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GOVERNMENT OF INDIA
MINISTRY OF NEW AND RENEWABLE ENERGY

PARTNERSHIP TO ADVANCE CLEAN ENERGY-DEPLOYMENT (PACE-D) TECHNICAL ASSISTANCE PROGRAM

Strategy for the Procurement of Renewable Energy for the Indian Railways

Presented by

USAID/India

PACE-D TA Program's engagement with the Indian Railways (IR) was initiated with a common objective of scaling up solar rooftop deployment

2014

- PACE-D identifies huge solar rooftop potential at IR
- Initiates discussions with Northern & Indian Railways under SECI's Solar Rooftop Program

2015

- Discussions move to structuring IR's solar rooftop strategy with Railway Board
- IR & PACE-D finalize implementation model & standard documents (PPA, RFQ & RFP)
- 50 MW solar rooftop procurement launched via Zonal Railways – 32 MW successfully bid out

2016

- 100 MW solar rooftop procurement through REMC – 48 MW successfully bid out

2017

- RE Procurement Strategy for IR
- 3rd round of 67 MW launched & bid out with REMC
- New tender for solar rooftop for small stations

The Program worked with the Railway Board & REMC to develop and institutionalize solar rooftop procurement at IR

1 UNDERSTANDING THE NEED

- Large potential for rooftops –9,500 installations
- Simple procurement and deployment process
- Easy to institutionalize & scale up

2 DEVELOPING DEPLOYMENT STRATEGY

- RESCO model selected
- No investment and risk for IR
- RESCOs, specialized players, operate better
- Easy to scale

3 INSTITUTIONALIZING DEPLOYMENT

- Prepared standard documents for procurement & contracting
- Assisted in aggregating and bidding 2 phases

4 REFINING THE STRATEGY

- Revised strategy based on learning from each bid
- Selected CAPEX model for small scale projects

The cornerstone of PACE-D support to IR has been the goal of scaling up solar rooftop

50 MW Rooftop Project

- 1st procurement with standard bidding documents
- Zonal Bidding
- 32 MW bid out to 19 developers

Key Learnings:

- The need to centralize bidding process to bring in efficiency of procurement & provide scale

100 MW Rooftop – Phase I

- Redesigned bid documents
- Central procurement through REMCL
- 48 MW bid out to 2 developers
- Tariff Range: INR 4.58-4.98

Key Learnings:

- Small rooftop capacities not preferred
- Simultaneous tenders constrained the bandwidth of developers

67 MW Rooftop – Phase 2

- Revised strategy to focus on large to medium sized roofs
- All 67 MW bid to 5 bidders
- Tariff Range: INR 2.68-4.49

Key Learnings:

- CAPEX model for small rooftop

4.75 MW rooftop - CAPEX

- Revised strategy for CAPEX model
- Developed framework and bid documents
- In process of launching the procurement

Indian Railways Goals & Targets for Electrification & Renewable Energy

Consumes

1.8%

of total electric energy generated in India

Largest Electricity Consumer

- Electrify 90% of all Rail Routes
- Carbon Neutrality by 2030
- 1 GW of solar power by 2020
- Achieve INR 41,000 Crore energy savings by 2025
- 10% of IR's energy from RE by 2020
- Meet NAPCC targets

