrated Power Development Scheme			Time period: FY19	

System Average Interruption Frequency Index

Consumer
experience

Pre-installation
consideration

Tariff rise for end
consumers

What it measures:	System Average Interruption Frequency Index (SAIFI) is the measure of the average number of sustained interruptions per consumer during the year.				
Rationale for inclusion:	SAIFI too accounts for the unreliability of a state to provide uninterrupted power to its consumers. The more is this unreliability, the more will be the willingness of consumers to go for decentralised source of power generation. The consumer can not only meet one's power requirement but also sell the extra units produced in the market. No longer has the consumer had to be dependent on the inefficient and unreliable distribution network and can enjoy power 24*7 by installing a rooftop solar system.				
Mode of measurement	The data here is tabulated as the worst performance of a state in a year in terms of number of times of power outage in a month. as weights. 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:	Times/ month	Range:	Lowest - 3.5 Highest - 64.8
Data source: (Secondary)	► Ministry of Power's URJA app under Integrated Power Development Scheme			Time period: FY19	

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 of 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 installing a rooftop solar system is a key determinant of the attractiveness of rooftop solar as an alternative source of energy. If the costs, time and efforts outweigh the benefits, then few would be interested in investing in a rooftop solar system. If that is the case, the 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 1 to 5 based on response to following questions: Consumers face a hassle free process from application to commissioning in your state: Score 5: Strongly agree Score 4: Agree Score 3: Neutral Score 2: Disagree Score 1: Strongly disagree				
Scoring criteria:	Higher is better	Unit of measurement:	Scale of 5	Range:	Lowest - 1 Highest - 5
Data source: (Secondary)	► Survey responses from questionnaires developed by SARAL team for state consultations			Time period: FY19	

Consumer
experiencePost-installation
experience/costs

O&M cost

What it measures:	The O&M cost refers to the perceived burden in terms of costs and time post installation of a rooftop solar system.				
Rationale for inclusion:	The additional consumer responsibility of operations and maintenance (O&M) for the rooftop solar system is a challenge to the widespread uptake of this sector. Many consumers don't want to take on the additional burden of O&M, as no such responsibility exists for grid power. More is the perceived burden of O&M lesser attractiveness is the state for installing the rooftop solar system.				
Mode of measurement	<p>The qualitative data has been quantified on a scale of 1 to 5 based on response to following questions:</p> <p>How is the system O&M cost in your state? Do consumers find O&M responsibility cumbersome? Rate your experience on a scale of 1-5</p> <p>Score 5: Strongly agree</p> <p>Score 4: Agree</p> <p>Score 3: Neutral</p> <p>Score 2: Disagree</p> <p>Score 1: Strongly disagree</p>				
Scoring criteria:	Lower is better	Unit of measurement:	Scale of 5	Range:	Lowest - 5
					Highest - 1
Data source: (Secondary)	<p>▶ Survey responses from questionnaires developed by SARAL team for state consultations</p> <p>▶ Answered by: SNA and developers</p>			Time period: N/A	

Warranty and aftersales experience

Consumer
experience

Post-installation
experience/costs

Warranty and
aftersales experience

What it measures:	The indicator captures the experience of a prosumer after installing a rooftop solar system with respect to warranty and aftersales services.				
Rationale for inclusion:	The life of a rooftop solar system is expected to be around 20-25 years. The solar panels may have a warranty clause and a long life expectancy means the 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, the word of mouth will result in lesser number of new prosumers going for it.				
Mode of measurement	<p>The qualitative data has been quantified on a scale of 1 to 5 based on response to following questions:</p> <p>Are consumers happy with the aftersales services? If not, what kind of challenges are faced by the consumers?</p> <p>Is there a provision for warranty by the developers to the consumers? If yes, what kind of disputes does generally arise?</p> <p>Score 5: Strongly agree</p> <p>Score 4: Agree</p> <p>Score 3: Neutral</p> <p>Score 2: Disagree</p> <p>Score 1: Strongly disagree</p>				
Scoring criteria:	Higher is better	Unit of measurement:	Scale of 5	Range:	<div>Lowest - 1</div> <div>Highest - 5</div>
Data source: (Secondary)	<div>▶ Survey responses from questionnaires developed by SARAL team for state consultations</div> <div>▶ Answered by: SNA and developers</div>			Time period: N/A	



05

State's business ecosystem

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

Ease of doing business 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 of the 372 recommendations, part of Business Reform Action Plan, for reforms on regulatory processes, policies, practices and procedures spread across 12 reform areas.				
Rationale for inclusion:	The Ease of Doing Business (EODB) index is indicative of how friendly the state is for setting up of any business and not just rooftop solar sector. The EODB index takes into account parameters like registering a company, getting clearances, electricity access, getting credit and taxation, among others. It paints a real picture of the business ecosystem and the progress made by the states in improving their investment climate. It is particularly relevant for large scale rooftop solar projects.				
Mode of measurement	<p>Here, the EODB index is based on the assessment of state implementation of business reforms as measured by the implementation percentage.</p> <p>Score to the individual state was assigned by normalizing the data on a scale of 0 to 100.</p> <p>Score 5: Strongly agree</p> <p>Score 4: Agree</p> <p>Score 3: Neutral</p> <p>Score 2: Disagree</p> <p>Score 1: Strongly disagree</p>				
Scoring criteria:	Higher is better	Unit of measurement:	%	Range:	Lowest - 0% Highest - 98.3%
Data source: (Secondary)	▶ Department of Industrial Policy and Promotion's EOBD portal			Time period: FY18	

NCAER economy rating of the state

State's Business
Ecosystem

Business
enablers

NCAER economy
rating of the state

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 the competitiveness of states on 50 parameters grouped under six broad pillars: land, labour, 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 the investments into rooftop sector too will flow in those states which are attracting investors in other sectors as well. Hence this has been included in the analysis.				
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
Data source: (Secondary)	<ul style="list-style-type: none"> National Council of Applied Economic Research's State Investment Potential report 			Time period: FY18	

MSME 5 year growth rate

State's Business
Ecosystem

Business
enablers

MSME 5 year
growth rate

What it measures:	The growth in the number of Micro, Small And Medium Enterprises (MSMEs) in a state is a measure of the rate at which business grows in that state.				
Rationale for inclusion:	It also sees how favourable the environment is for business and the kind of support is extended by the government to help these grow. If the MSMEs growth rate in a state is high, this means that the investment opportunities are more with better access to loans and better regulations. As a result, the entrepreneurial spirit is high in the state.				
Mode of measurement	Simple percentage change in the number of MSMEs is taken as a measure of the growth rate. The nature of data did not allow calculation of CAGR. 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 - 40% Highest - 149%
Data source: (Secondary)	<ul style="list-style-type: none"> Ministry of Statistics and Programme Implementation's Operational Characteristics of Unincorporated Non-Agricultural Enterprises (Excluding Construction) in India report Ministry of Micro, Small & Medium Enterprises' Sixth Economic Census report 			Time period: FY14 - FY16	

Credit rating of the state

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Credit rating
of the state

What it measures:	A credit rating is an assessment of the creditworthiness of a borrower, in this case a state.				
Rationale for inclusion:	Solar rooftop projects require funding and/or financial assistance from external agencies such as banks, Non-Banking Financial Companies, insurers and others. Credit rating is one of the criteria used by these agencies to judge the credibility of the state and quantify the returns they will get on the investment. Hence this has been included in the index to grade the states.				
Mode of measurement	Public Affairs Centre publishes its annual Public Affairs Index (PAI) which ranks the states based on a detailed examination of 10 broad themes of governance, fiscal management being one of them. This index is used as a proxy for credit rating. The scores have been directly taken from the PAI portal. 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 1	Range:	Lowest - 0.33 Highest - 0.70
Data source: (Secondary)	► Public Affairs Centre's PAI portal			Time period: FY18	

Transparency of government policy making

State's Business
Ecosystem

Business
enablers

Transparency of government
policy making

What it measures:	Transparency and accountability index, as a subsidiary index of Public Affairs Index (PAI), scores and ranks the states on basis of their openness and information dissemination of the decision making by government and public offices.				
Rationale for inclusion:	Public Affairs Centre (PAC) publishes its annual PAI which ranks the states based on a detailed examination of 10 broad themes of governance, transparency and accountability being one of them. A transparent and accountable Government will not only help the States to achieve growth, but also ensure development with the active participation of the people. Openness within the institutions will allow the consumers/investors to be aware of the functioning and the incentives related to installation of solar rooftop thus driving a market for rooftop solar systems.				
Mode of measurement	The scores have been directly taken from the PAI portal. 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 1	Range:	Lowest - 0.22 Highest - 0.65
Data source: (Secondary)	► Public Affairs Centre's PAI portal			Time period: FY18	

Institutional architecture

State's Business
Ecosystem

Business
enablers

Institutional
architecture

What it measures:	This indicator focuses on the existing institutional set up and how that acts as an enabler in the uptake of rooftop solar.				
Rationale for inclusion:	Institutional architecture has been included as a parameter for rating a state because it highlights the importance placed by the state on alternative sources of energy, solar power in particular, through the establishment of special cells, dedicated teams in the state utility, etc. to streamline all activities associated with the segment and to ensure their smooth operation and future growth.				
Mode of measurement	<p>The qualitative data has been quantified on a scale of 1 to 3 based on responses to the following questions:</p> <p>Is there any institutional structure exclusively for rooftop in state DISCOMs?</p> <p>Score 3: Strongly agree, Structure in place with completely defined responsivity</p> <p>Score 2: Agree, structure in place but overlap in roles and responsibilities</p> <p>Score 1: Structure in place but roles and responsibilities not defined</p>				
Scoring criteria:	Higher is better	Unit of measurement:	Scale of 3	Range:	Lowest - 1 Highest - 3
Data source: (Secondary)	<p>► Survey responses from questionnaires developed by SARAL team for state consultations</p> <p>► Answered by: DISCOMs, SNA and developers</p>			Time period: N/A	

GSDP per capita

State's Business
Ecosystem

Business
enablers

GSDP
per capita

What it measures:	GSDP per capita is a measure of an economy's economic output 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 the 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 the 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 that the potential for growth of the solar power sector in such areas should be high.				
Mode of measurement	<p>GSDP per capita for FY17 has been taken at current prices with FY12 as the base year.</p> <p>Score to the individual state was assigned by normalizing the data on a scale of 0 to 100.</p>				
Scoring criteria:	Higher is better	Unit of measurement:	INR	Range:	Lowest - 40,819 Highest - 4,43,694
Data source: (Secondary)	► Central Statistics Office publications			Time period: FY18	

GSDP growth

State's Business
Ecosystem

Business
enablers

GSDP
growth

What it measures:	The GSDP growth measures the increase in the GSDP of a state over the period of last five years.				
Rationale for inclusion:	The GDP growth experienced by an economy has always been considered by government and economic decision-makers for planning, policy formulation and 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 investments projects. For rooftop solar projects too, states that has more financial muscle will attract more investments.				
Mode of measurement	GSDP growth is tabulated as CAGR for past three years which is a better indicator of growth over multiple time periods. 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 - 0.6% Highest - 16.5%
Data source: (Secondary)	▶ Central Statistics Office publications			Time period: FY18	



4.2. State consultation and regional **Workshop Reports**



4.2.1. State consultation report

Introduction

For 40 GW solar energy to come from rooftop systems, it is crucial to have an increased participation of states and coordination among agencies. A self-sustainable and private-sector driven rooftop solar sector holds the key for renewable energy revolution in India. SARAL is a stepping stone to this journey.

In order to achieve its intended benefits, the visibility and acceptance of the SARAL index amongst various industry stakeholders is of utmost importance. The stakeholders can provide invaluable insights for building the index and the EY team, in association with ASSOCHAM, has reached out to the states to solicit their opinions and concerns over the index. The inputs from the state consultations are to be incorporated into the model, wherever feasible and also to form the basis of assigning the weightages to the five main drivers/parameters on which the index model is built.

States covered

The SARAL team has set the target to appraise all the 29 states and 2 union territories (UT) - Delhi and Chandigarh on different aspects to objectively arrive at the ranking/grading for solar rooftop attractiveness. As part of their efforts to raise awareness and seek inputs on the model, the EY team reached out to states to solicit their responses. For a meaningful analysis and to drawdown inferences, these states and UTs are grouped under six regions as per their geographical location:

- ▶ North
- ▶ South
- ▶ Central
- ▶ East
- ▶ West
- ▶ North-east

Stakeholders contacted

The SARAL index is based on equity to bring in objectivity and fairness to the model. With this aim in mind, the EY team has reached out to the different stakeholders in a state to capture the data holistically so that the real picture is portrayed. The following stakeholders were consulted to solicit the responses:

- ▶ State electricity regulatory commission
- ▶ State Nodal Agencies
- ▶ Distributing companies (DISCOMs)
- ▶ Developers

Both state and public DISCOMs were contacted to capture the inputs from all the relevant stakeholders.

Mode of interaction

The state consultations were done either in person and over the e-mail and/or telephones. For in-person meetings, the EY team flew to the respective states to meet the various stakeholders.

Collation of the responses/inputs

Objective

The objective of this exercise, as stated earlier, is to generate interest and raise awareness about the SARAL index so that the index is acceptable and recognized all over the country. In addition to this, the other objective was to seek inputs from all the stakeholders and incorporate these into the model, wherever feasible. With this in mind, the agenda for the state consultations was:

- ▶ Brief introduction of project SARAL - its objectives and outcome
- ▶ Relevant stakeholders involved in SARAL, their intended objectives and outcomes
- ▶ Steering committee members and their involvement in the project

- ▶ Our approach and methodology to rank Indian states
- ▶ Seeking feedback on the parameters listed under the developed model
- ▶ Seeking help regarding some data points required to complete the model and ranking
- ▶ Seeking ideas on launch and outreach plan of the index

Methodology

EY team prepared a detailed questionnaire. The meetings or the interviews were guided by the questionnaire and the team analyzed the responses so collected to drive out meaningful insights. One of the focal areas was to seek inputs to arrive at tentative weightages of the five core drivers/parameters. The sample of the questionnaire is attached in the appendix.

Output

The EY team prepared the minutes of the meetings to capture the key ideas and inputs shared. The inputs collated from the questionnaire were analyzed to arrive at the weightages of the five drivers. The insights received were also documented to be presented to the steering committee for better dialogue.

Analysis and findings

Assigning of weightages

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 these drivers/parameters.

Methodology

As part of the questionnaire, the following questions were asked to each of the stakeholder contacted so far:

Out of 5 following drivers, please rank (in a scale of 1 to 5) according to importance of each of them in assessing state attractiveness for rooftop solar.

S.no	Bucket/parameter	Weightages
1	Robustness of policy framework	14%
2	Effectiveness of policy support/implementation	28%
3	Investment climate	15%
4	Consumer experience	31%
5	Business ecosystem	12%

The purpose of this question was to gauge the mindsets 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 for this question were analyzed to arrive at the weightages for the drivers/parameters.

Each stakeholder gave its own ranking (from 1 to 5) for the five drivers. After qualitative assessment and analysis of their interactions, the EY team reached at the relative ranking of these drivers for all the 29 states and the two UTs. To arrive at the weightages for these drivers, the following process was adopted:

- ▶ The ranking of the five drivers was collected and collated.
- ▶ Each driver, say “robustness of policy framework”, was summed and the same was done for all the five drivers.
- ▶ The sum of the rankings for all the five drivers was again summed to arrive at the grand sum.
- ▶ For each driver, its sum was divided by the grand sum to arrive at its relative importance.
- ▶ The process was repeated for all the five drivers.
- ▶ The relative importance so calculated to act as the weightages for the drivers in the index model.

Illustration: for simplification purposes, assume that the states under consideration are only four. The driver “Robustness of policy framework” received 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 multiplication of sum of the ranks i.e., 1 to 5 (15) and the number of states considered. This amounts to 60 (15*4). The relative importance of this drivers is reached at 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.

Zone-wise analysis

As mentioned earlier, in order to have a meaningful analysis and to drawdown inferences, these states and UTs are grouped under six zones as per their geographical location.

North

The north zone comprises of the following six states:

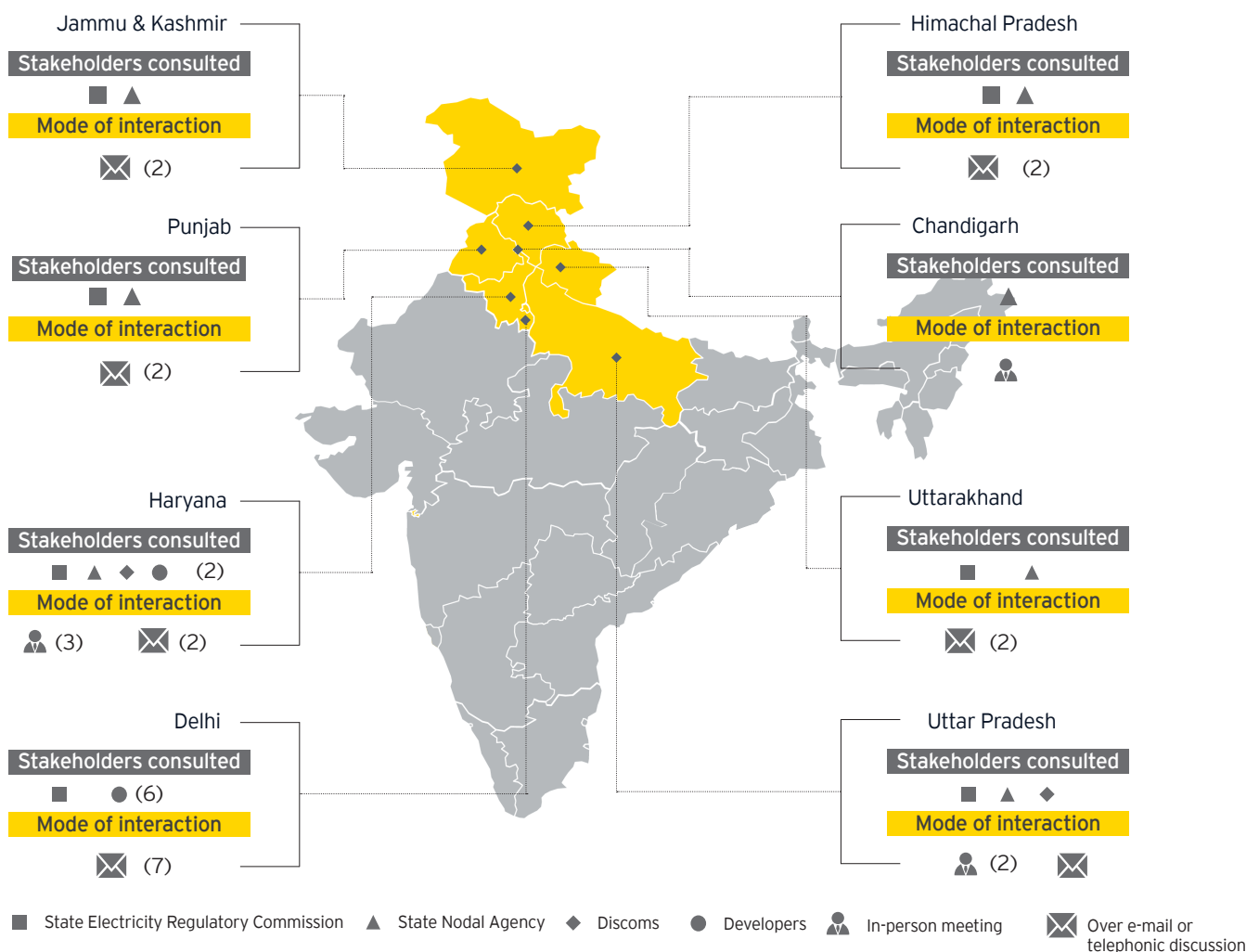
- ▶ Jammu and Kashmir

- ▶ Himachal Pradesh
- ▶ Punjab
- ▶ Haryana
- ▶ Uttarakhand
- ▶ Uttar Pradesh

In addition to these six states, it also covers two UTs:

- ▶ Delhi
- ▶ Chandigarh

Exhibit 1: Stakeholders consulted and their mode of interaction in the north zone



