Case Study: Consideration for Electric Vehicles Scaling

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Renewable Integration and Sustainable Energy (RISE) Initiative
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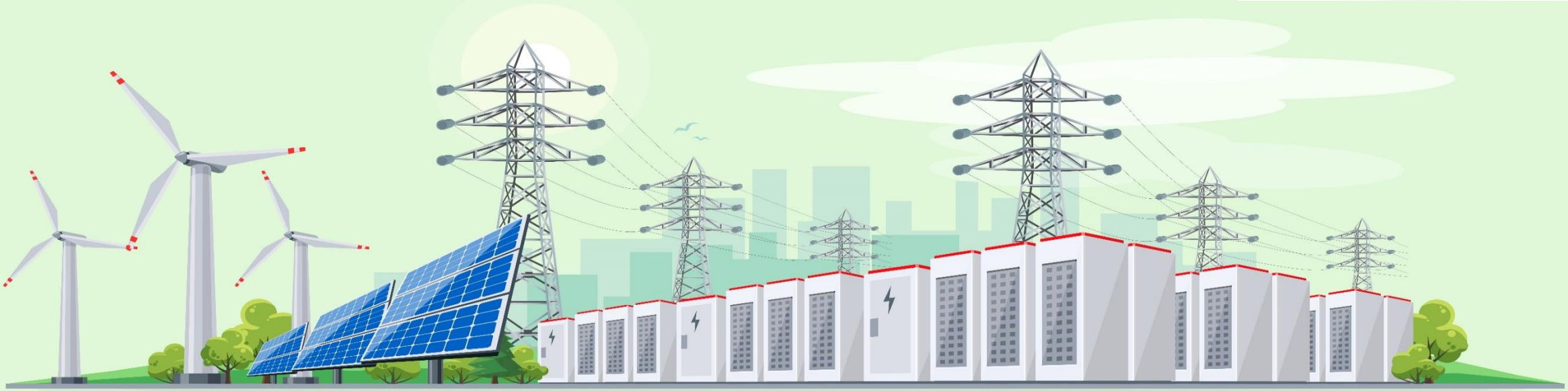


There are a range of requirements which distribution utilities must consider while setting up a framework for supporting an EV charging eco-system.

Proliferation of EVs is dependent on appropriate planning and impact study

Agenda

- Key considerations for Distribution Utilities while planning for EVs
- Key issue to be addressed and how it can be addressed scientifically
- Modeling the utility network
- Conclusions

Key considerations for Distribution Utilities while planning for EVs

Distribution utilities face critical challenges in provisioning and managing access to EV charging infrastructure for the end consumers

- **Network Upgrades:** A key challenge is the identification of necessary distribution system upgrades to support EV charging stations along with its associated costs and cost recovery mechanisms.

- **Impact on components:** Distribution utilities need to analyze the impact of EV charging on distribution transformer loading along with aspects such as increased ohmic losses and degradation of network components leading to reduced component life span.

- **Location:** Identification of locations in distribution network for setting up of EV charging stations to optimize the existing available infrastructure to support EV charging would be key.

- **Business model:** Commercial challenges which include medium to long term planning for network upgrades, modes of financing and recovery, setting up of pricing mechanisms for EV charging, and provisions of incentive mechanisms for setting up of charging stations should also be a focus area.

Modelling and analysis to understand impact on distribution grid and power procurement

1. **Planning:** Scenario based analysis provides specific EV penetration level that a network can manage based on existing topology and upgrades.
2. **Component loading:** Insights into number of transformers which may be overloaded and thus require upgrades can be analyzed.
3. **Cost estimation:** Based on analysis of upgrade requirement, short, medium, and long-term costs can be derived.
4. **Impact of consumer behavior:** Impact of managed charging measures such as ToU on network components.
5. **Optimizing solutions:** A range of solutions to reduce integration cost can be first tested before deployment is carried out.

Case Study: Sacramento Municipal Utility District (SMUD)

Source: Smart Electric Power Alliance, and SMUD, 2017

The Sacramento case study above showcases important insights that can be derived from a modelling exercise to understand the impact of EV integration and adopt solutions accordingly. Smart Charging can reduce grid upgrade expense by 70% based on modelling study for SMUD

Prioritization framework for deploying EVSE and identification of manageable overloading instances through Managed Charging (Active)