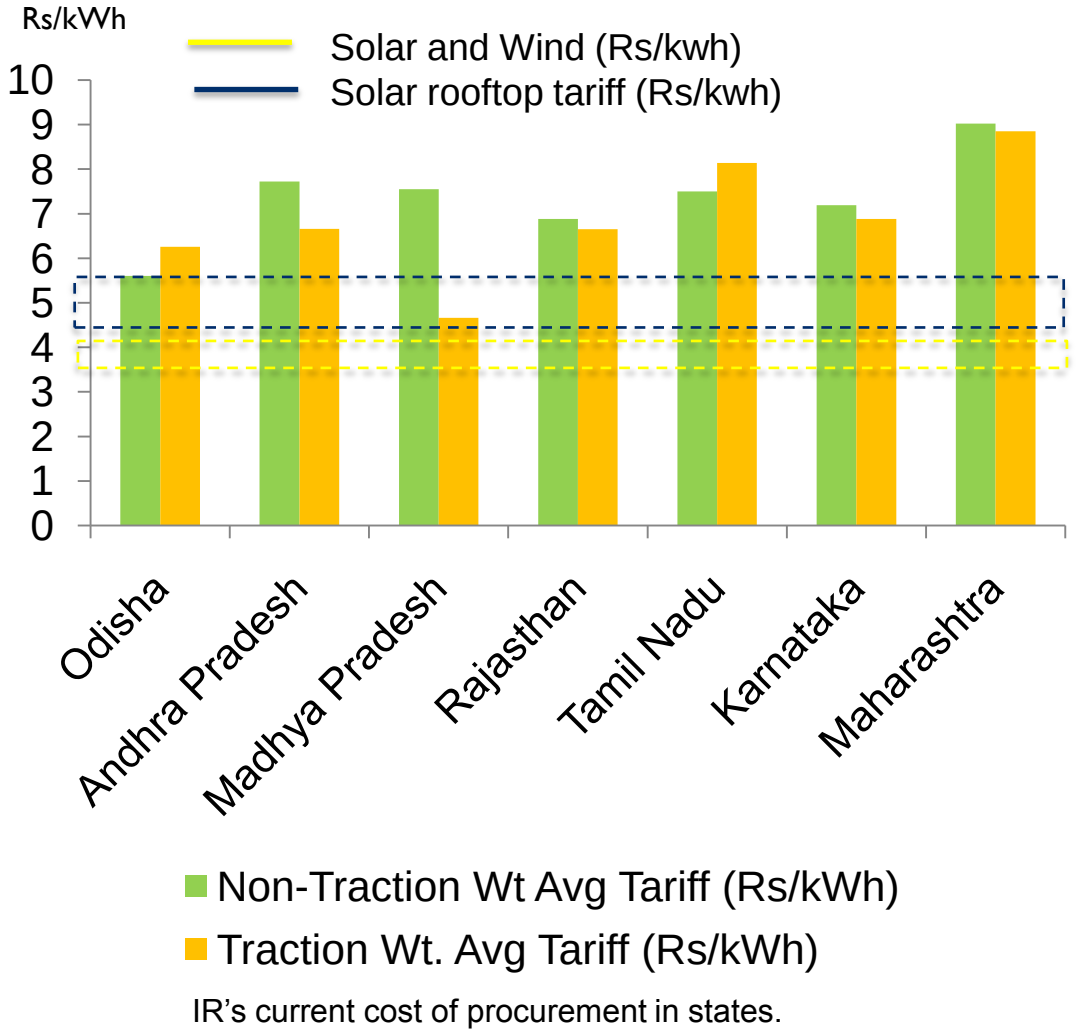
Comprehensive Strategy needed due to Complexities in RE Procurement

RE Options

- Decentralized generation stations i.e., solar rooftop for all non traction loads
- Centralized generation stations i.e., large-scale solar & wind projects for all traction and bulk non-traction loads