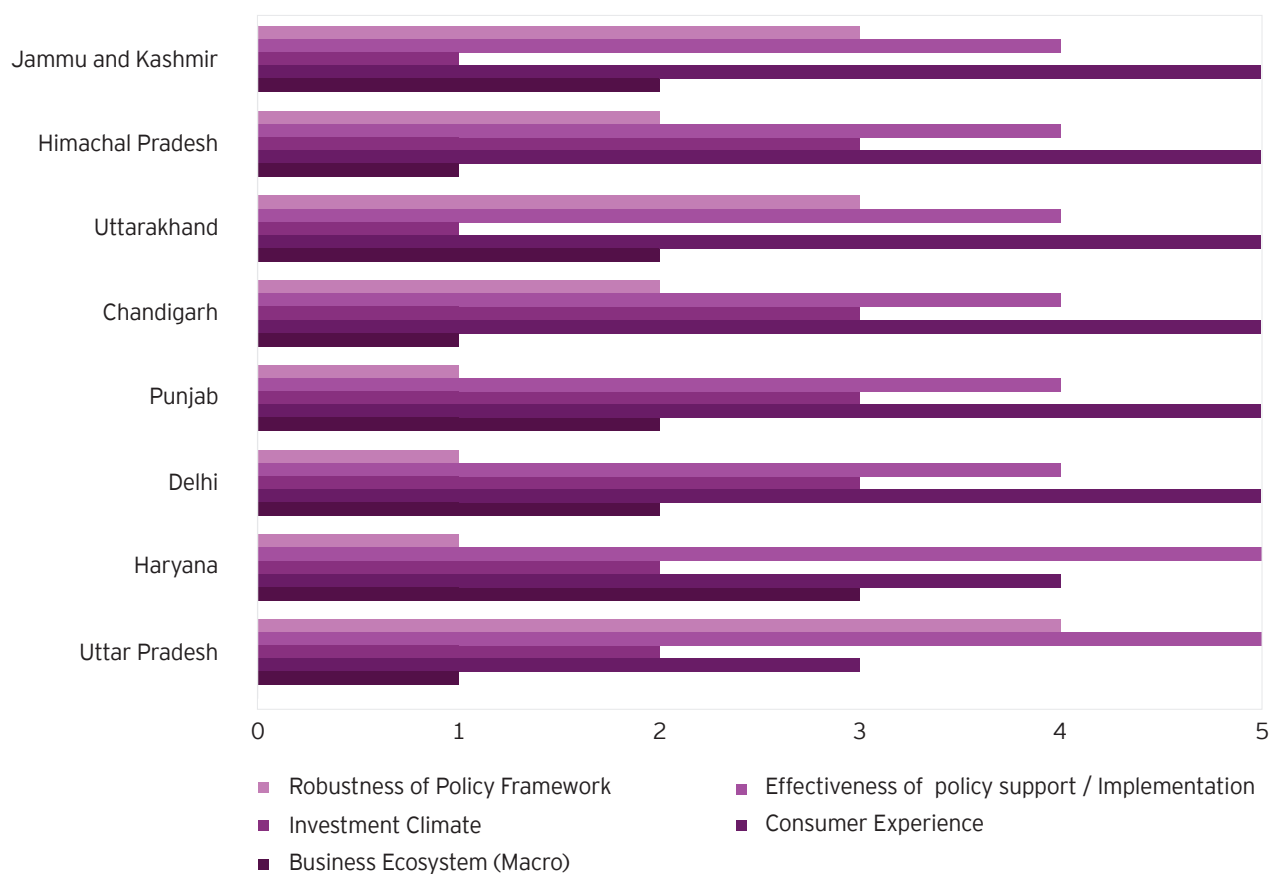
Note: Numbers in bracket indicate count of that mode of interaction

The driver “consumer experience” is regarded as the most important parameter for a state to determine its attractiveness for the investment in the solar rooftop sector. The second essential parameter that emerges is “effectiveness of policy support/implementation”. The sole exception to this is Uttar Pradesh which has given the first preference to “effectiveness of policy support/

implementation” and the second to “robustness of policy framework”. The “consumer experience” is given the third preference.

The investment climate and business ecosystem have been given the least preference by the northern states. Only Haryana has given the ranking of 3 to business ecosystem which makes sense as it has better macro-economic conditions viz.-a-viz. its peers. The state has given the lowest rank to the “robustness of policy framework”.

Exhibit 2: The skewness in the preference of the north zone



The ranks given by the states were used to arrive at the weightages for the five drivers using the methodology prescribed above. The weightages for the five drivers are as follows:

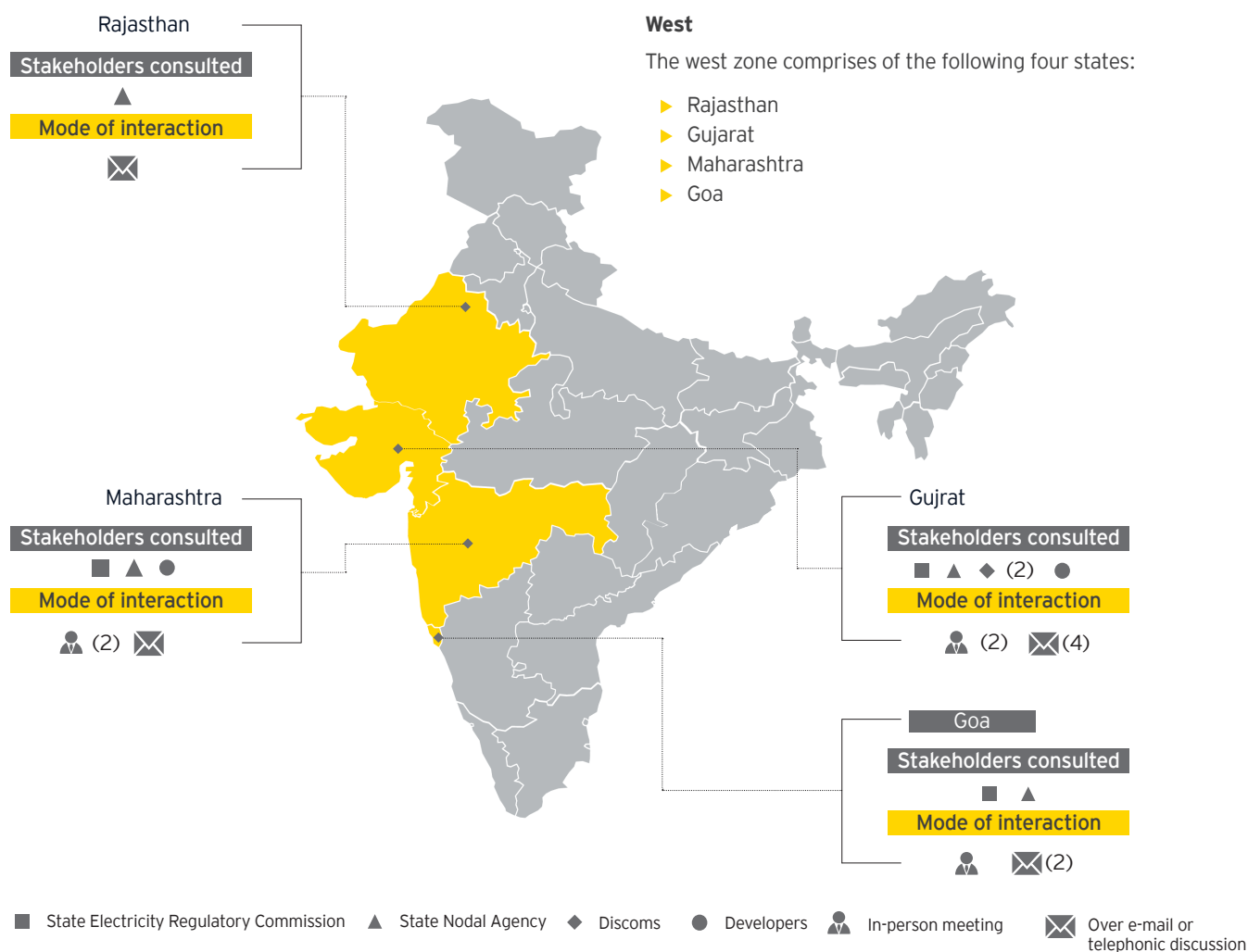
S.no	Bucket/parameter	Weightages
1	Robustness of policy framework	14%
2	Effectiveness of policy support/implementation	28%
3	Investment climate	15%
4	Consumer experience	31%
5	Business ecosystem	12%

West

The west zone comprises of the following four states:

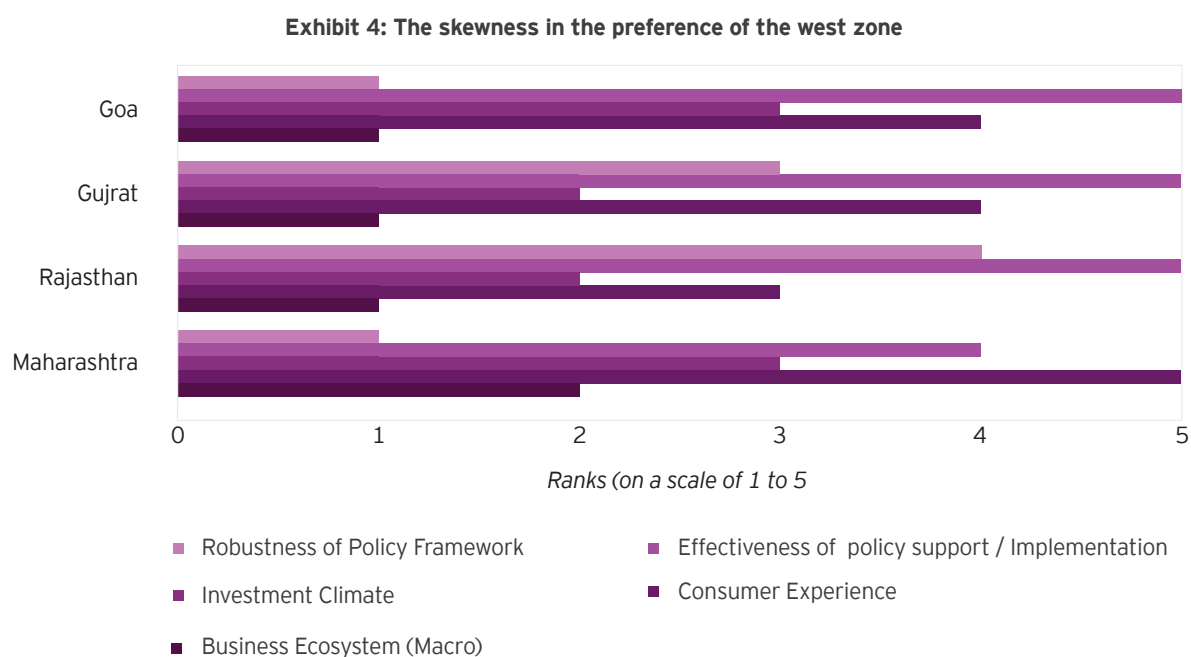
- ▶ Rajasthan
- ▶ Gujarat
- ▶ Maharashtra
- ▶ Goa

Exhibit 3: Stakeholders consulted and their mode of interaction in the west zone



Note: Numbers in bracket indicates the count of that mode of interaction

The driver “effectiveness of policy support/implementation” is the top-ranked driver in the west zone. Only Maharashtra has given the highest score to “consumer experience” followed by “effectiveness of policy support/implementation”. The second most preferred driver that emerges here is that of “consumer experience”. The “business ecosystem” is the least important parameter here in the west zone. Maharashtra has rated “robustness of policy framework” as the least preferred driver



The ranks given by the states were used to arrive at the weightages for the five drivers using the methodology prescribed above. The weightages for the five drivers are as follows:

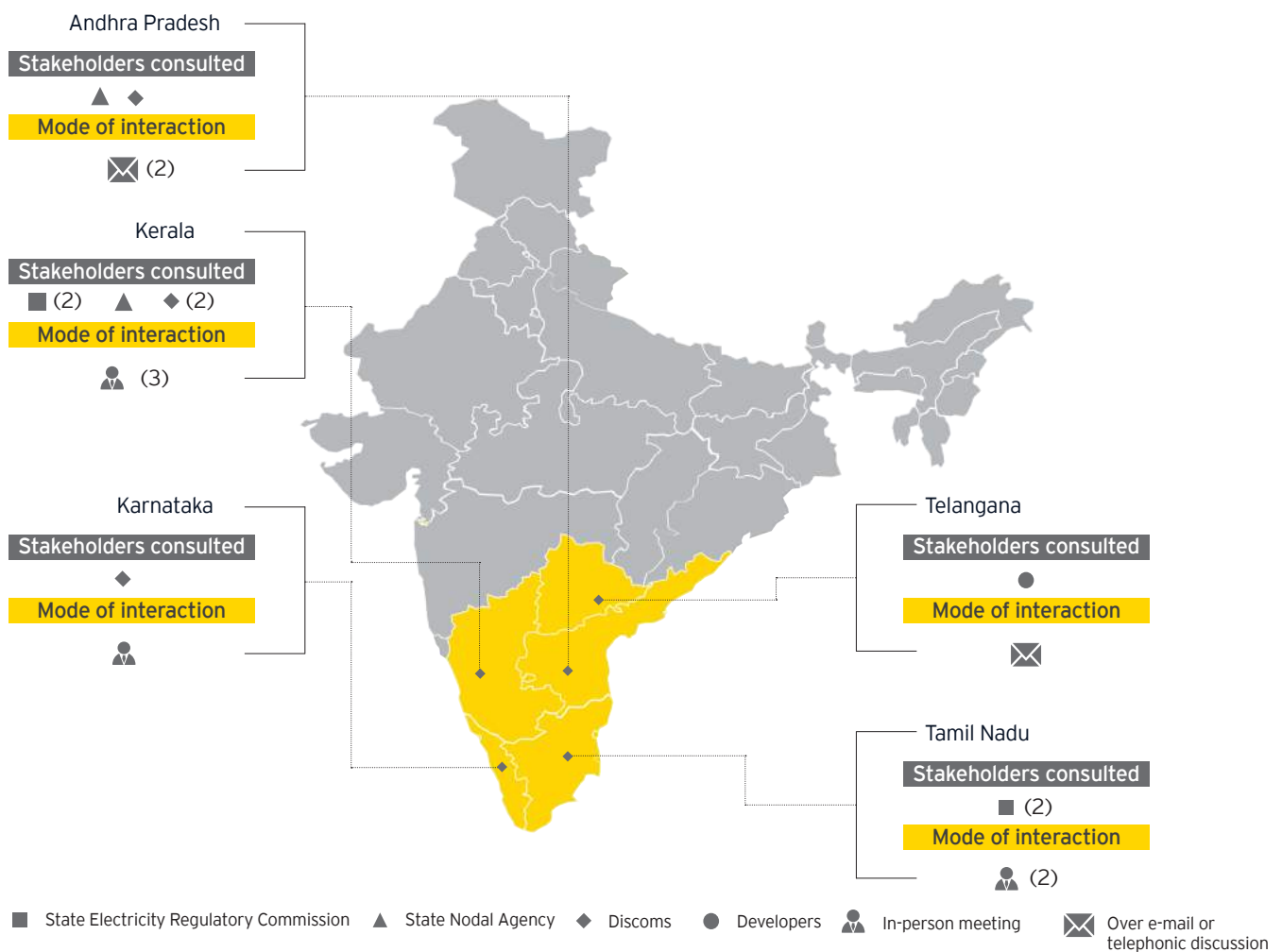
S.no	Bucket/parameter	Weightages
1	Robustness of policy framework	17%
2	Effectiveness of policy support/implementation	32%
3	Investment climate	17%
4	Consumer experience	27%
5	Business ecosystem	7%

South

The south zone comprises of the following five states:

- ▶ Karnataka
- ▶ Telangana
- ▶ Kerala
- ▶ Andhra Pradesh
- ▶ Tamil Nadu

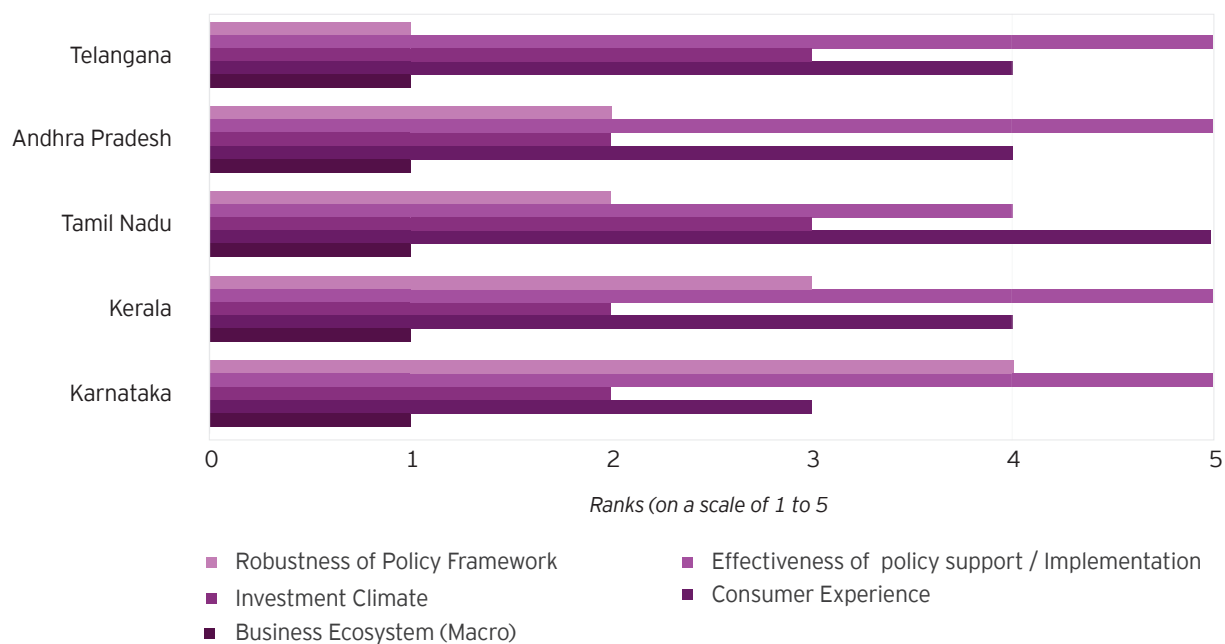
Exhibit 5: Stakeholders consulted and their mode of interaction in the south zone



Note: Numbers in bracket indicates the count of that mode of interaction

The driver “effectiveness of policy support/implementation” is the top-ranked driver in the west zone. Only Maharashtra has given the highest score to “consumer experience” followed by “effectiveness of policy support/implementation”. The second most preferred driver that emerges here is that of “consumer experience”. The “business ecosystem” is the least important parameter here in the west zone. Maharashtra has rated “robustness of policy framework” as the least preferred driver.

Exhibit 6: The skewness in the preference of the south zone



The ranks given by the states were used to arrive at the weightages for the five drivers using the methodology prescribed above. The weightages for the five drivers are as follows.