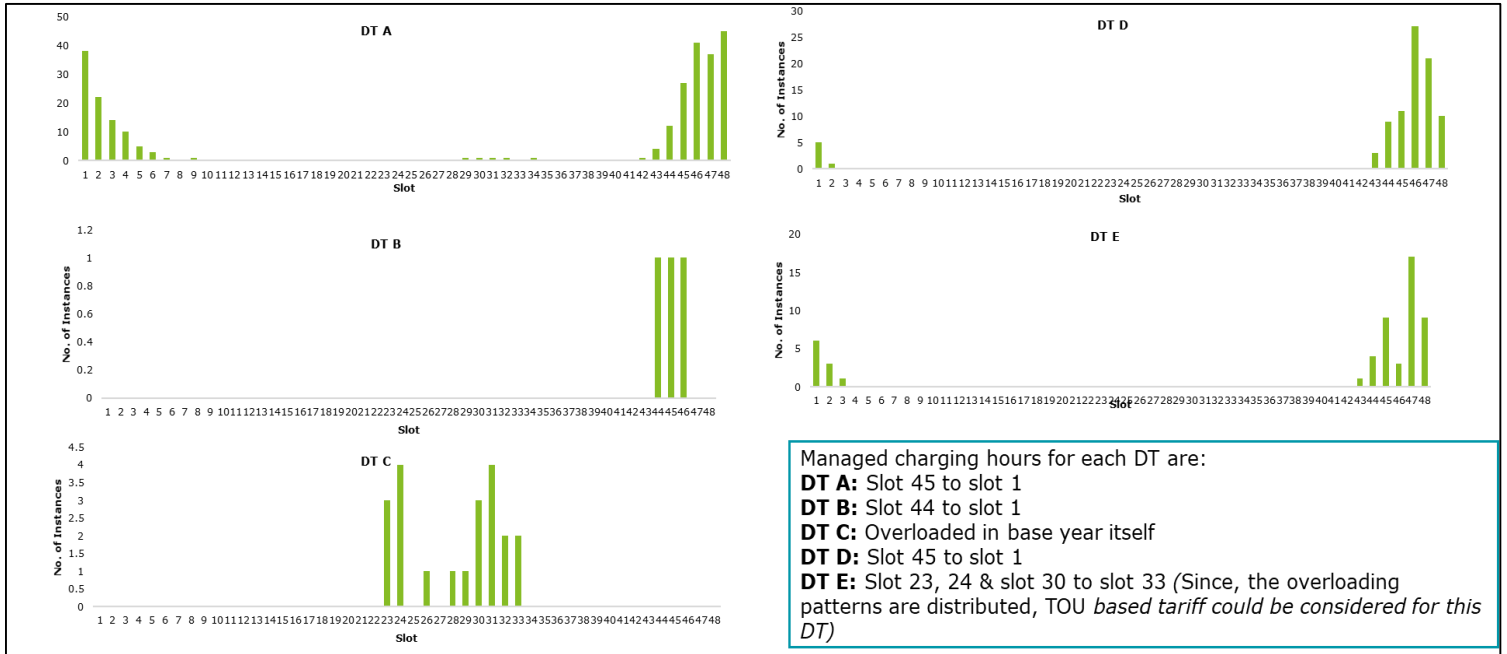
Preliminary analysis

- This analysis has been carried out on maximum load data of a distribution feeder to determine the years in which each of the DT loading cross 70% of their rated capacity.

Deep dive analysis

- The deep dive analysis is carried out for each slot in the entire year to analyze the number of slots that are observed under overloading instances
- Slots where DTs are overloaded are categorized into:-
  - Manageable: where overloading can be compensated by shifting the EV load
  - Unmanageable: where overloading can not be compensated even after shifting the EV load