Challenges

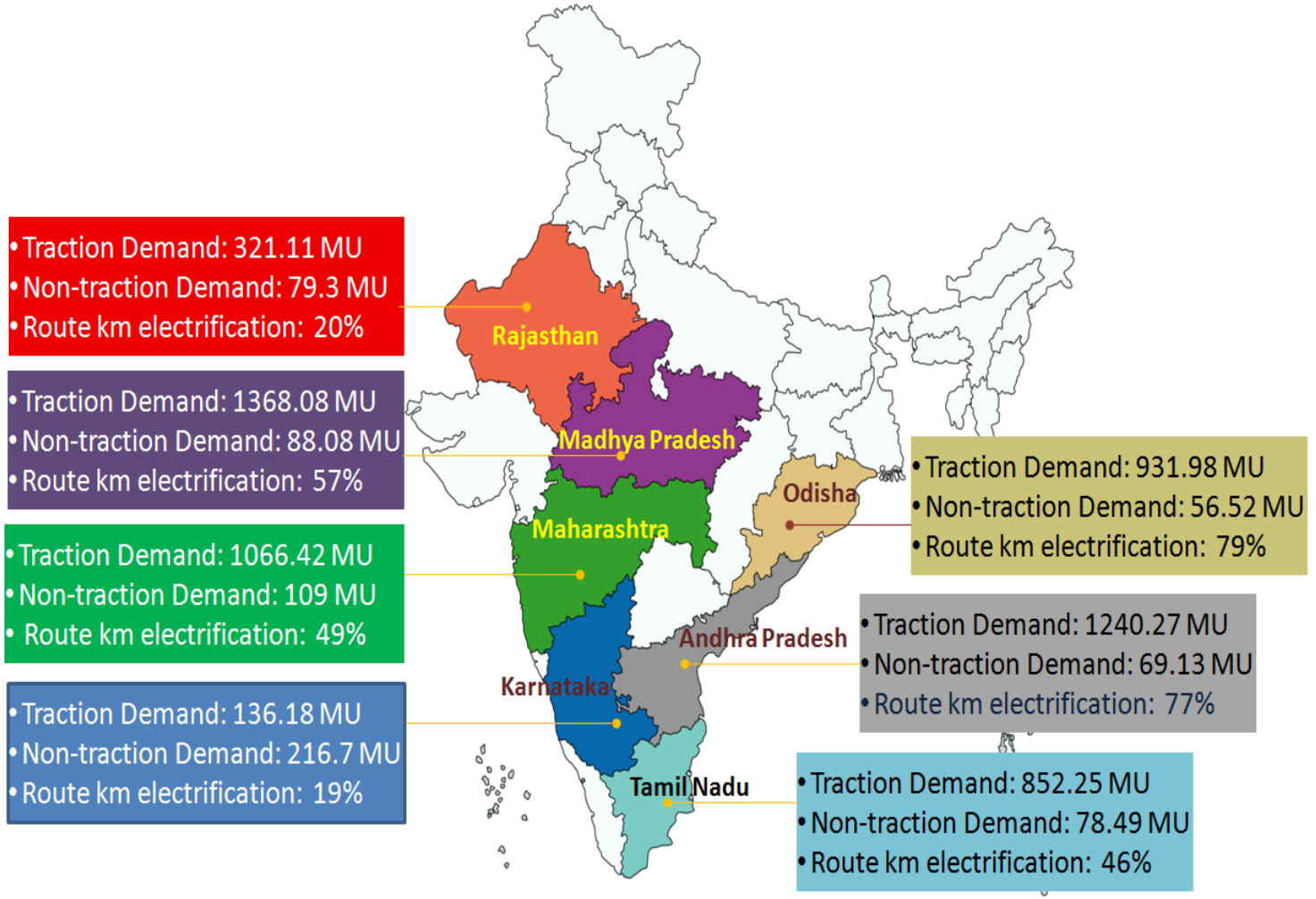
- Capital intensive
- On site captive generation from large projects not feasible
- Regulatory Framework
- Open Access charges
- Infirm nature of power
- DISCOM reluctance as IR is a high value customer