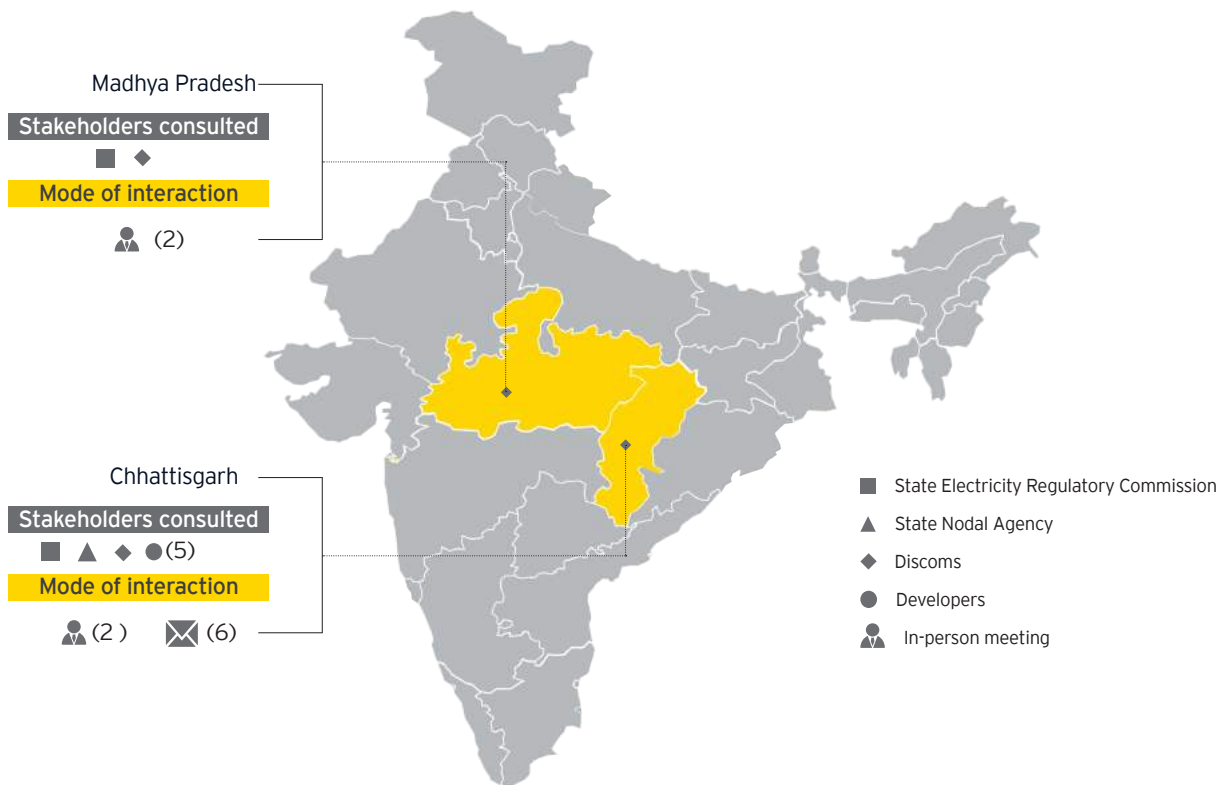
S.no	Bucket/parameter	Weightages
1	Robustness of policy framework	17%
2	Effectiveness of policy support/implementation	32%
3	Investment climate	17%
4	Consumer experience	27%
5	Business ecosystem	7%

Central

The central zone comprises of the following two states:

- ▶ Madhya Pradesh
- ▶ Chhattisgarh

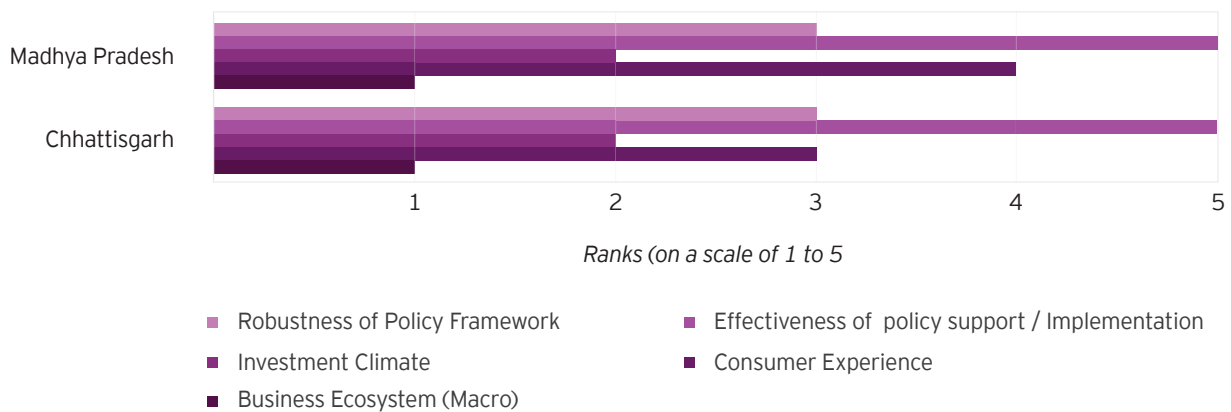
Exhibit 7: Stakeholders consulted and their mode of interaction in the central zone



Note: Numbers in brackets indicates count of that mode of interaction

Madhya Pradesh and Chhattisgarh are in sync with respect to their least and most preferred drivers. The most preferred being “effectiveness of policy support/implementation” and least being the business ecosystem. Madhya Pradesh has stressed on “consumer experience” as the more important parameter (gave rank of 4) than “robustness of policy framework” (gave rank of 3). The relative importance of these two is reversed for Chhattisgarh. The “investment climate” is again ranked two by both the states, emerging as the second least important parameter. The trend consistent in other zones as well.

Exhibit 8: Stakeholders consulted and their mode of interaction in the central zone



The ranks given by the states were used to arrive at the weightages for the five drivers using the methodology prescribed above. The weightages for the five drivers are as follows:

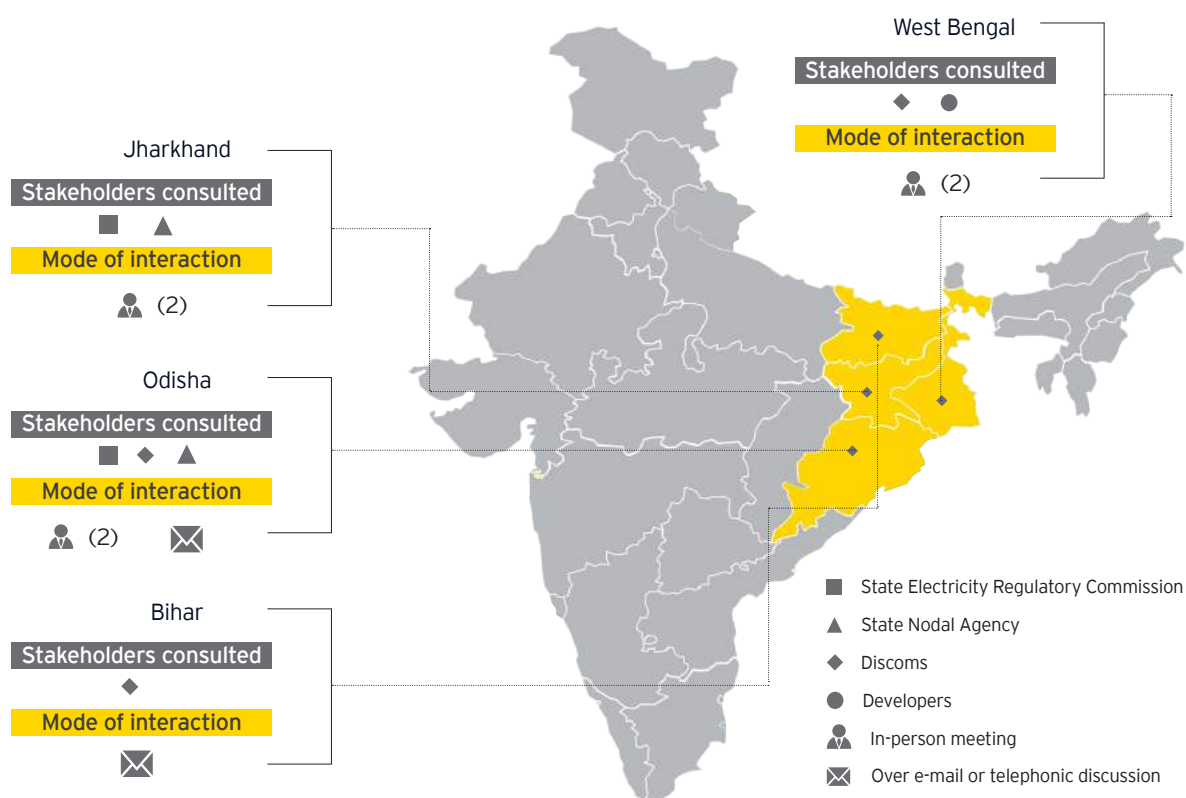
S.no	Bucket/parameter	Weightages
1	Robustness of policy framework	23%
2	Effectiveness of policy support/implementation	33%
3	Investment climate	13%
4	Consumer experience	24%
5	Business ecosystem	7%

East

The east zone comprises of the following four states:

- ▶ Bihar
- ▶ Jharkhand
- ▶ West Bengal
- ▶ Odisha

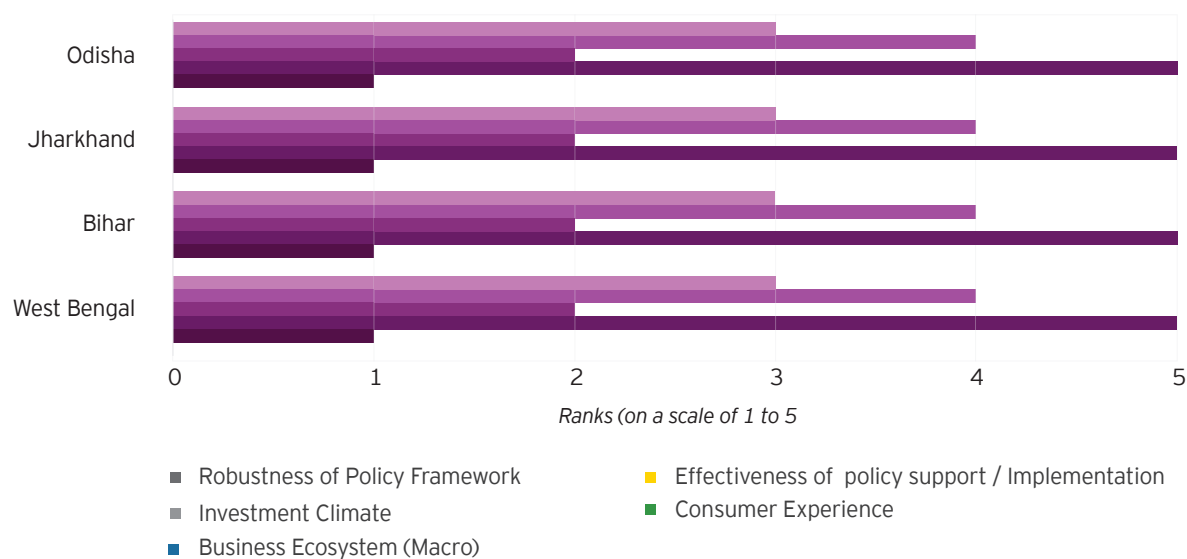
Exhibit 9: Stakeholders consulted and their mode of interaction in the east zone



Note: Numbers in brackets indicates count of that mode of interaction

The four states have been unanimous in their preference of the five drivers. The driver that, in the opinion of the east zone, should have the maximum weightage in determining the attractiveness of the states is the “consumer experience”. The next in the list is the “effectiveness of policy support/implementation” followed by the “robustness of policy framework”. The least important parameter here too is that of “business ecosystem”.

Exhibit 10: The skewness in the preference of the east zone



The ranks given by the states were used to arrive at the weightages for the five drivers using the methodology prescribed above. The weightages for the five drivers are as follows:

S.no	Bucket/parameter	Weightages
1	Robustness of policy framework	23%
2	Effectiveness of policy support/implementation	27%
3	Investment climate	13%
4	Consumer experience	33%
5	Business ecosystem	7%

North-east

The north-east zone comprises of the following eight states:

- ▶ Arunachal Pradesh
- ▶ Sikkim
- ▶ Assam
- ▶ Nagaland
- ▶ Manipur
- ▶ Tripura

Exhibit 11: Stakeholders consulted and their mode of interaction in the north-east zone

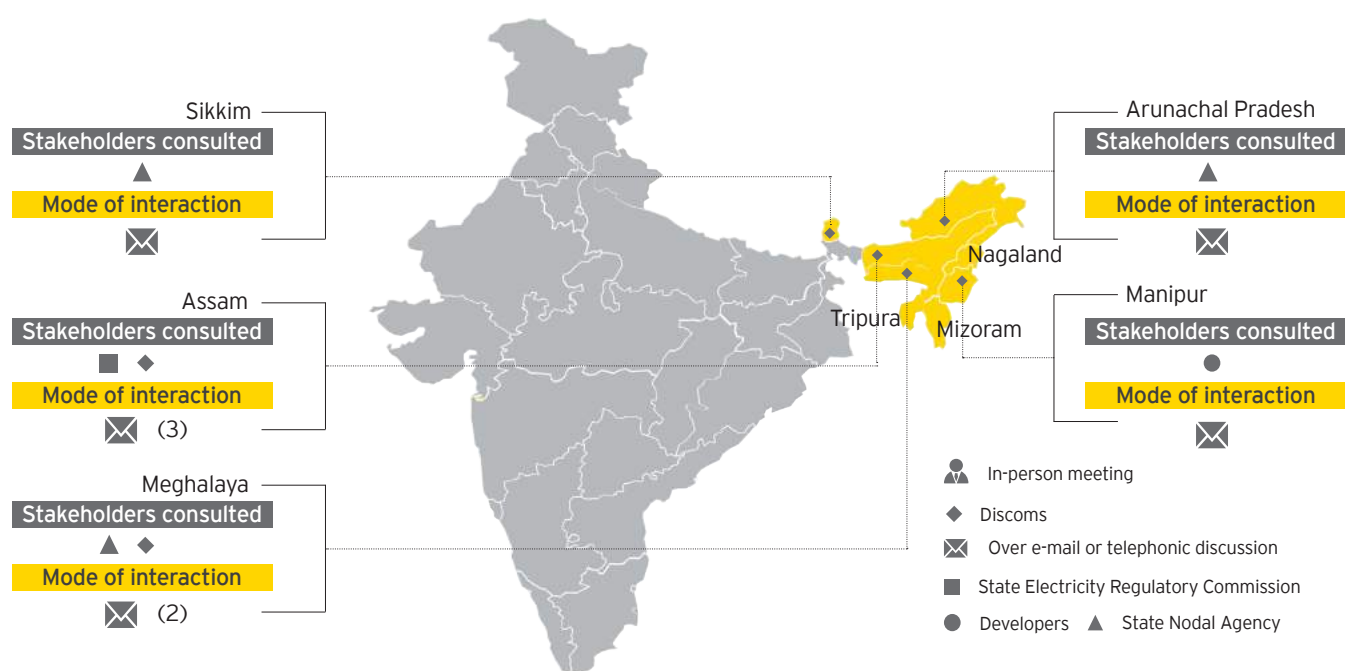
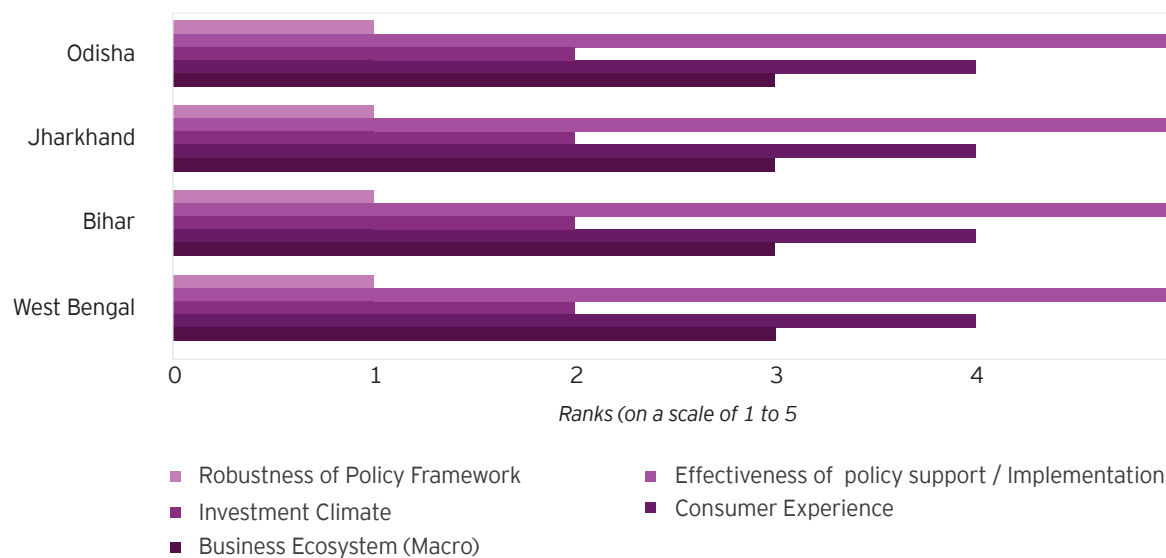


Exhibit 12: The skewness in the preference of the north zone



The ranks given by the states were used to arrive at the weightages for the five drivers using the methodology prescribed above. The weightages for the five drivers are as follows:

S.no	Bucket/parameter	Weightages
1	Robustness of policy framework	20%
2	Effectiveness of policy support/implementation	27%
3	Investment climate	13%
4	Consumer experience	33%
5	Business ecosystem	7%

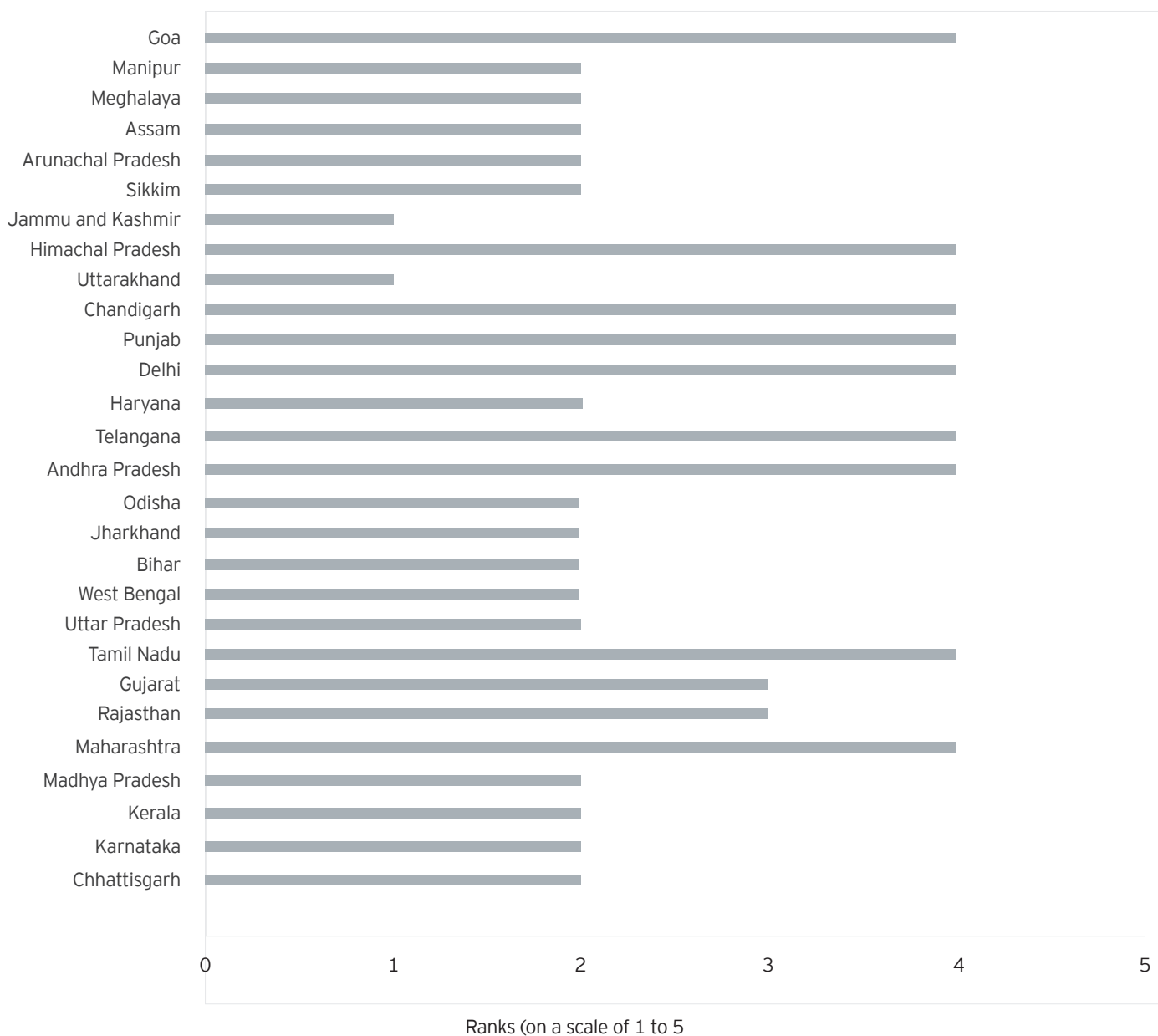
Overall picture

As seen above “consumer experience” and “effectiveness of policy support/implementation” are deemed to be of utmost importance in assessing a state for its attractiveness for solar rooftop. Most states have given either the rank of 4 or 5 to these two parameters with a few exceptions. The weightages for these two parameters

are very close with “consumer experience” having a weightage of 30% while it is 29% for the “effectiveness of policy support/implementation”. Together these two have a combined weightage of 59%. The least important parameter was consistent throughout all the zones i.e., “business ecosystem” with an overall weightage of just 8%.