Results

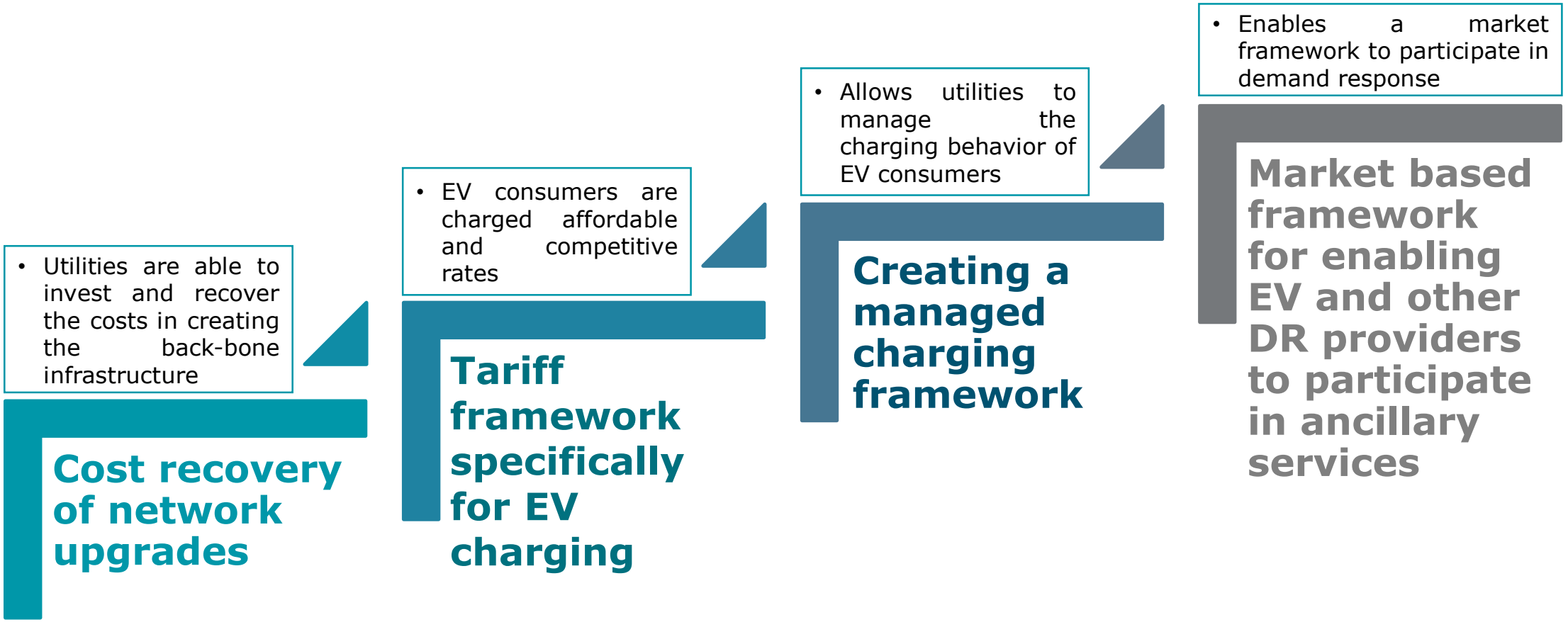


Managed charging hours for each DT are:
DT A: Slot 45 to slot 1
DT B: Slot 44 to slot 1
DT C: Overloaded in base year itself
DT D: Slot 45 to slot 1
DT E: Slot 23, 24 & slot 30 to slot 33 (Since, the overloading patterns are distributed, TOU *based tariff could be considered for this DT)*

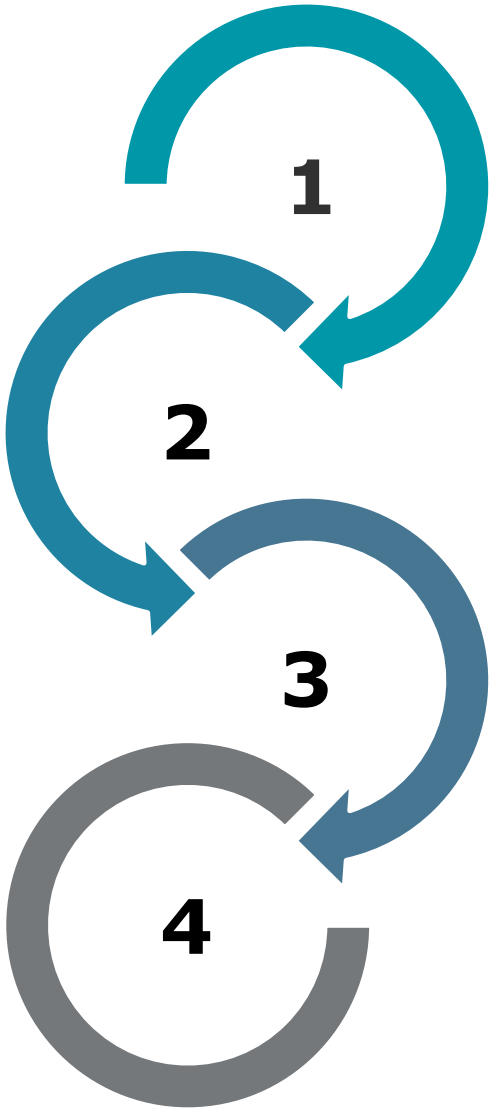
DT number	Year of overloading
A	2019
B	2020
C	2021
D	2025
E	2029

Managed charging can relive the distribution system of its over-loading to a substantial extent whereas in some pockets, the same may not be possible considering differing load shapes and user requirement

Regulatory interventions for enabling EV charging framework



Conclusion



Adequate capacity planning needs to be done for at least a 10-year horizon

There should be scientific modelling studies/ multiple system cost scenarios developed with/-without storage systems, with/ without RE based charging, with/ without managed charging etc., to effectively design the network

Utilities should start representing to concerned regulators for justification and subsequent introduction of managed charging practices, TOU tariff pricing, etc.

Mechanisms such as rate-basing and progressive regulations like ancillary services would go a long way in framing up conducive regulatory landscape for EVs

Thank you

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