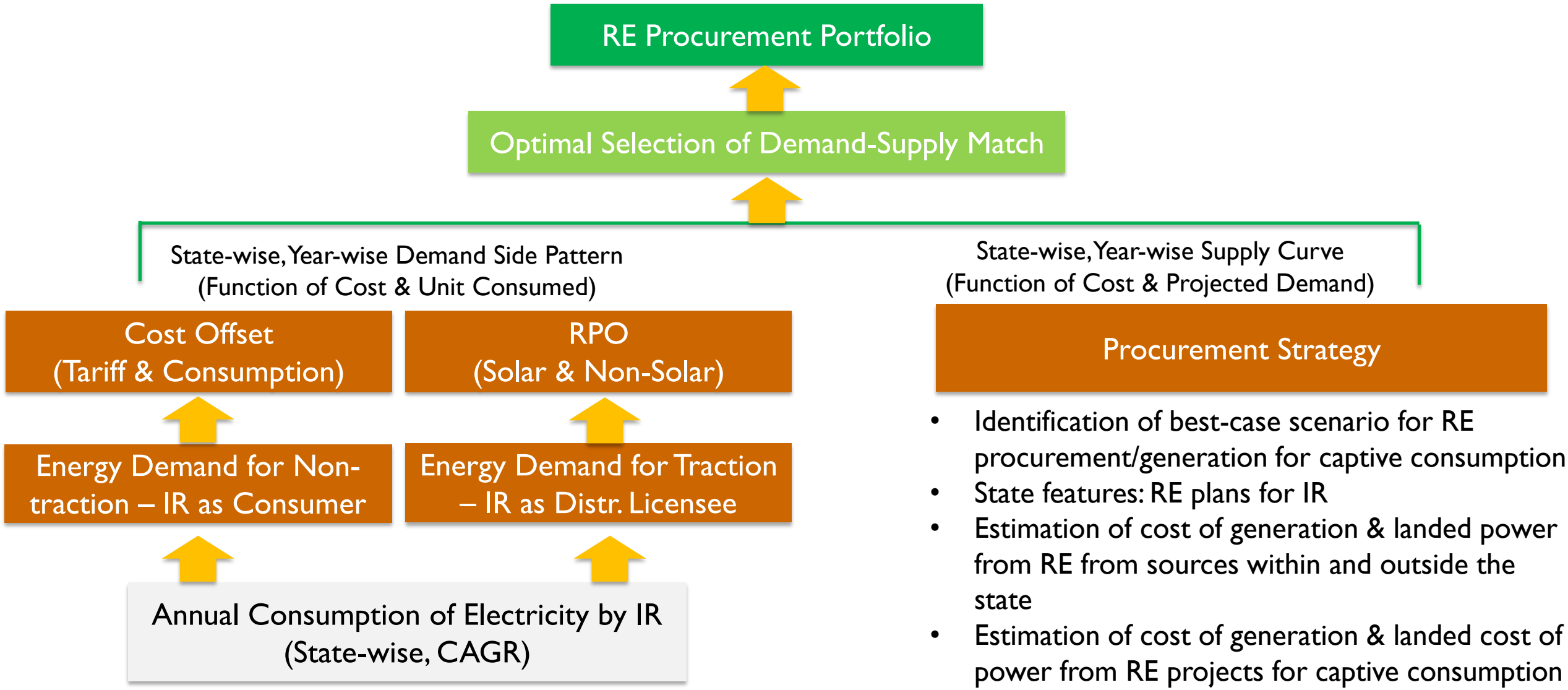
IR's current cost of procurement in states.

Objective - To maximize benefits within constraints

- PACE-D TA Program carried out a study and developed a strategy to:
  - Meet IR's RPO target (for traction loads) at cheapest available option
  - Reduce energy costs (traction & non-traction) with renewable energy
- Selected 7 states for the study:
  - High tariffs
  - Good solar and wind potential
  - Availability of policy and regulations
  - High electricity demand



Approach for Design of Procurement Strategy



- Identification of best-case scenario for RE procurement/generation for captive consumption
- State features: RE plans for IR
- Estimation of cost of generation & landed power from RE from sources within and outside the state
- Estimation of cost of generation & landed cost of power from RE projects for captive consumption
- State-wise electricity tariff analysis

Regulatory Constraints for RE Development

Net Metering – Solar Rooftop

- Capacity limited to sanctioned load
- Maximum allowed capacity - 1 MW
- Constrained by DT capacity
- Net metering regulations across states

Open Access

- Minimum allowed load - 1 MW
- OA regulations across states
- OA charges for RE projects waived off in part or full in few states
- Banking allowed in few states

The strategy for Indian Railway's RE procurement has been devised based on these constraints.