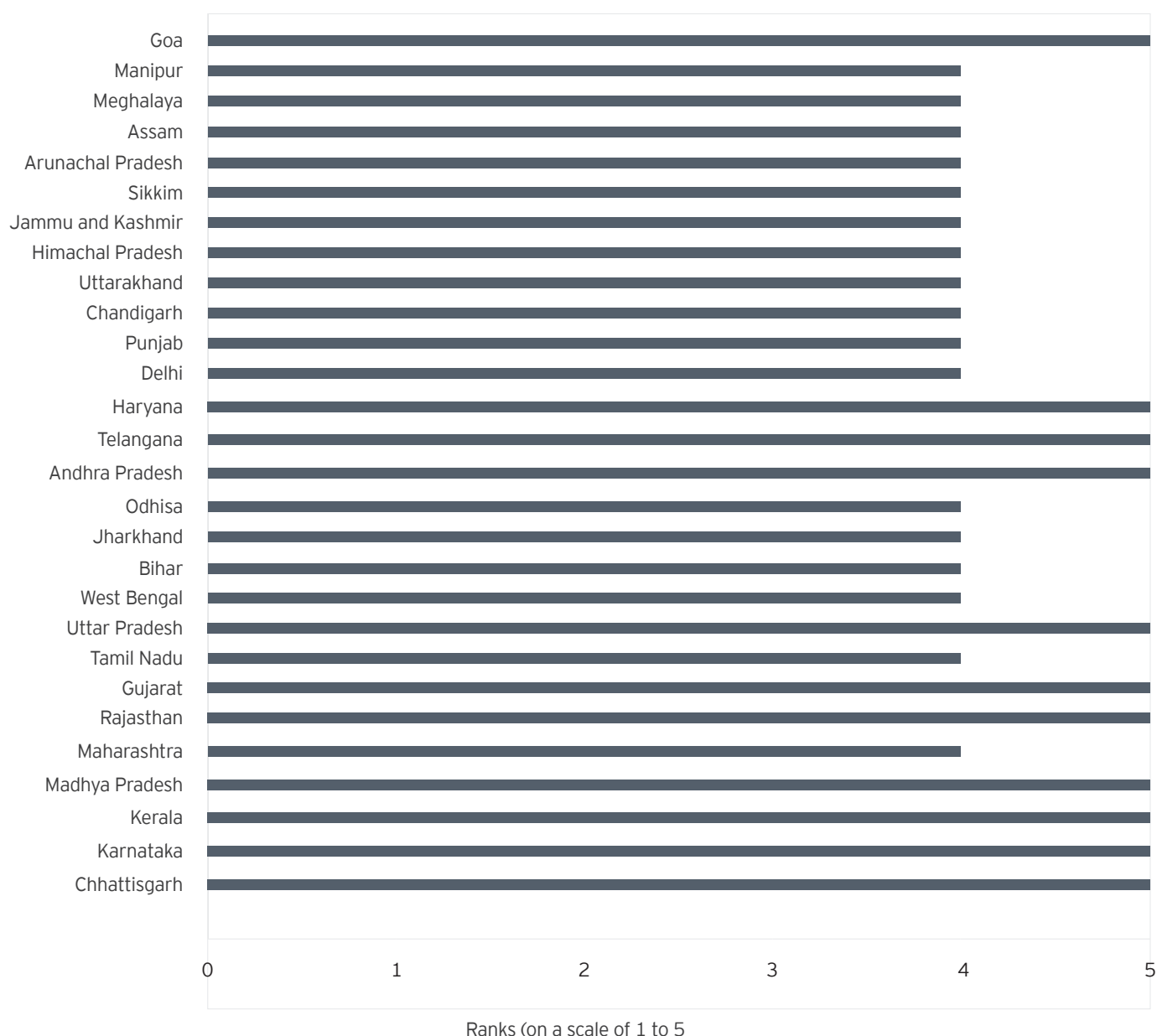
A detailed analysis of the five drivers is as follows:

Exhibit 13: State-wise ranks given to the parameter “robustness of policy framework”



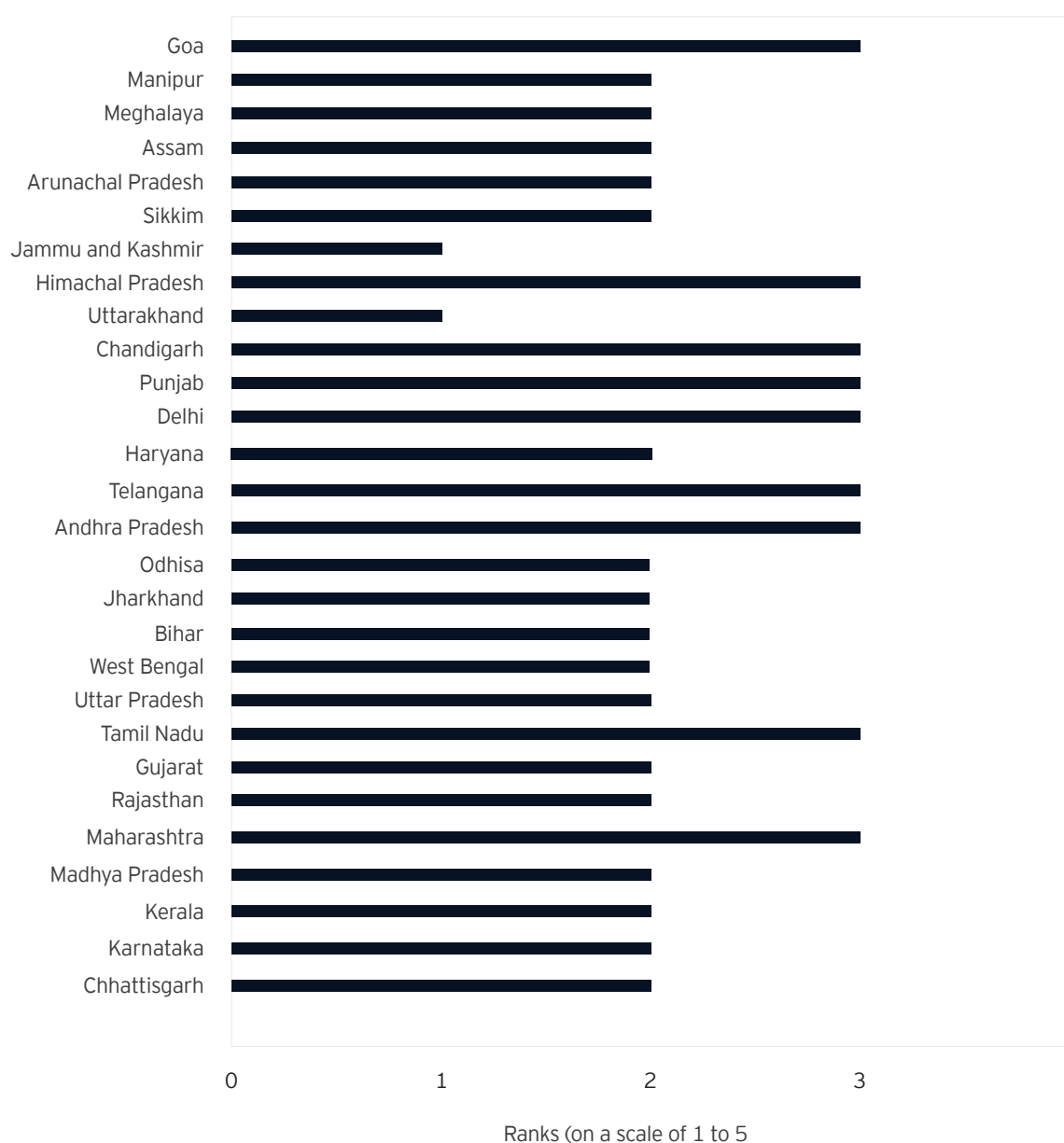
The “robustness of policy framework” has an overall weightage of 18% as per the stakeholders. Only a few states have given it the rank of four and none has given it the rank of 5. On the other hand, Delhi, Punjab, Haryana and Maharashtra has given it a rank of 1. This shows that this parameter is moderately important in the overall picture.

Exhibit 14: State-wise ranks given to the parameter “effectiveness of policy support/implementation”



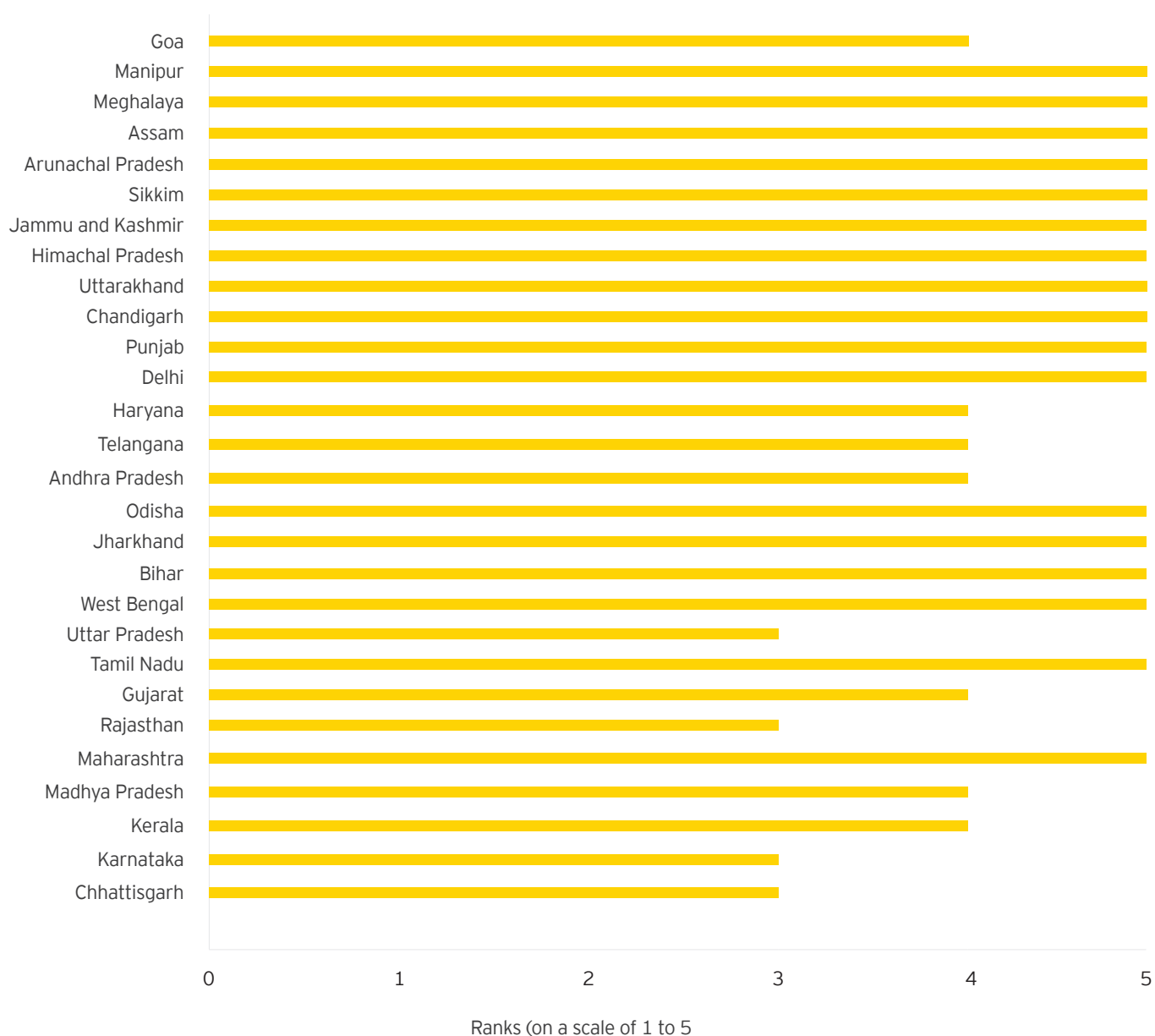
The parameter “effectiveness of policy support/implementation” emerges as the one of the most influential parameters for grading/ranking the states for their solar rooftop attractiveness. None of the states have given it the rank of 3 or less thus verifying the intuitive reasoning that unless a law or rule is followed, the mere existence of it does not have any serious consequences. It has an overall weightage of 29% in the model.

Exhibit 15: State-wise ranks given to the parameter “investment climate”



The investment climate has an overall weightage of 15% as per the stakeholders. Only a few states have given it the rank of three and no one has given it the rank of 4 or higher. In fact, Jammu and Kashmir and Uttarakhand have given it a rank of 1. This shows that this parameter is less important in the overall model of SARAL.

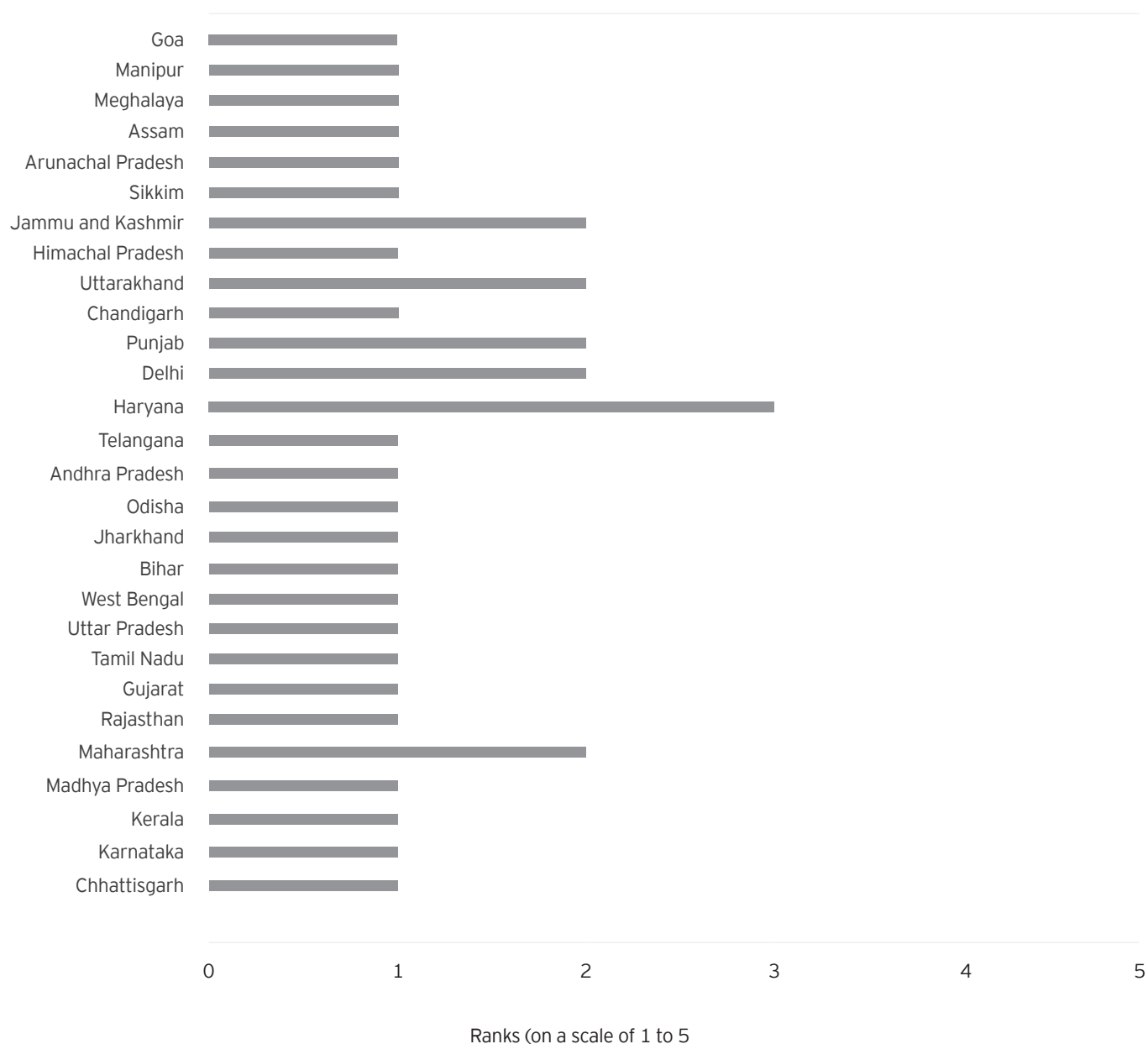
Exhibit 16: State-wise ranks given to the parameter “consumer experience”



Source: SARAL excel model

The parameter, consumer experience, emerges as the most relevant parameter for grading/ranking the states for their solar rooftop attractiveness. None of the states have given it the rank of 2 or less with over three-fifth of the states keeping it as the rank of 5. This parameter has the highest weightage of 30% as per the EY analysis.

Exhibit 17: State-wise ranks given to the parameter “business ecosystem”



Source: SARAL excel model

The investment climate has an overall weightage of 8% as per the stakeholders. With the sole exception of Haryana, no other state has given it the rank of 3 or more. A large majority, i.e., 80% of the states have given this parameter the lowest rank of 1 thus making it the least important parameters for the grading/ranking process.

The ranks given by the states were used to arrive at the weightages for the five drivers using the methodology prescribed above. The weightages for the five drivers are as follows:

S.no	Bucket/parameter	Weightages
1	Robustness of policy framework	18%
2	Effectiveness of policy support/implementation	29%
3	Investment climate	15%
4	Consumer experience	30%
5	Business ecosystem	8%

4.2.2. Regional workshop - Bangalore

“SARAL - The State Rooftop Solar Attractiveness Index” Round table discussion on 13 July 2018



Round table discussion no: 01

Venue: EY office, Bangalore

Purpose of regional workshop

Business ecosystem: Briefing regional stakeholders about ranking approach and methodology

Key discussion points attractiveness for rooftop solar.

- ▶ **Discussion 1** - What are the key barriers to uptake of rooftop solar in India?
- ▶ The panel listed down the following barriers hindering uptake of rooftop solar in India:
 - ▶ The industry bodies shared their problems regarding the application procedure right from pre-installation, installation and post-installation stages of setting up rooftop solar and requested the joint secretary to ease the procedures as soon as possible.
 - ▶ The panel also agreed in unison that consumer awareness is a major barrier as a lot of them are not aware of the benefits of RTS, cost of RTS and different models associated to it.
 - ▶ The panel also shared that there are a lot of policy and regulatory issues that need to be simplified and or resolved.
- ▶ Net metering system application and the role of DISCOMS need to be clearly demarcated from the central governing authorities so that every stakeholder is clear about their roles and responsibilities.
- ▶ The definition of rooftop solar and lack of clarity was addressed by various panel members to the joint secretary.



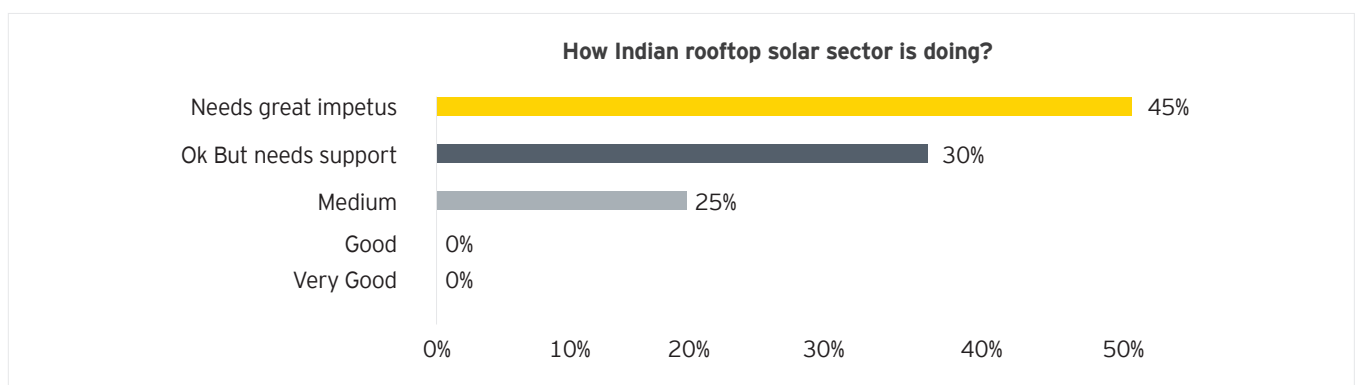
- ▶ **Discussion 2** - What factors would you consider to rank Indian states based on rooftop solar attractiveness?
 - ▶ The following parameters were considered important to rank states on rooftop solar attractiveness:
 - ▶ Ease of procedures and clarity on net metering
 - ▶ Consumer awareness
 - ▶ Ease of doing business and ease of financing
 - ▶ Policies and regulatory affairs
- ▶ **Discussion 3** - Overall feedback on the model, factors and comments on the indicator list?
 - ▶ The panel appreciated for taking up such an activity and expressed that the parameters and the scoring indicators were able to justify the holistic view of the solar rooftop attractiveness in the states. Due to this, it was easier for the wider audience to understand the discussion.
 - ▶ Panel gave the following order of preference and weightage on five drivers:
 - ▶ Effectiveness of policy support/implementation
 - ▶ Consumer experience
 - ▶ Robustness of policy in the state
 - ▶ Investment climate (suggested to add the business enablers in this driver)
 - ▶ Macro level parameters (suggested to remove as these were deviating from the subject)
- ▶ The panel also added that for rooftop solar to completely take off in India, residential rooftop solar needs to expand, as it has the most untapped potential. In the commercial segment, many companies are turning to rooftop solar to meet their energy demands, however, due to high cost of rooftop generating systems, residential solar is still not able to lead in installation.

Analysis of questionnaire assessment on the participant's feedback Number of participants: 20

While garnering feedback from the participants, a survey form was circulated to understand stakeholders' opinion about assigned weightages to different drivers of parameters. The survey form was developed with the aim of getting a quantitative rating at a scale of 1 to 5 for all the drivers based on their importance in final ranking and few other qualitative feedback on the model developed.

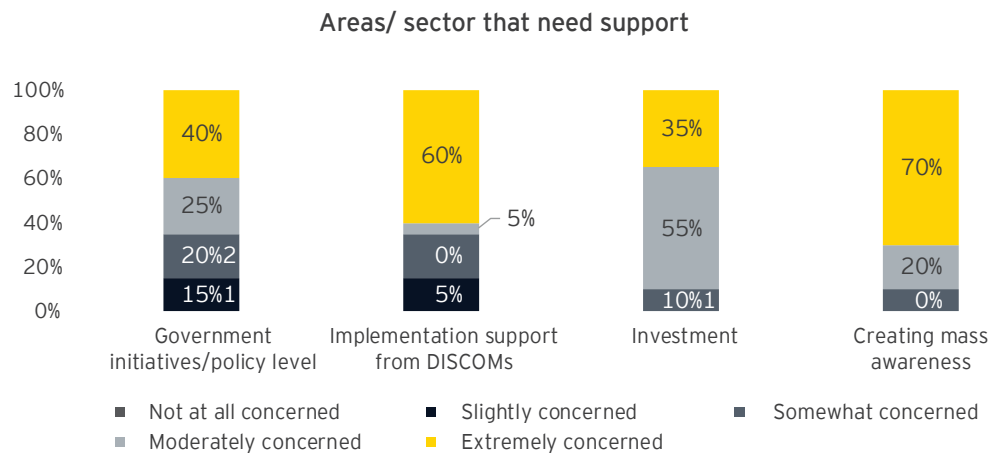
Feedback of the participants

Analysis of feedback given by participants is summarized below



- ▶ Two-third of the participants (~75%) believe that rooftop solar sector need support to grow further

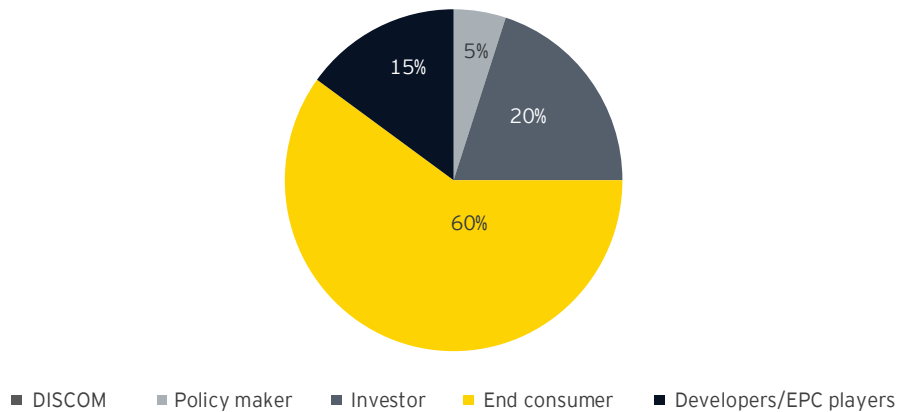
2. What are the areas/sector that need support?



- ▶ The participant’s exhibit concern about all the facets identified, however, implementation support from DISCOMs and creating mass awareness are the areas that they think need more support.

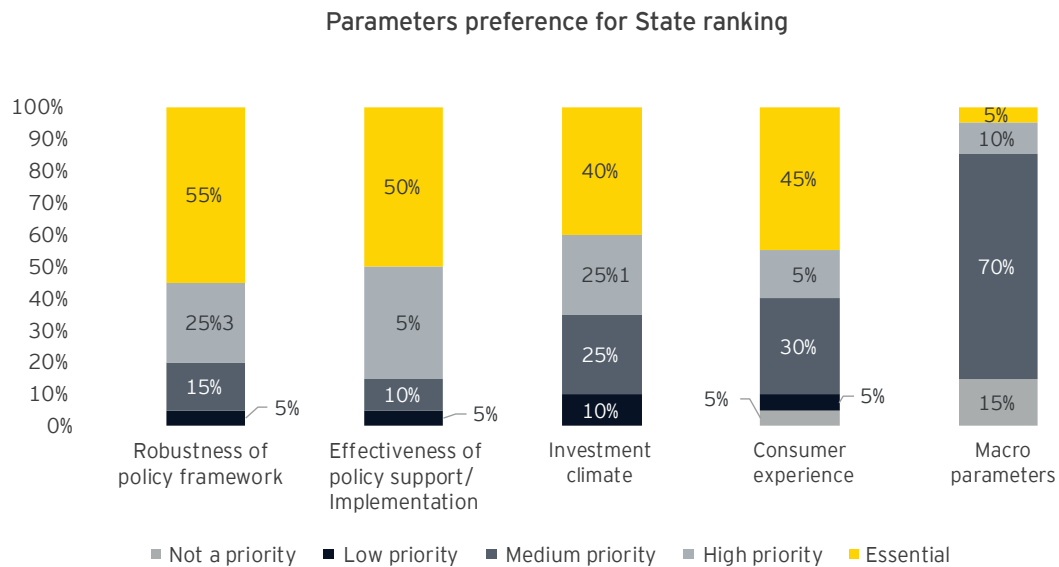
3. The rooftop solar attractiveness index should be seen from lenses of which stakeholder/stakeholders?

The rooftop solar attractiveness index should be seen from lenses of which stakeholder



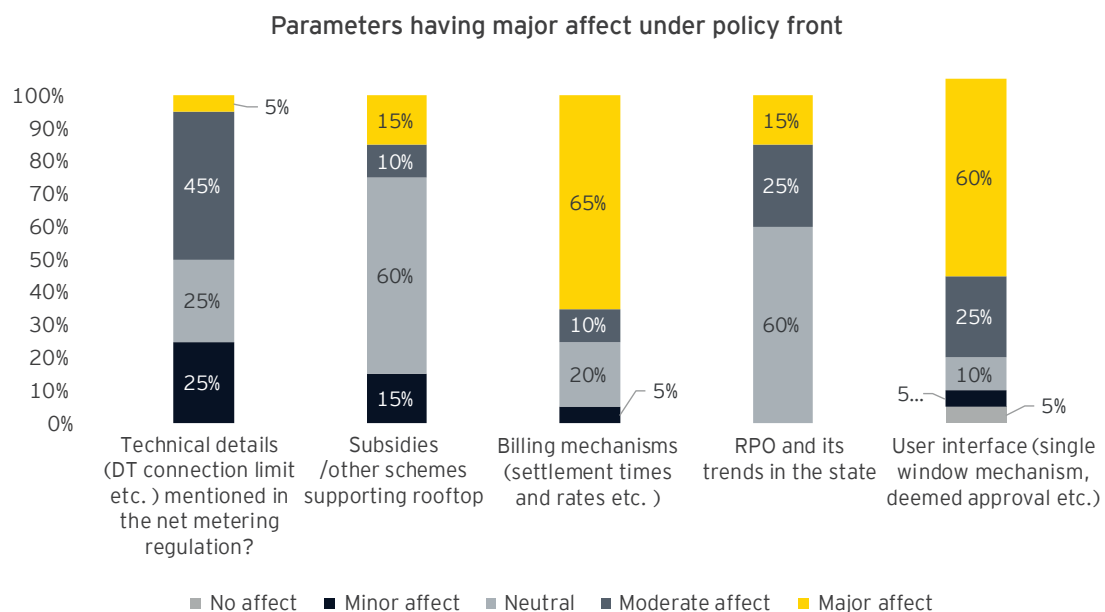
- ▶ The market is consumer driven and residential solar is already facing challenges such as lack of awareness among consumers
- ▶ Participants reflect the same view, as around 60% believe that the index should be seen from end consumers’ perspective.

4. Indicate the relative importance on the parameters?



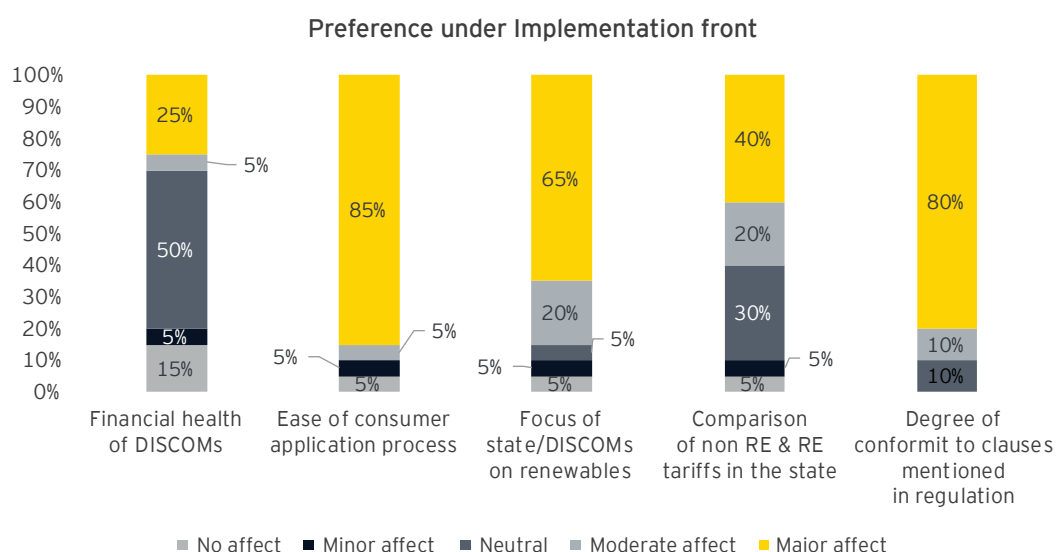
- The participants were asked to give feedback on the parameters suggested on the basis of the priority for ranking the state, 55% of them said that “robustness of policy framework” is the highest priority to rank the state, followed by “effectiveness of policy support/implementation” having 50% preference as the second highest parameters in ranking the state

5. Under policy front, what are the important parameters in state ranking?



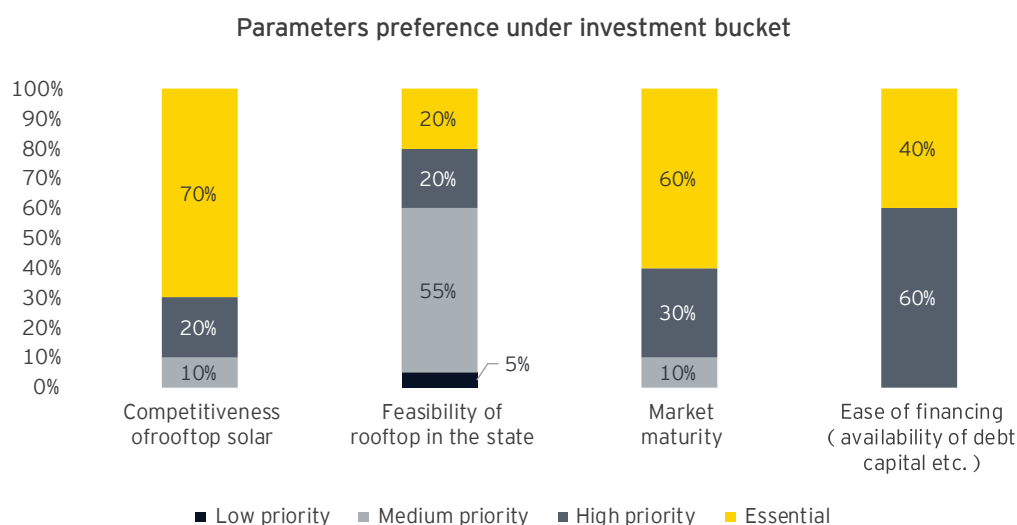
- 65% of participants said, “billing mechanisms” will have a major affect under policy front, while 60% of participants voted neutral affect to subsidies/other schemes supporting rooftop and RPO and their trends in the state.

6. Under implementation front, what is the most important parameter to rank a state?



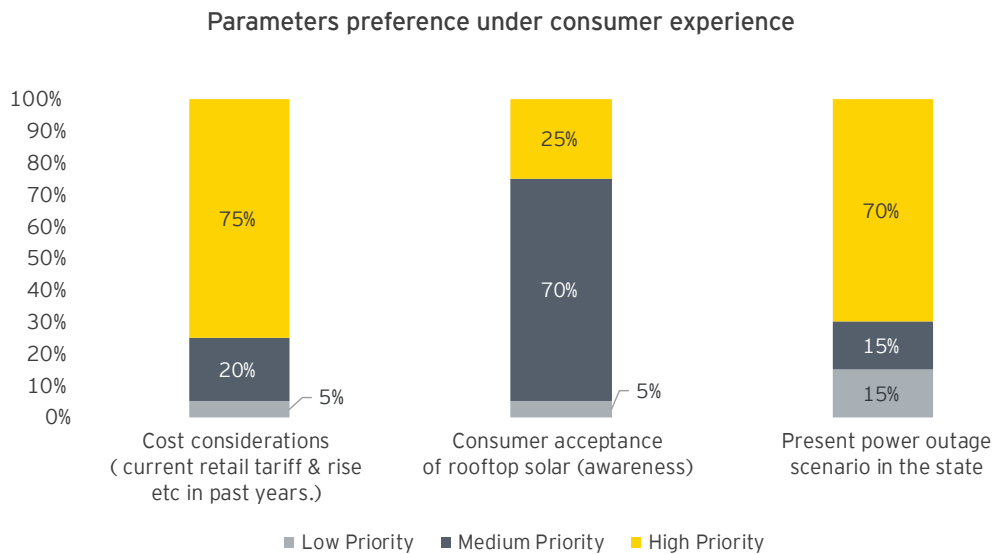
- As rooftop solar projects belong to a consumer-driven sector, majority of the participants believe that under “implementation front”, if the process of implementing the rooftop solar project is smooth, a fewer hurdles in the process points to a swifter setting up procedure and hence more uptake in the sector. Thus, indicators like “ease of consumer application process” and “degree of conformity to clauses mentioned in regulation” having 85% and 80%, respectively will have a major effect on the index.

7. Under investment climate driver, what is the most important factor in state ranking?



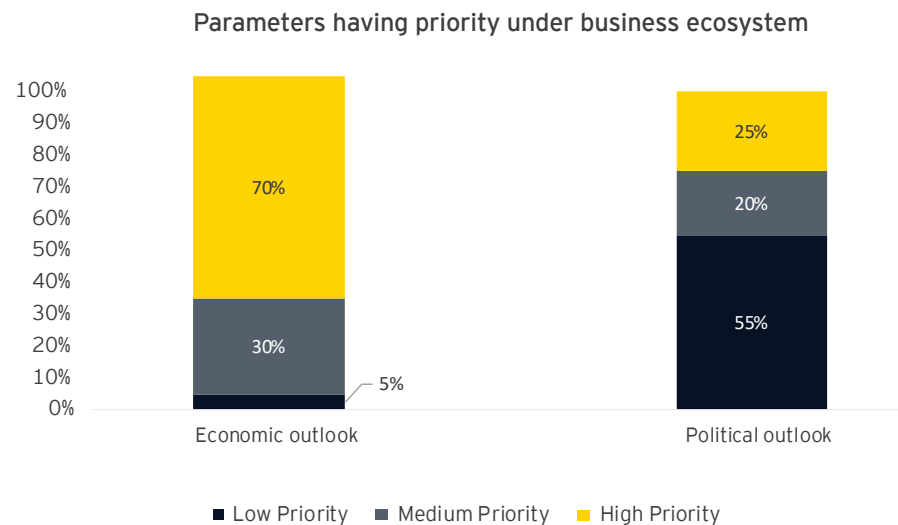
- Under the investment climate driver, 70% of participants rated competitiveness of rooftop solar i.e., charges associated with a rooftop solar system and pitting them against what a regular consumer pays for electricity, as the driver of rooftop solar driver.

8. Which parameter will be having the maximum weightage under consumer experiences?



► Experiences of the end consumers are a very important factor in evaluating the offtake potential in the state, thus, cost consideration was suggested by 75% of the participants as the high priority under consumer experience driver, followed by present power outage scenario in the state having 70% preference.

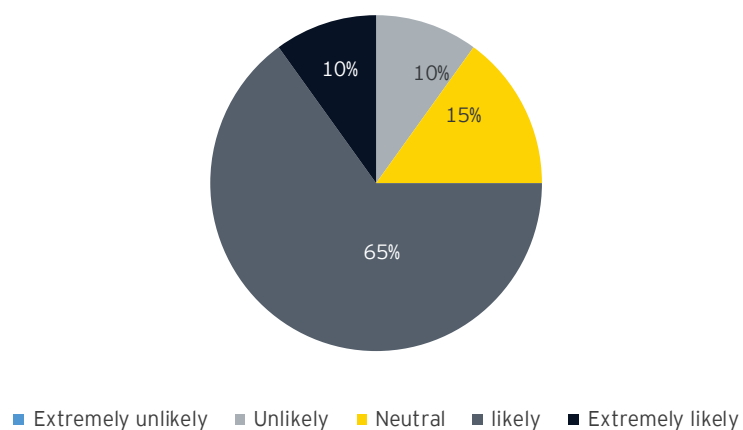
9. Under business ecosystem, which parameter is the most important in state ranking?



► According to the participants, political outlook will have less impact on the macro driver. Over 55% of the participants recommended to consider political outlook on low priority for macro driver and 70% weightage was given to the economic well-being of the state and its future outlook.

10. Overall feedback on “SARAL” model developed to rank Indian states?

Feedback on the SARAL model developed



- ▶ 65% of participants liked the “SARAL” model developed to rank the state depending upon the attractiveness towards solar rooftop installation and majority of them added that this kind of initiative will create a conducive environment for solar rooftop installations, encourage investment and lead to an accelerated growth of the sector in the states.