IR Procurement Options: Applicable Charges for Procuring RE

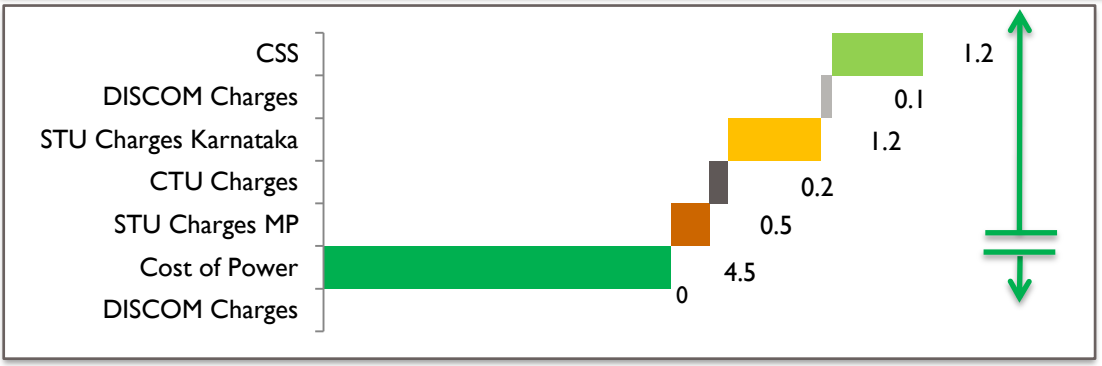
	Power procured from	Power drawn through	Source state		CTU	Destination State				
			STU	SLDC		STU	SLDC	DISCOM	CSS	Other
Sources from other states	**STU**	DISCOM	√	√	√	√	√	√	√	√
	STU	STU	√	√	√	√	√			
	CTU	STU			√	√	√			
	CTU	DISCOM			√	√	√	√	√	√
Sourced from within the	**STU**	STU				√	√			
	STU	DISCOM				√	√	√	√	√
	DISCOM	DISCOM						√	√	√

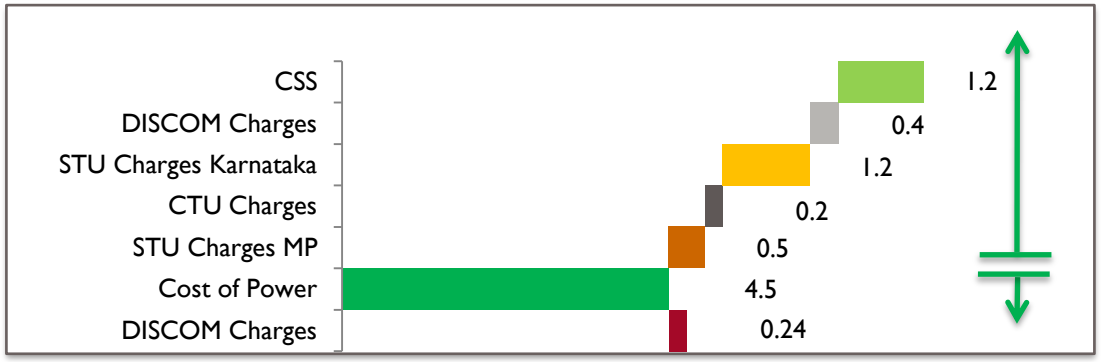
Charges for STU, CTU and DISCOM include both charges and losses

- RE procurement strategy devised from:
  - Analysing regulatory constraints in state
  - Selecting cheapest landed cost option for solar/wind
- E.g. For Karnataka, OA charges exempted till March 2018, making intra-state solar (rooftop & ground-mounted systems) most favourable procurement option

STU – State Transmission Utility
SLDC - State Load Dispatch Centre
CSS – Cross Subsidy Surcharge
CTU – Central Transmission Utility
DISCOM – Distribution Company