Questionnaire

SARAL Stakeholders Survey - Bangalore, 13-July-2018

Stakeholder's name :										
Contact number :										
Email ID :										
Entity :										

Question 1.	What do you think how Indian rooftop solar sector is doing?									
	Very good		Good		Medium		Ok but needs support		Needs great impetus	

Question 2.	Which are the areas the sector needs support and please indicate the level at a scale of 1-5									
a	Government initiatives/policy level				1	2	3	4	5	
b	Implementation support from DISCOMs				1	2	3	4	5	
c	Investment				1	2	3	4	5	
d	Creating mass awareness				1	2	3	4	5	
e	Please mention if any others:				1	2	3	4	5	

Question 3.	Which are the parameters you think should be considered in ranking states based on rooftop attractiveness									

Question 4.	According to you, the rooftop solar attractiveness index should be seen from lenses of which stakeholder/stakeholders									
DISCOM		Policy maker		Investor		End consumer		Developers/ EPC players		

Question 5.	Please indicate (use a tick) relative importance of the following parameters for the state ranking purpose									
a	Robustness of policy framework				1	2	3	4	5	
b	Effectiveness of policy support/ Implementation				1	2	3	4	5	
c	Investment climate				1	2	3	4	5	
d	Consumer experience				1	2	3	4	5	
e	Macro parameters				1	2	3	4	5	

Question 6.	Under policy front, what do you think is the most important(rate at a scale of 1-5) in state ranking?									
a	Technical details (DT connection limit etc.) mentioned in the net metering regulation?				1	2	3	4	5	
b	Subsidies/other schemes supporting rooftop				1	2	3	4	5	
c	Billing mechanisms (settlement times and rates etc.)				1	2	3	4	5	
d	RPO and its trends in the state				1	2	3	4	5	
e	User interface (single window mechanism, deemed approval etc.)				1	2	3	4	5	
Comments if any:										

Question 7.	Under implementation front, what do you think is the most important(rate at a scale of 1-5) in state ranking?									
a	Financial health of DISCOMs				1	2	3	4	5	
b	Ease of consumer application process				1	2	3	4	5	
c	Focus of state/DISCOMs on renewables				1	2	3	4	5	
d	Comparison of non RE & RE tariffs in the state				1	2	3	4	5	
e	Degree of conformity to clauses mentioned in regulation (eg. timelines from application submission to final commissioning				1	2	3	4	5	
Comments if any:										

Question 8.	Under investment bucket, what do you think is the most important(rate at a scale of 1-4)in state ranking?									
a	Competitiveness of rooftop solar	1	2	3	4					
b	Feasibility of rooftop in the state (rooftop area, dust level, irradiance etc.)	1	2	3	4					
c	Market maturity (availability of developers, consumer awareness etc.)	1	2	3	4					
d	Ease of financing (availability of debt capital etc.)	1	2	3	4					
Comments if any:										
Question 9.	Under consumer experience, what do you think is the most important(rate at a scale of 1-3)in state ranking?									
a	Cost considerations (current retail tariff & rise etc in past years.)	1	2	3						
b	Consumer acceptance of rooftop solar (awareness)	1	2	3						
c	Present power outage scenario in the state	1	2	3						
Suggestions if any:										
Question 10.	Under macro parameters, what do you think is the most important(rate at a scale of 1-3)in state ranking?									
a	Economic outlook	1	2	3						
b	Political outlook	1	2	3						
c	Other business enablers(FDI inflow etc.)	1	2	3						
Comments if any:										
Question 11.	Overall feedback (rate at a scale of 1 - 5)on the SARAL model developed to rank Indian states									
	1		2		3		4		5	
Suggestion if any:										

4.2.3. Regional workshop - Kolkata

SARAL - The State Rooftop Solar Attractiveness Index" Round table discussion on 17 August 2018



Round table discussion no: 01

Venue: EY office, Bangalore

Key discussion points

Discussion 1 - What are the key barriers hindering uptake of rooftop solar in India?

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

- ▶ Difficulty in accessing debt finance as the subsidy schemes cannot support the sector for a longer period of time.
- ▶ Lack of financing instruments/solutions is a major hurdle in the RTS market which needs an urgent attention. The PSU or commercial banks are averse in debt financing rooftop solar projects due to lack of due diligence knowledge and proven operational performance of the projects.
- ▶ Capital expenditure is high for residential sector, the RTS revolution has to be led by the common man but many consumers may not have the liquidity to pay for the entire solar system upfront and they are also skeptical about the total life of the plant.
- ▶ In West Bengal, the challenge in the residential segment lies in getting an access to the roof area for a longer period. Culturally, people love to spend time with community in gathering and other social activities on the roof premises, thus there are chances for them not be willing to use the same place for a technology, which lacks popularity in India.
- ▶ A few participants in the panel reiterated that in India, rooftop solar sector is growing but delay in getting subsidies due to stringent administrative procedures and lack of accountability in the SNA hierarchy to disburse these subsidies is creating hurdles in gaining popularity.
- ▶ The MNRE needs to remove all the remaining roadblocks to encourage rooftop solar power to feed their solar power into the grid. Thus, bringing DISCOMs at the forefront will be crucial for the sector to grow.
- ▶ Rooftop solar still remains a relatively new technology in India and due to this, there is a perception that it may not perform as expected over its lifetime.
- ▶ There is another major challenge in the form of its storage. Currently, the cost of a rooftop solar system with battery storage could be between INR90,000 and INR 1,35,000 per kW, depending on its voltage. Considering that the one backed up with storage will significantly increase the CAPEX leads to limiting the options of mass commercialization.
- ▶ on its voltage. Considering that the one backed up with storage will significantly increase the CAPEX leads to limiting the options of mass commercialization.

Discussion 2 - What are the key barriers hindering uptake of rooftop solar in West Bengal? The panel suggests the following observation as the key barriers hindering uptake of rooftop solar in West Bengal:

- ▶ Limited awareness and understanding of RTS among consumers regarding costs and payback period.
- ▶ Confusion on net-metering meter specifications (solar generation meter and net meter) among the consumers.
- ▶ Lack of information on how to select project developers' selection and limited interaction between the utilities and the end consumers.
- ▶ West Bengal Electricity Regulatory Commission (WBERC) mentioned in the net metering guideline that a minimum cap of 5 kW for system sizes in West Bengal for the end users. This limit hinders applications as a lot of end users have sanctioned load way less than 5 kW.
- ▶ The existing provision of system applications is only for consumers having three phase connectivity. It also limits the end users to apply and a lot of residential users don't have three phase connectivity yet.

- ▶ Limited reach and appeal of the net-metering program in the state. Marketing and outreach campaign needs to be bolstered.

Discussion 3 - What is the overall feedback on the model, factors and comments on the indicator list?

The panel appreciated the ASSOCHAM and EY initiatives of initiating such an activity to holistically support the sector. The panelists expressed that though the robustness of policy framework and implementation of the policy will guide the index, the business ecosystem will have the least impact as the involved data might not be changeable.

- ▶ The panel gave the following order of preference and weightage on the five drivers:
- ▶ Effectiveness of policy support/implementation
- ▶ Robustness of policy in the state
- ▶ Consumer experience
- ▶ Investment climate
- ▶ Macro level parameters



Analysis of questionnaire assessment on the participant's feedback

Number of participants: 20

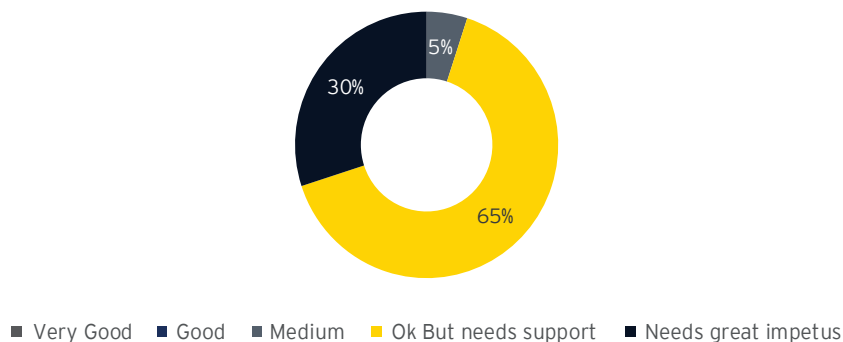
While garnering feedback from the participants, a survey form was circulated to understand stakeholders' opinions about assigning weightages to different drivers of parameters. The form was developed with the aim of getting a quantitative rating on a scale of 1 to 5 for all the drivers based on their importance in the final ranking and a few other qualitative feedbacks on the models developed.

Feedback of the participants

Analysis of feedback given by participants is summarized below

1. How Indian rooftop solar sector is doing?

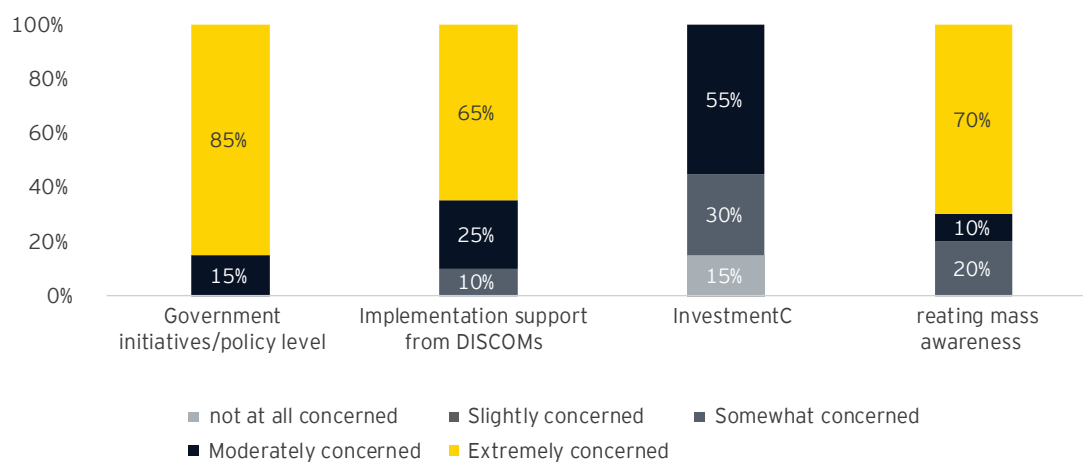
How Indian rooftop solar sector is doing?



- More than 95% of the participants believe that rooftop solar sector needs support, and/or great impetus to achieve MNRE's 2022 target.

2. What are the areas/sectors that need support?

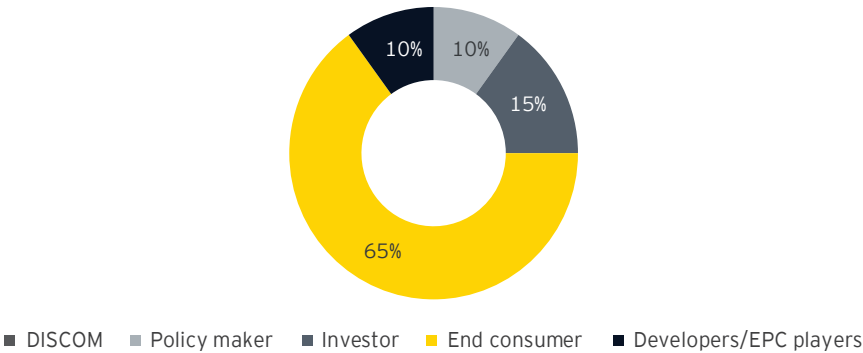
In areas the sector needs support



- The participants exhibit concerns about all the facets identified, but government intervention at policy level and creating mass awareness are the areas that need most support.

3. The rooftop solar attractiveness index should be seen from the lenses of which stakeholder/stakeholders?

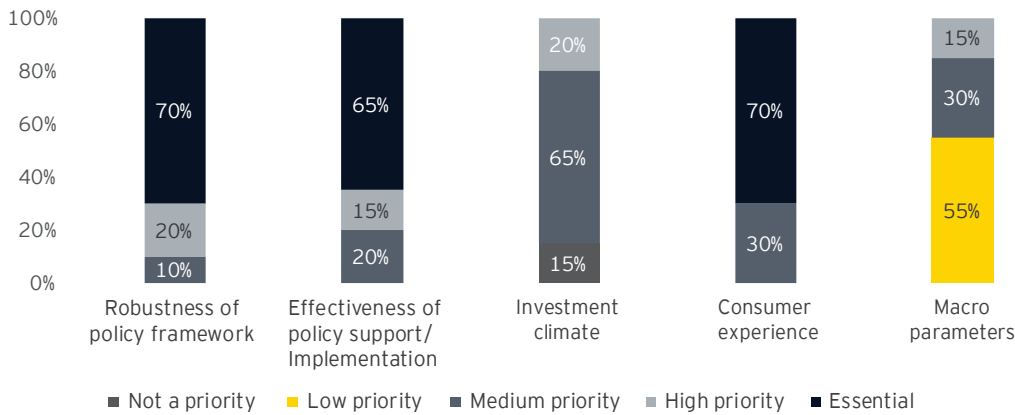
The rooftop solar attractiveness index should be seen from lens of which stakeholder



- ▶ The market is consumer driven and residential solar is already beset with challenges such as lack of awareness among consumers.
- ▶ Participants reflect the same view, as around 65% believe that the index should be seen from end consumers' perspective.

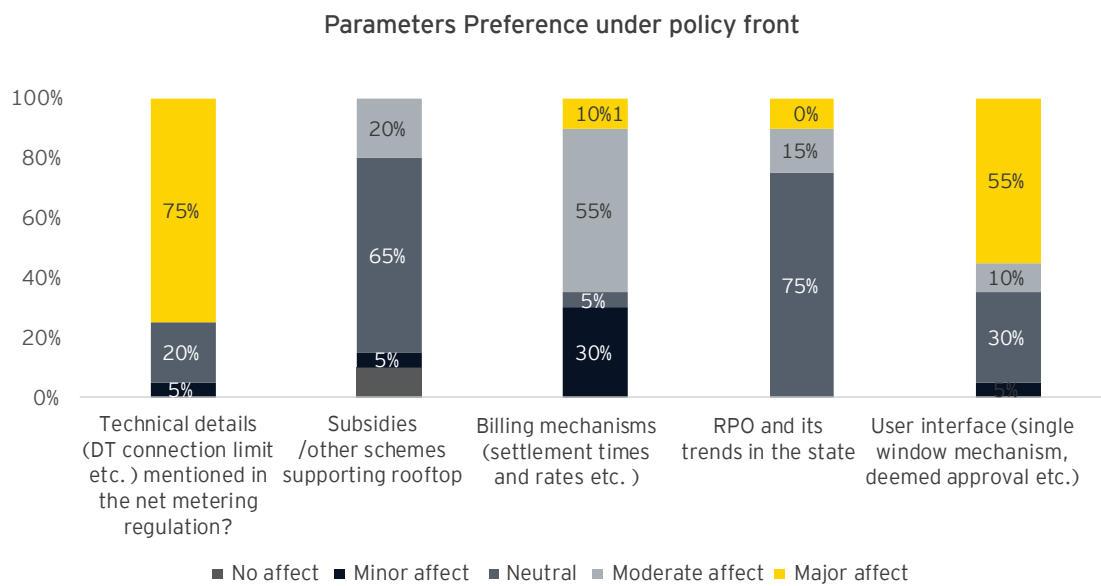
4. Indicate the relative importance on the parameters?

Parameters preference for State ranking



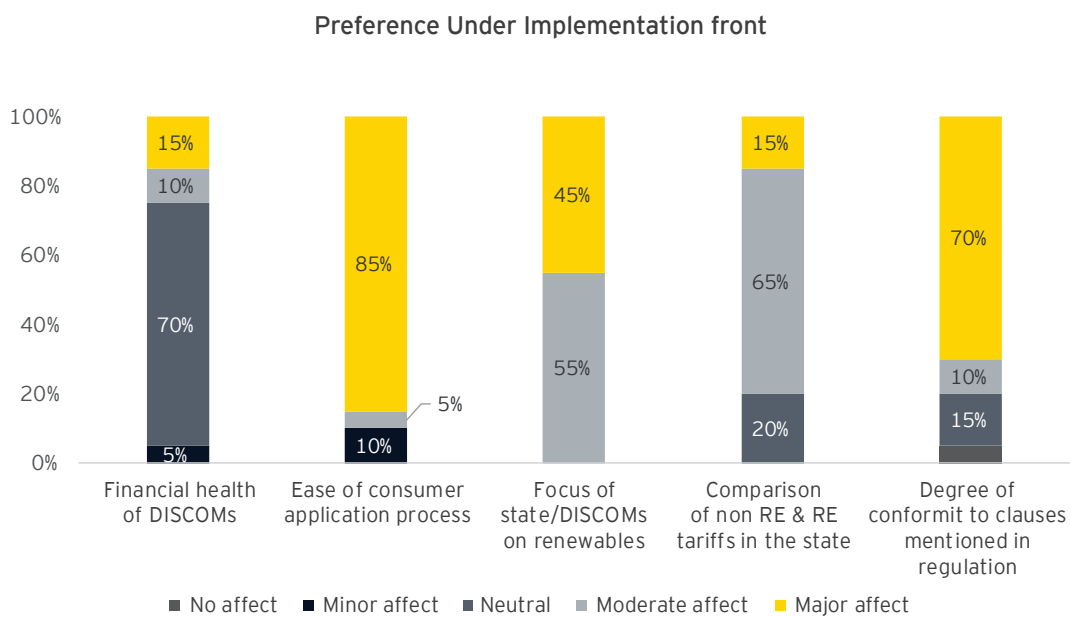
- ▶ The participants were asked to give feedback on the parameters suggested on the basis of the priority for ranking the state. Seventy percent of them said “robustness of policy framework” is essential to rank the state, while “consumer experience” also holds a major concern from 70% of the participants.

5. Under policy front, what is the important parameters in state ranking?



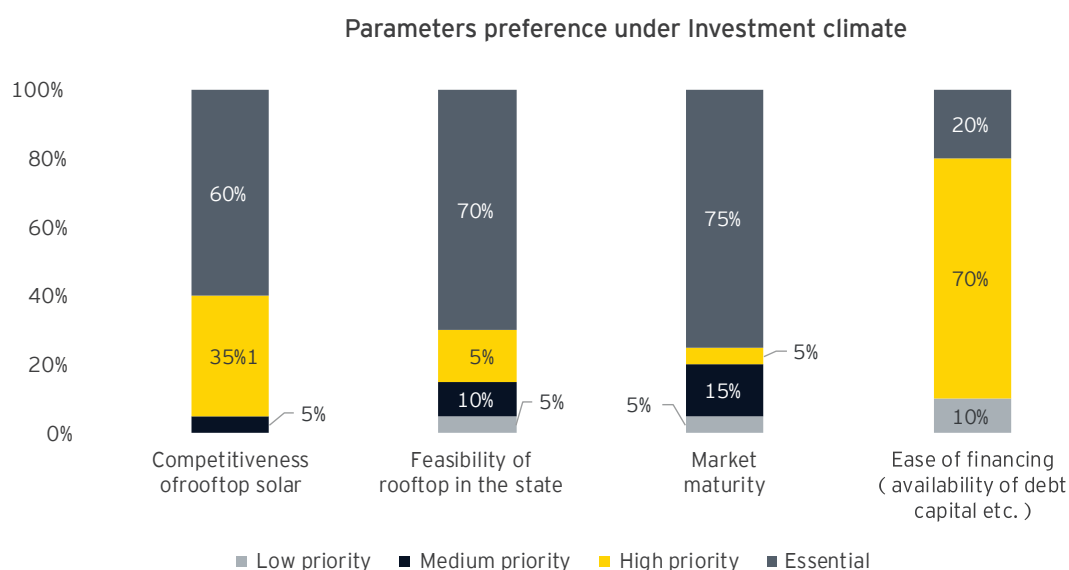
- Seventy-five percent of participants said, “technical details” will have major affect under policy front, while 55% of participants voted that “user interface” will have a major impact under policy front.

6. Under implementation front, what is the most important parameter to rank a state?



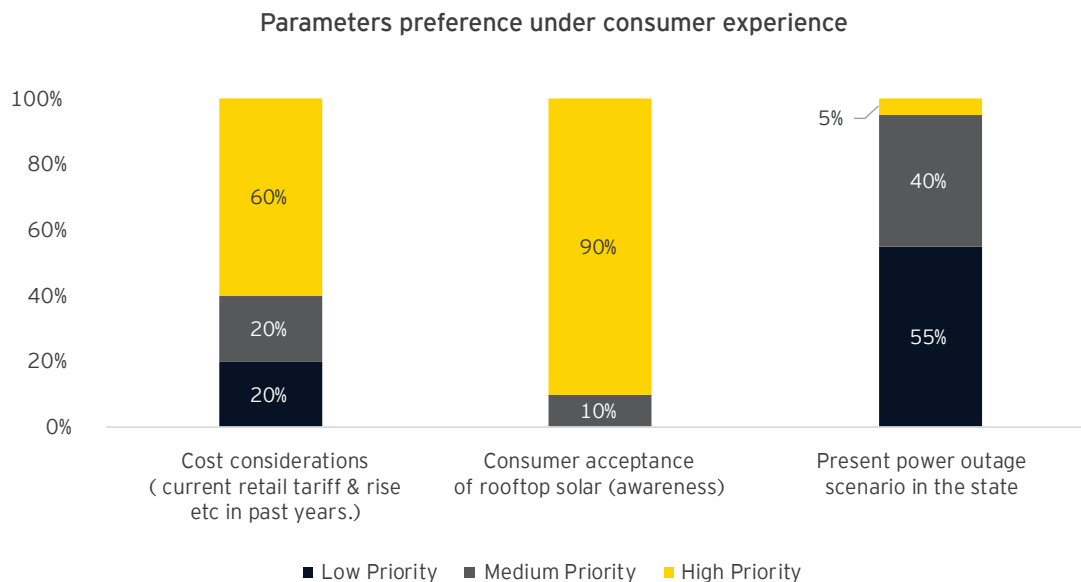
- As rooftop solar projects fall under consumer-driven sector, majority of the participants believe that on implementation front, there are a few hurdles to a swifter setting up procedure. Thus, indicators like “ease of consumer application process” and “degree of conformity to clauses mentioned in regulation” having 85% and 70%, respectively, will have a major effect on the index.

7. Under investment climate driver, what is the most important parameter in state ranking?



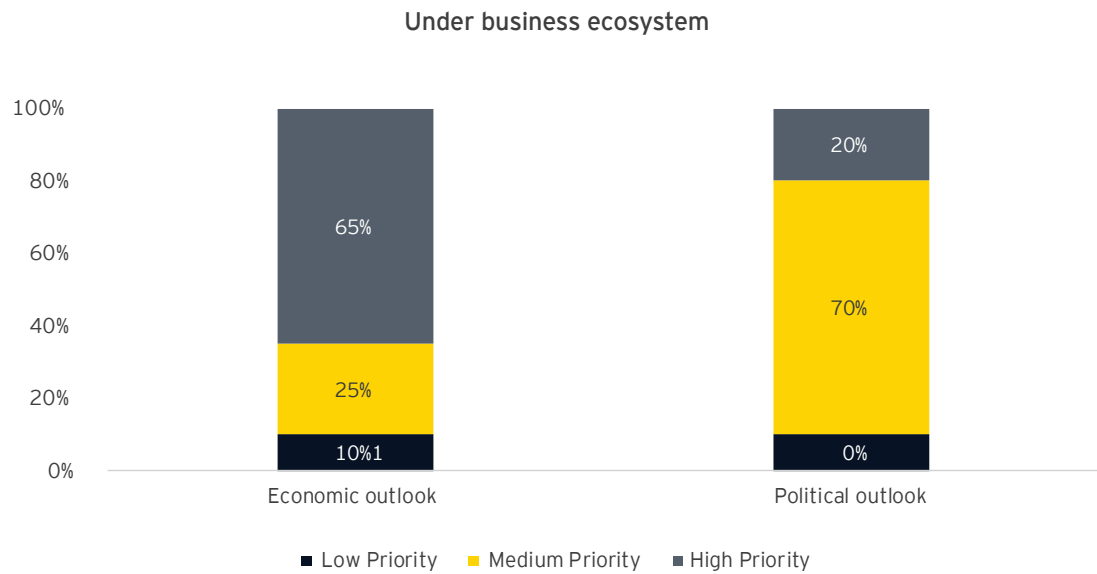
- Under the investment climate driver, the participants felt that “market maturity” holds the maximum weightage. Seventy-five percent of them believe that the existing market conditions i.e., number of developers, industry workforce and the number of C&I consumers in rooftop solar sector will improve the investment in the state.

8. Which parameters will be having the maximum weightage under consumer experiences ?



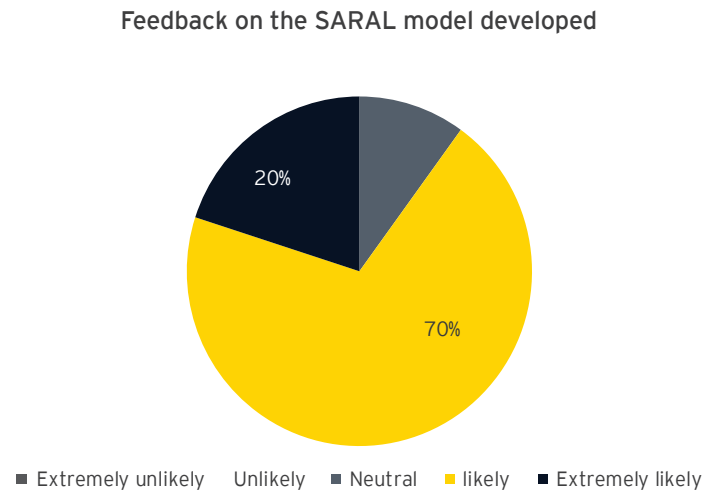
- Experience of the end consumer is a very important factor in evaluating the offtake potential in the state. Thus “consumer acceptance of rooftop solar” was suggested by 90% of the participants as the high priority under consumer experience driver, followed by “cost consideration” in the state having 60%.

9. Under business ecosystem, what is the most important in state ranking?



- ▶ According to the participants, “political outlook” will have less impact on the macro driver. Over 65% of the participants recommended to consider economic well-being of the state and its future outlook as the important driver under business ecosystem.

10. What is the overall feedback on SARAL model developed to rank Indian states ?



- ▶ Seventy percent of the participants like SARAL model developed to rank the state depending upon the attractiveness towards solar rooftop installation and majority of them added that such an initiative will create a conducive environment for solar rooftop installations, encourage investment and lead to accelerated growth of the sector in the state.

4.2.4. Regional workshop - New Delhi

SARAL - The State Rooftop Solar Attractiveness Index" On 18 October 2018



Round table discussion No: 03

Venue: ASSOCHAM

Corporate Office, New Delhi

Discussion 1 - What are the key barriers hindering uptake of rooftop solar in India?

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

- ▶ Presently in India, there are two dominant business models for rooftop solar: the capital expenditure (CAPEX) model and the renewable energy supply company (RESCO) model. These models work fine for larger commercial and industrial (C&I) players who have access to upfront capital, or can obtain commercial loans. However, rooftop solar remains constrained among smaller C&I players, micro, small and medium enterprises (MSME), and residential customers due to lack of financial resources and inability to access debt.
- ▶ The biggest barrier that the model faces for MSME clients is perceived lack of creditworthiness due to lack of credit information/ratings.
- ▶ Capital expenditure is high for residential sector, the rooftop solar system revolution has to be led by the common man but many consumers may not have the liquidity to pay for the entire system upfront and even the consumers are sceptical about total plant life.
- ▶ Few participants in the panel reiterated the fact that in India the lack of interest by the lenders, lack of awareness among the MSMEs, inability of MSME to absorb additional debt and opportunity cost of the investment serves the biggest block to take up the rooftop solar system
- ▶ The MNRE needs to remove all the remaining roadblocks to encourage rooftop solar power to feed their solar power into the grid thus bringing DISCOMs at the forefront will be crucial for the sector to grow.
- ▶ There is still a widespread perception that installation of rooftop solar panels needs a large investment, and people are not always aware of the financial incentives available. The central and state governments must do something of reaching out to resident welfare associations and community groups to encourage people to shed their inhibitions and embrace rooftop solar,
- ▶ Rooftop solar remains a relatively new technology in India and thereafter, majorly in residential sector, there is a perception that it may not perform as expected over its lifetime.

Discussion 2 – What are the key barriers hindering uptake of rooftop solar in Delhi?

The benefits of rooftop solar are clear – it produces zero emissions, does not require the additional use of land and the installation costs have decreased drastically.

- ▶ Limited awareness and understanding of RTS among the consumer, cost, and payback period
- ▶ Confusion on net-metering meter specifications (solar generation meter & net meter) among the consumers
- ▶ a majority of rooftop solar installations are in the C&I segment, primarily due to a business case for rooftop solar tariffs against the prevailing electricity tariffs. Market expansion in the C&I, however, has been limited to large corporations and high-credit rated entities, and is reaching a plateau as a result.
- ▶ In Delhi, everyone puts the water tank on the south side of the roof and it is the direction where you get maximum solar energy. Plus, you have various things on roofs which reduces the available area needed for solar.

- ▶ However, the challenges on the ground are more complex. Developers stress that there is a problem of lack of uniform roofs in Delhi and the fact that roofs are often used for various purposes that doesn't leave enough space to install big panels. A 10 KW solar plant that can power three air-conditioners and is sufficient for a three-bedroom apartment needs around 1,000 sq. ft. of terrace area.

Discussion 3 – Overall Feedback on the Model, Factors and Comments on the indicator list?

- ▶ The panel appreciated the ASSOCHAM & EY initiatives of initiating such an activity to holistically support the sector
- ▶ Panel gave the following order of preference and weightage on five buckets:
 - ▶ Effectiveness of policy support / implementation
 - ▶ Robustness of Policy in the State
 - ▶ Investment Climate
 - ▶ Consumer Experience
 - ▶ Macro level parameters

Analysis of Questionnaire Assessment on the Participant's Feedback

Number of participants: 21

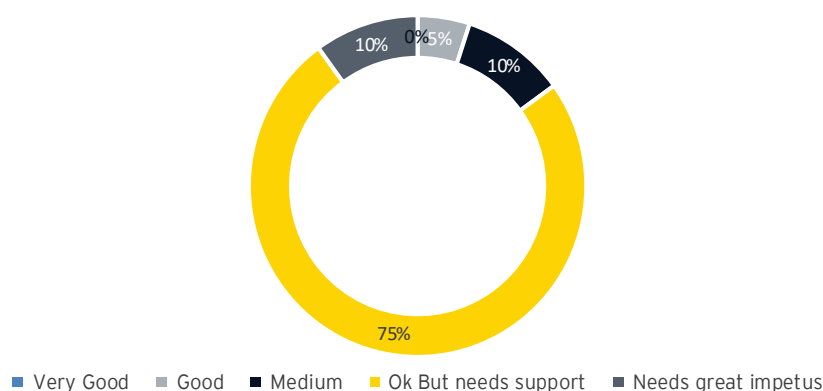
While garnering feedback from the participants, a survey form was circulated to understand stakeholders' opinion about assigning weightages to different buckets of parameters. The survey form was developed with the aim of getting a quantitative rating at a scale of 1 to 5 for all the buckets based on their importance in final ranking and few other qualitative feedback on the model developed.

Feedback of the Participants

Analysis of feedback given by participants is summarized below

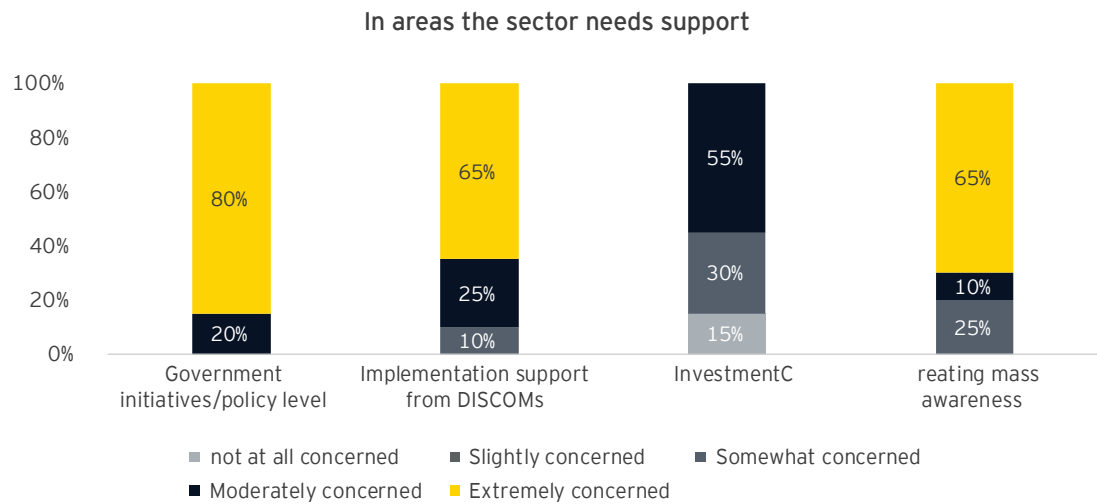
1. How Indian rooftop solar sector is doing?

What do you think how Indian rooftop solar sector is doing?



- ▶ More than 75% of the participants believe that rooftop solar sector needs support, and/ or great impetus.

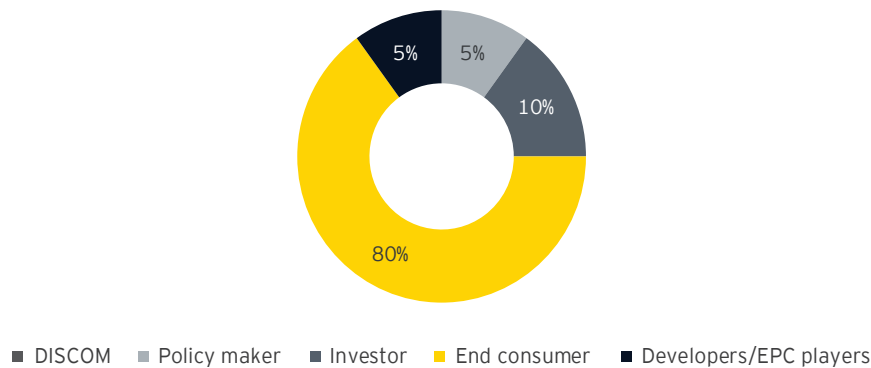
2. What are the areas/ sector need support?



- ▶ The participant’s exhibit concern about all the facets identified, but Government intervention at policy level & creating mass awareness are the areas that need most support.

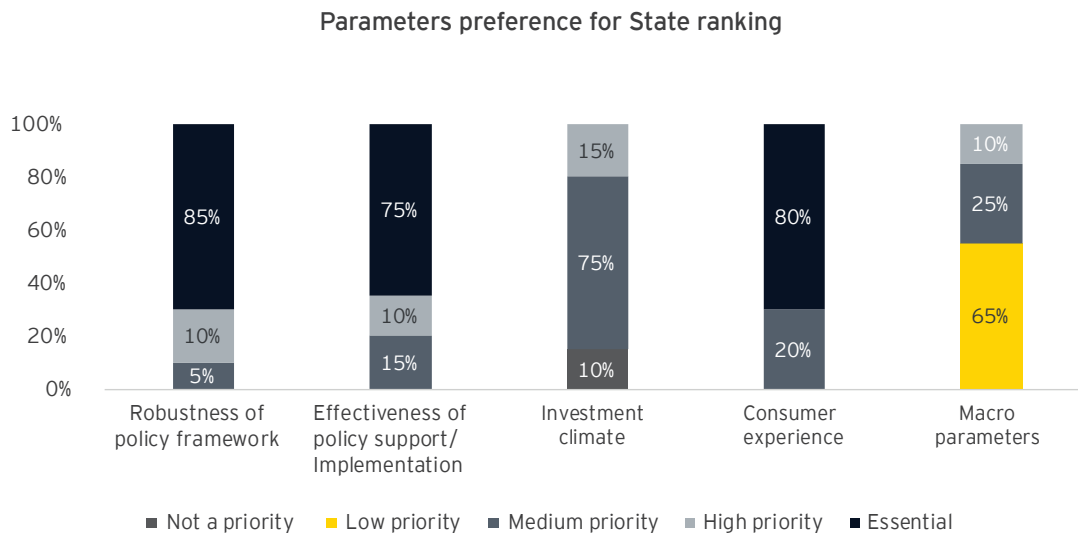
3. The rooftop solar attractiveness index should be seen from lenses of which Stakeholder/ Stakeholders?

The rooftop solar attractiveness index should be seen from lense of which stakeholder



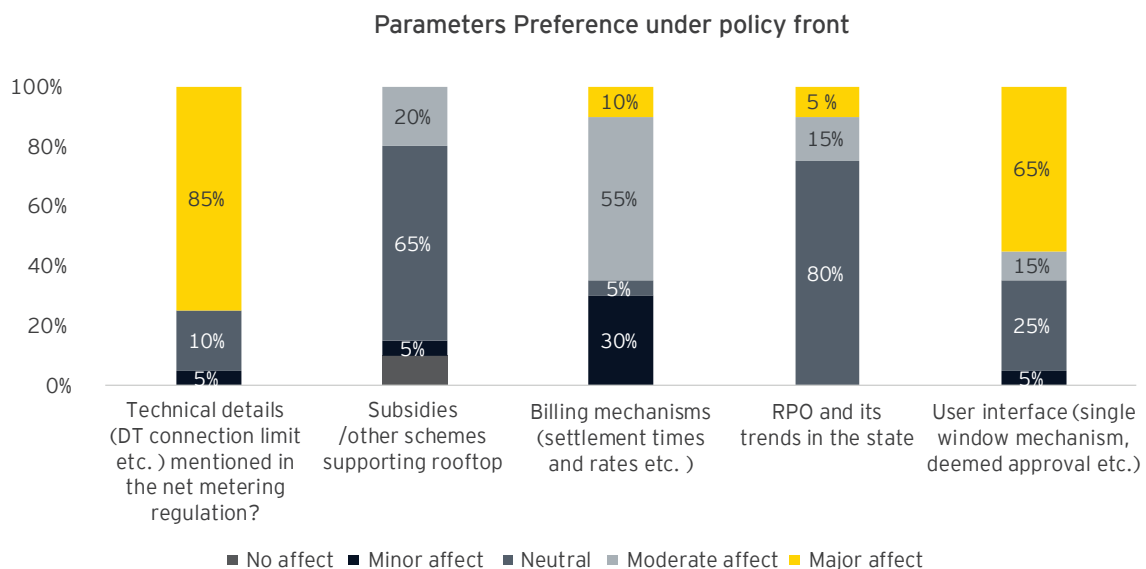
- ▶ According to the participants the rooftop system is always consumer driven as around 80% believe that the index should be seen from end consumer perspective.

4. Indicate the relative importance on the parameters?



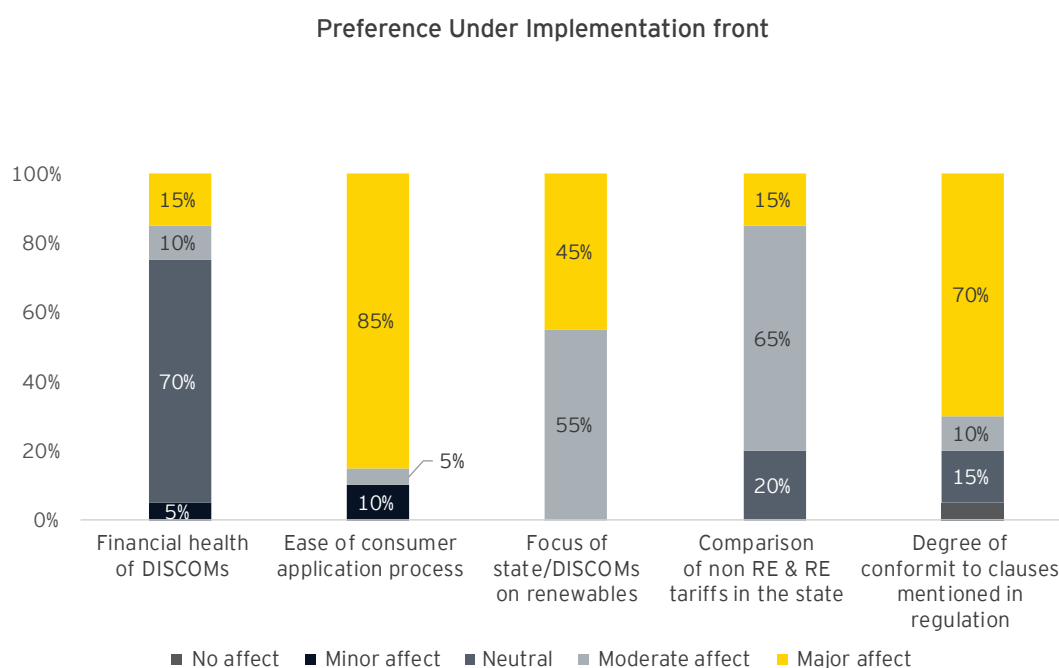
- The participants were asked to give feedback on the parameters suggested based on the priority for ranking the state, 85% of them says “Robustness of policy framework” is the essential to rank the state, While Consumer experience is also holds the major concern from the participants that is - 80%.