Supply Options for Karnataka

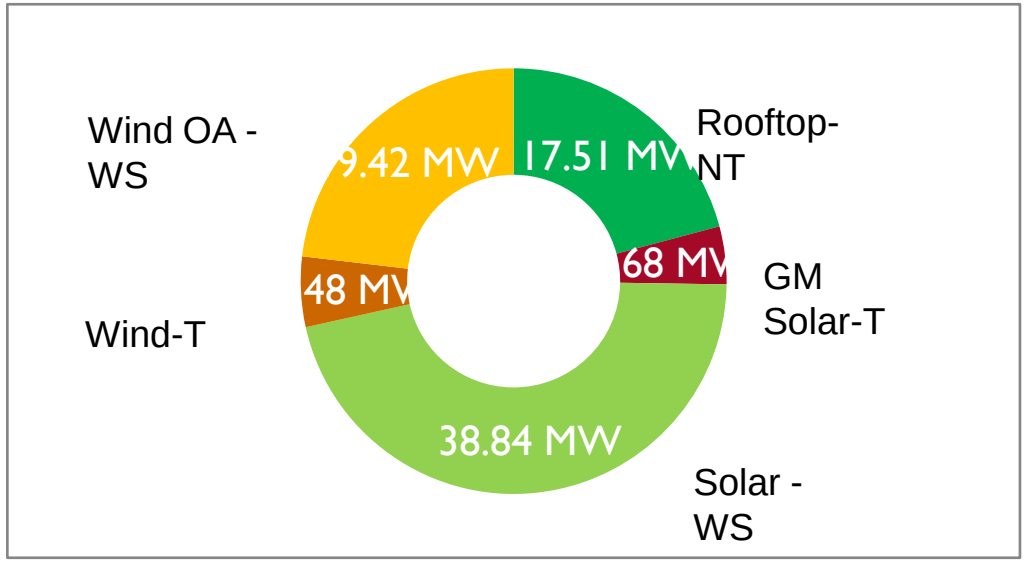




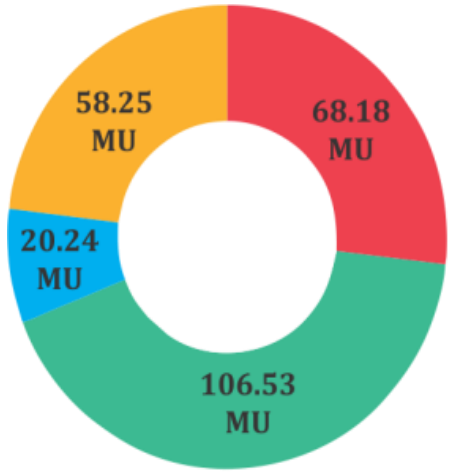
- All available roof space to be used for captive solar generation
- Solar and non solar RPO of traction load through OA within the state
- 75% demand of bulk non-traction loads (RWF) through OA within the state

- Based on the injection and withdrawal location, OA charges vary
- OA charges for solar and wind vary
- Power procured from Karnataka at INR 4.5/kWh can still be cheaper than power procured from other state at INR 3/kWh

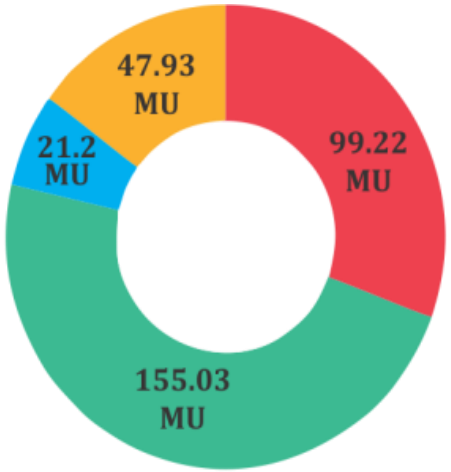
Proposed RE Procurement Mix for 2022 - Karnataka