5. Under policy front, what is the important parameters in state ranking ?



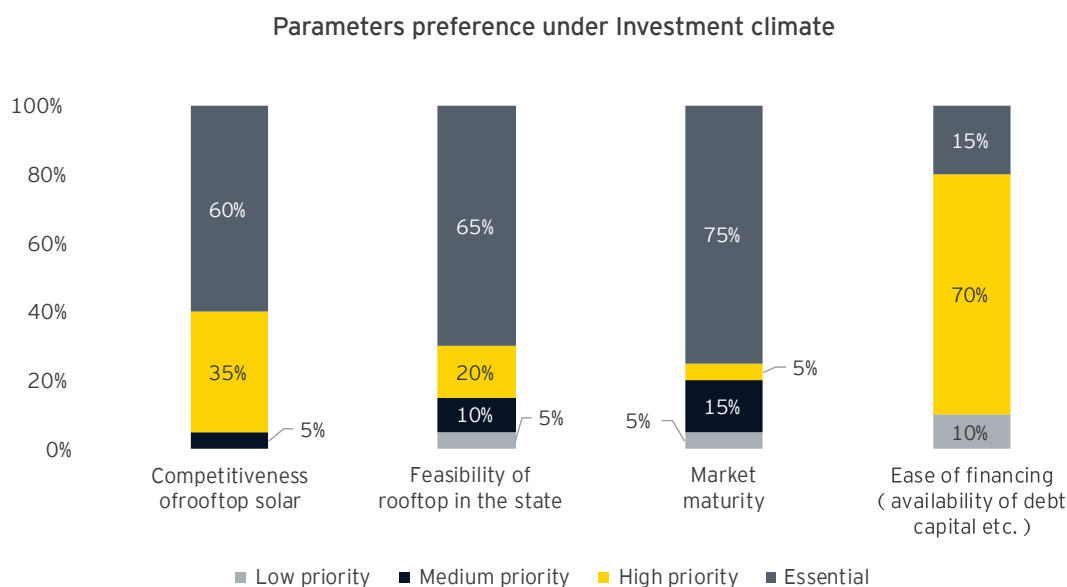
- 85% of participants said, “Technical details” comprises of DT capacity, HT/LT consumer, Sanction load or Connected load of the consumer will have major affect under policy front, while 65% of participants voted “User interface” as having major impact under policy front.

6. Under implementation front, what is the most important to rank a state?



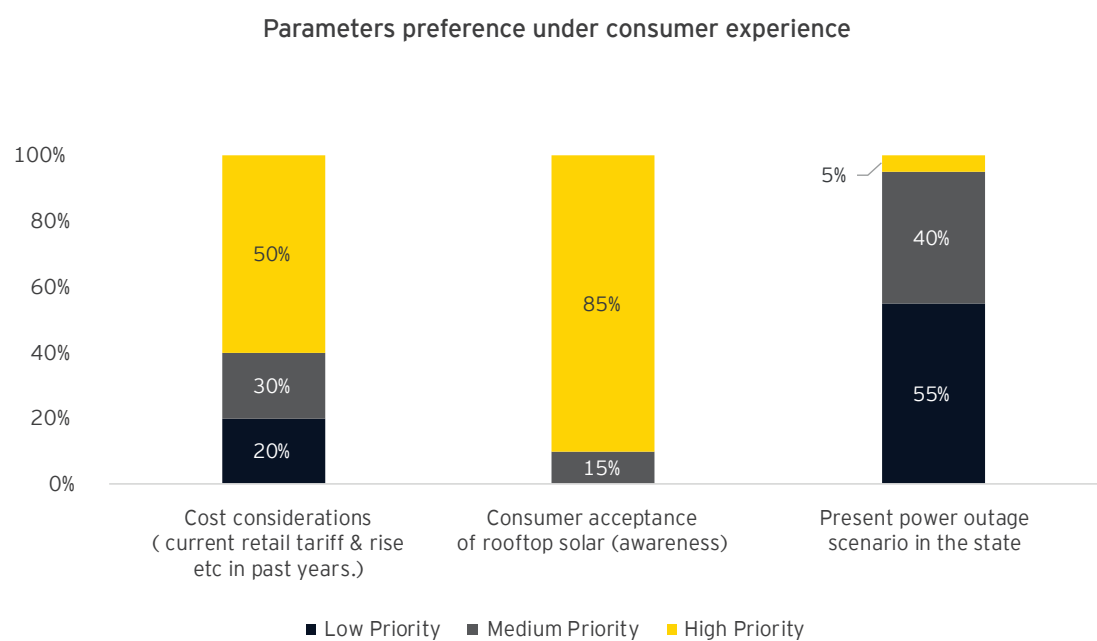
- Majority of the participants believes that under implementation front, fewer hurdles in the process points to a swifter setting up procedure and hence more uptake in the sector. Thus, indicators like “Ease of consumer application process” and “Degree of conformity to clauses mentioned in regulation” having 85% and 70% respectively will have major effect on the Index.

7. Under investment climate bucket, what is the most important in state ranking?



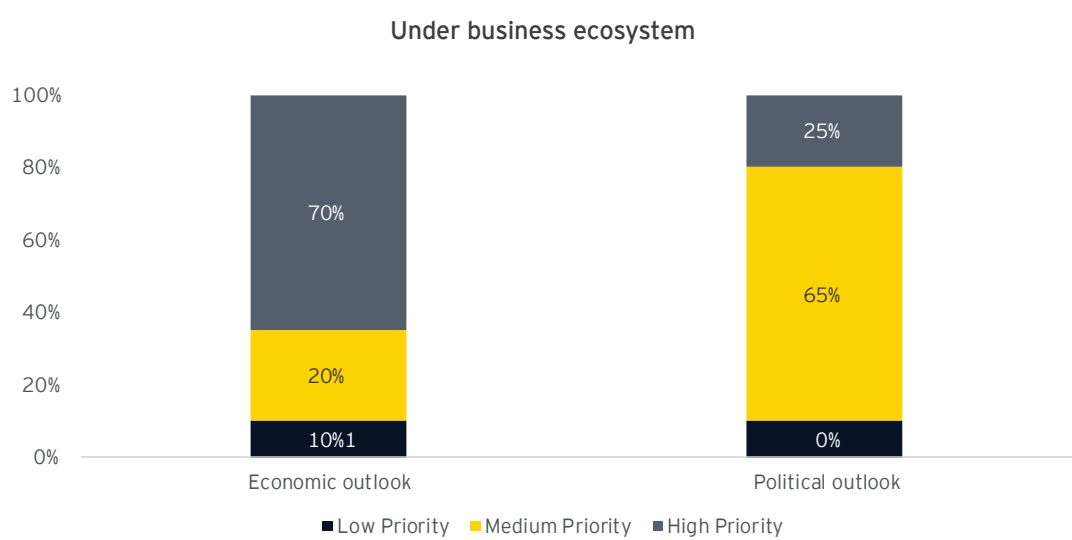
- Under the investment climate bucket, according to the participants’ “Market maturity” holds the maximum weightage. 75% of the participants believes that the existing market conditions regarding number of developers, industry workforce, the number of C&I consumer in rooftop solar sector will improve the investment in the state.

8. Which parameter will be having the maximum weightage under consumer experiences?



► The rooftop solar system is a consumer driven market, thus “Consumer acceptance of rooftop solar” was suggested by 85% of the participants as the high priority under consumer experience bucket, followed by “Cost consideration” in the state having 50%.

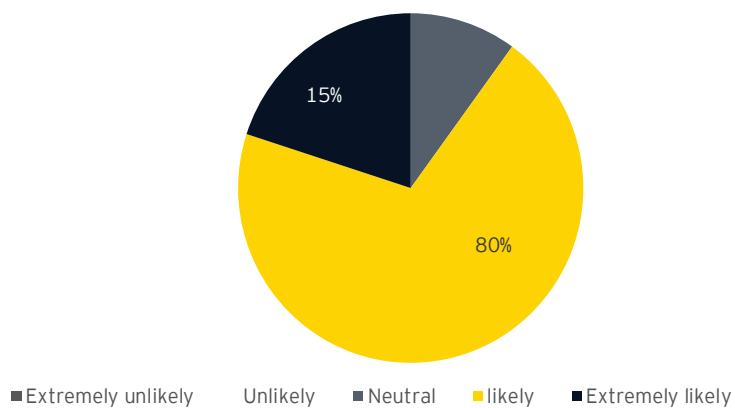
9. Under business ecosystem, what is the most important in state ranking?



► According to the participants, “Political outlook” will have less impact on the macro bucket. Over 70% of the participants recommended to consider economic well-being of the state and its future outlook as the important bucket under business ecosystem.

10. Overall feedback on the “SARAL” model developed to rank Indian States?

Feedback on the SARAL model developed



- ▶ 80% of participants like the “SARAL” model developed to rank the state depending upon the attractiveness towards solar rooftop installation.

4.3. Previous SARAL models

SARAL - The State Rooftop Solar Attractiveness Index" On 18 October 2018

The first model

As a preliminary step, an extensive desk review of other available indices in the market was undertaken to develop the premise of the SARAL index. The four indices studied in detail were:

- ▶ The World Bank's Ease of Doing Business
- ▶ Solar Power Rocks' United States Solar Power Ranking
- ▶ Renewable Energy Country Attractiveness Index
- ▶ United States Renewable Energy Attractiveness Index

Initially four key areas of focus or the drivers for the rooftop solar sector were identified. These were macro-economic driver, energy market and generation, transmission and distribution driver, rooftop value chain driver and end consumer attractiveness which were thought upon as the engines of growth of solar rooftop. The 29 states and 2 UTs were to be ranked based on their attractiveness for solar rooftop market as measured by the potency of these four drivers. These four drivers consisted of nine sub-drivers that were be measured through 24 parameters which collectively had 57 scoring indicators.

Figure 13: The initial SARAL model



Macro parameters

Economic stability

- ▶ Credit rating
- ▶ GDP per capita
- ▶ NCAER economy rating
- ▶ Fiscal management Index
- ▶ GDP growth

Political stability

- ▶ Corruption perceptions index
- ▶ Governance and political stability
- ▶ Transparency of government policy making
- ▶ Strength of legal rights

Investment climate

- ▶ Ease of doing business Index FDI inflow
- ▶ Strength of investor protection
- ▶ MSME 5 year growth rate
- ▶ Ease of access to loans

Energy market and GTD

Energy supply and demand

- ▶ Tariff rise in last 3 years
- ▶ Solar in energy mix %
- ▶ Electricity consumption growth
- ▶ Forecasted supply growth

Level of political support

- ▶ Solar targets/obligations
- ▶ Exemptions provided
- ▶ State subsidy provided
- ▶ Support policies

Competitiveness of Solar Power

- ▶ Cost of electricity
- ▶ Discovered tariff in the market
- ▶ Current electricity tariff

Importance of decarbonisation

- ▶ CO2 emissions per capita
- ▶ Past history of achieving RPO

Contract Timelines

- ▶ Solar contracts pre 2014/Solar contracts post 2014
- ▶ Thermal contracts pre2000/Thermal contracts post 2000
- ▶ Wind power contracts pre 2009/Wind power contracts post 2009

Need for Solar rooftops

- ▶ Power Deficit
- ▶ Availability of Non-RE resources

Feasibility of Solar rooftop

- ▶ Land use and availability

Transmission Charges

- ▶ Transmission open access charge
- ▶ Wheeling charges

Grid Management

- ▶ Peak Deficit
- ▶ Peak Deficit timings
- ▶ Balancing reserve

Cost of Distribution

- ▶ Average Cost Per Unit for Non-RE
- ▶ Distribution open access charge

DISCOMS

- ▶ ACS-ARR gaps (Operational losses)
- ▶ Debts of DISCOMS
- ▶ AT&C losses

Power Reliability

- ▶ SAIDI
- ▶ SAIFI

Rooftop value chain
Power offtake attractiveness <ul style="list-style-type: none"> ▶ Net metering payment settlement time
Technology maturity <ul style="list-style-type: none"> ▶ Rooftop Installed capacity ▶ Average project size
Developers <ul style="list-style-type: none"> ▶ Number of SNA empanelled developers
Financers <ul style="list-style-type: none"> ▶ Banks & NBFCs having MSME Lending Schemes
Insurers <ul style="list-style-type: none"> ▶ Insurers

End Consumer Attractiveness
Consumer Acceptance <ul style="list-style-type: none"> ▶ Level of consumer acceptance
TC&I consumers <ul style="list-style-type: none"> ▶ Industrial clusters to be constructed ▶ % of C&I consumers

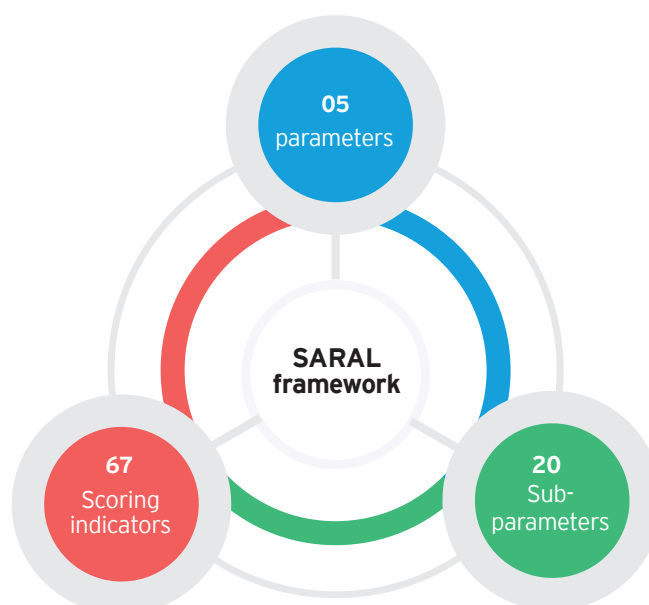
The revised model

The initial model of SARAL was much deliberated and it was found to be insufficient to capture the nuances of the Indian rooftop solar sector. The main idea behind this elaborate exercise of creating an index to measure the attractiveness of the states is to bring out key actionable points for different stakeholders, adopting those that can set the stage right for proliferation of rooftop solar in the country.

Moreover, the need was to make the wider audiences understand the phrases used for ranking different states. Thus, the model was revised to keep it simple with realistic, measurable and quantifiable scoring indicators. The new model so developed is based on five broad drivers of parameters that would collectively determine the attractiveness of a state to drive investment in the solar rooftop space, which are the **robustness of the policy framework, the effectiveness of that policy support or the implementation driver, the investment climate** of a state, the **consumer experience** and the business ecosystem. These parameters have been chosen to provide different angles to the intended user to judge the performance of a state on each of these individual parameters as well as to have a comprehensive view through the SARAL score. They further constituted 20 sub-parameters that were to be measured on the basis

of 67 scoring indicators. The number of scoring indicator subsequently came down to 46 after consultation with various stakeholders.

Figure 14: The interim SARAL model



Robustness of the policy framework

Level of policy support

- ▶ Comprehensiveness of net/gross metering policy in the state
- ▶ Eligibility to participate under REC mechanism
- ▶ Special benefits/support systems available for developers in GRPV segment
- ▶ Single Window Mechanism
- ▶ Deemed Approval Process
- ▶ Ease of availing state subsidies
- ▶ Availability of other state schemes

Covenants

- ▶ Maximum load that is allowed per prosumer
- ▶ Permissible cumulative capacity of solar vis-a-vis regional distribution transformer capacity

Billing Mechanism

- ▶ Settlement Time
- ▶ Price offered by Discom for buying power from prosumer

Solar commitments

- ▶ Solar commitments

Effectiveness of policy support/implementation

State of affairs of DisComs

- ▶ ACS-ARR gaps (Operational losses)
- ▶ AT&C losses
- ▶ Debts of DISCOMS

Ease of application

- ▶ Availability of interactive consumer platforms for rooftop solar
- ▶ Availability of online portal for end user application
- ▶ Average time taken from application to system installationmer capacity

Power offtake attractiveness

- ▶ Net metering payment settlement time

Fulfilment of commitments

- ▶ Past history of achieving RPO
- ▶ Rooftop Installed capacity
- ▶ Solar in energy mix %

Responsiveness to policy changes

- ▶ Solar contracts pre 2014/Solar contracts post 2014
- ▶ Thermal contracts pre 2000/Thermal contracts post 2000
- ▶ Wind power contracts pre 2009/Wind power contracts post 2009

Effectiveness of policy support/implementation

State of affairs of DisComs

- ▶ ACS-ARR gaps (Operational losses)
- ▶ AT&C losses
- ▶ Debts of DISCOMS

Ease of application

- ▶ Availability of interactive consumer platforms for rooftop solar
- ▶ Availability of online portal for end user application
- ▶ Average time taken from application to system installationmer capacity

Investment Climate

Competitiveness of solar electricity

- ▶ Average Cost Per Unit for Non-RE
- ▶ Cost of electricity
- ▶ Distribution open access charge
- ▶ Transmission open access charge
- ▶ Wheeling charges

Feasibility of solar rooftop

- ▶ Average dust level
- ▶ Balancing reserve
- ▶ Realisable GRPV potential in the state
- ▶ Coincidence of solar generation with peak demand

Maturity of the market

- ▶ Average project size
- ▶ Number of solar developers
- ▶ Share of C&I consumers in total GRPV installation in the state
- ▶ Total solar industry workforce

Driver for solar-rooftop uptake

- ▶ Current electricity tariff
- ▶ Forecasted supply growth
- ▶ Electricity consumption growth
- ▶ Peak Deficit

Prioritization of solar

- ▶ Focus of state government to meet power deficit through renewable sources
- ▶ Focus on other renewable resources in the state other than GRPV

Ease of financing

- ▶ Ease of access to loans
- ▶ Presence of banks giving debt capital in the state
- ▶ Availability of insurers in GRPV segment

Consumer experience

Cost considerations

- ▶ Discovered tariff in the market
- ▶ Tariff rise for end consumers

Consumer acceptance

- ▶ Level of consumer acceptance

Power reliability

- ▶ System Average Interruption Duration Index
- ▶ System Average Interruption Frequency Index

Business ecosystem

Economic outlook

- ▶ GSDP per capita
- ▶ GSDP growth

Business enablers

- ▶ Ease of doing business index
- ▶ FDI inflow
- ▶ Strength of investor protection
- ▶ MSME 5 year growth rate
- ▶ Ease/progress of implementation of other schemes (such as smart cities)
- ▶ NCAER economy rating of the state

Political outlook

- ▶ Credit rating of the state
- ▶ State Government's outlook towards GRPV
- ▶ Strength of legal rights to protect investors
- ▶ Transparency of government policy making
- ▶ Institutional architecture
- ▶ Perceived corruption in the state

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2. Ministry of New and Renewable Energy
3. The Borda solution to the plurality rule paradox is the following scoring rule: given "n" countries, if a country is ranked last, it receives no points; it receives 1 point if ranked next to last. The scoring process continues like this up to N-1 points, awarded to the country ranked first. Of course, the Borda winner is the country with the highest total score