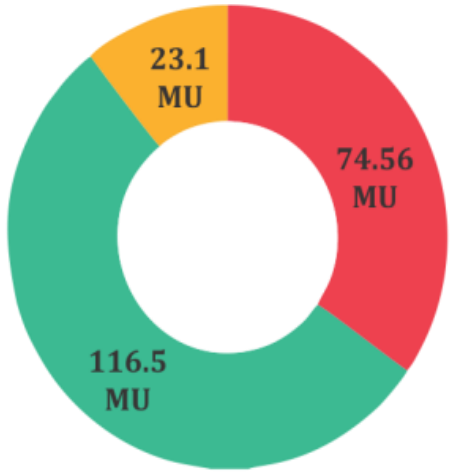
RE Procurement Envisaged for Key States by 2022



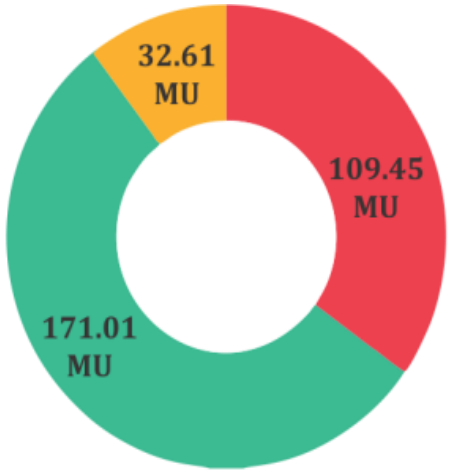
Tamil Nadu



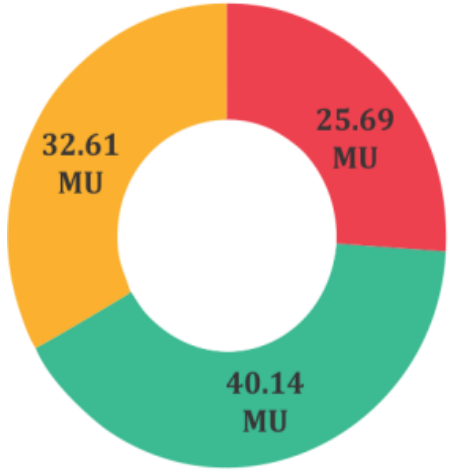
Andhra Pradesh



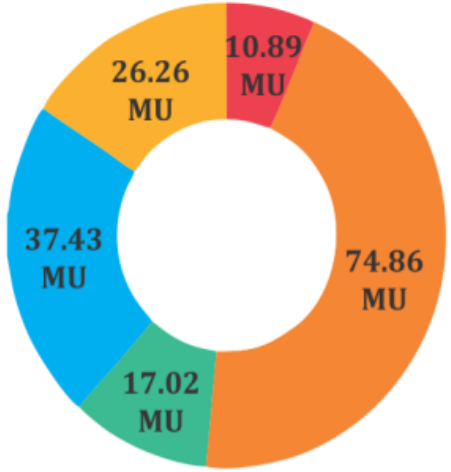
Odisha



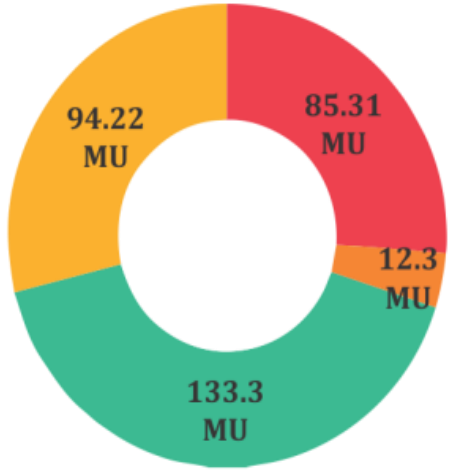
Madhya Pradesh



Rajathan



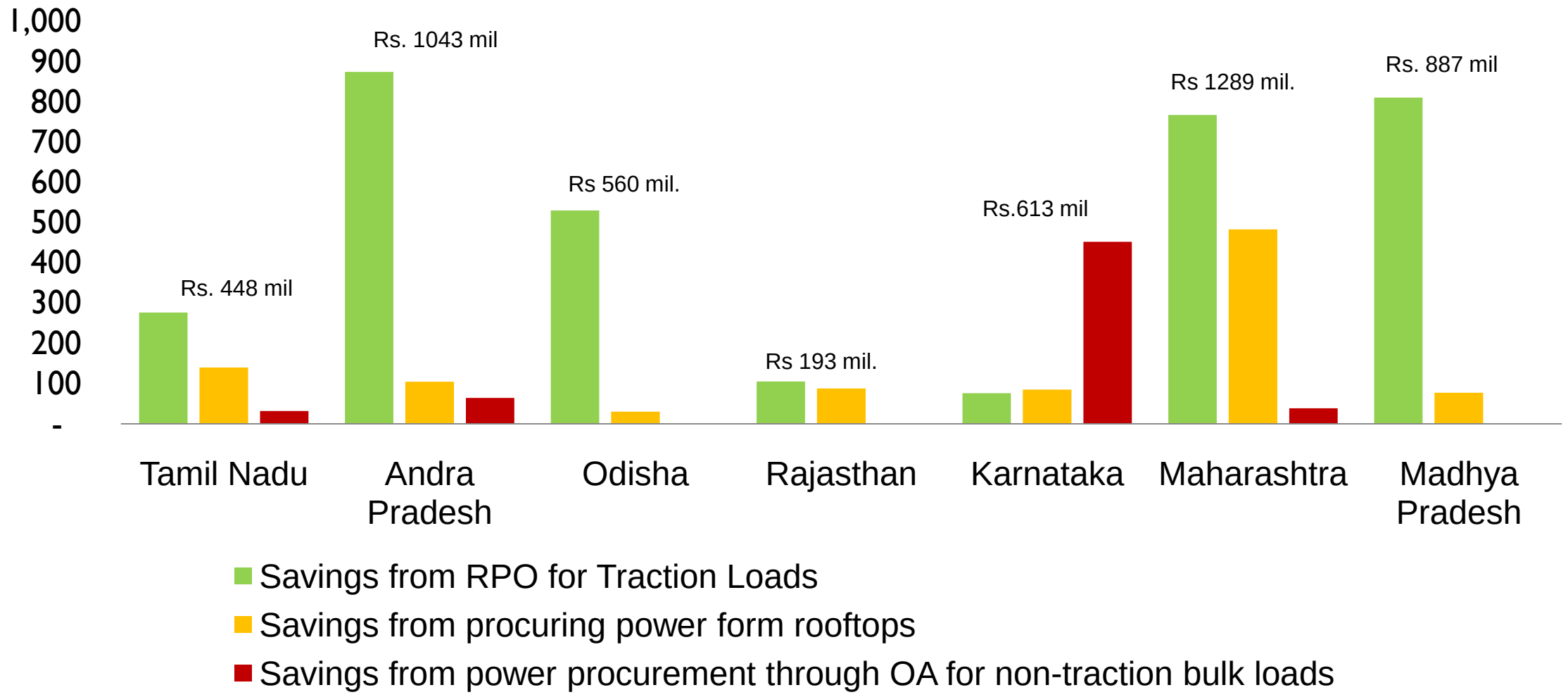
Karnataka



Maharashtra

- Rooftop solar projects on IR buildings for non-traction load
- Ground mounted solar projects through OA (for meeting solar RPO)
- Ground mounted solar projects through OA for supplementing non-traction bulk loads
- Wind projects through OA (for meeting non-solar RPO)
- Wind projects OA for supplementing non-traction bulk loads

Indian Railways: RE Savings Envisaged in 2021-22



On Going Work - Decarbonisation of Traction Loads

Challenges

- Difficulty in matching generation profile and load profile
- Scheduling power and load
- Regulatory requirements of states

Objectives

- Understand maximum RE penetration levels
- Devise procurement strategy
- Assess the optimum need for energy storage

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