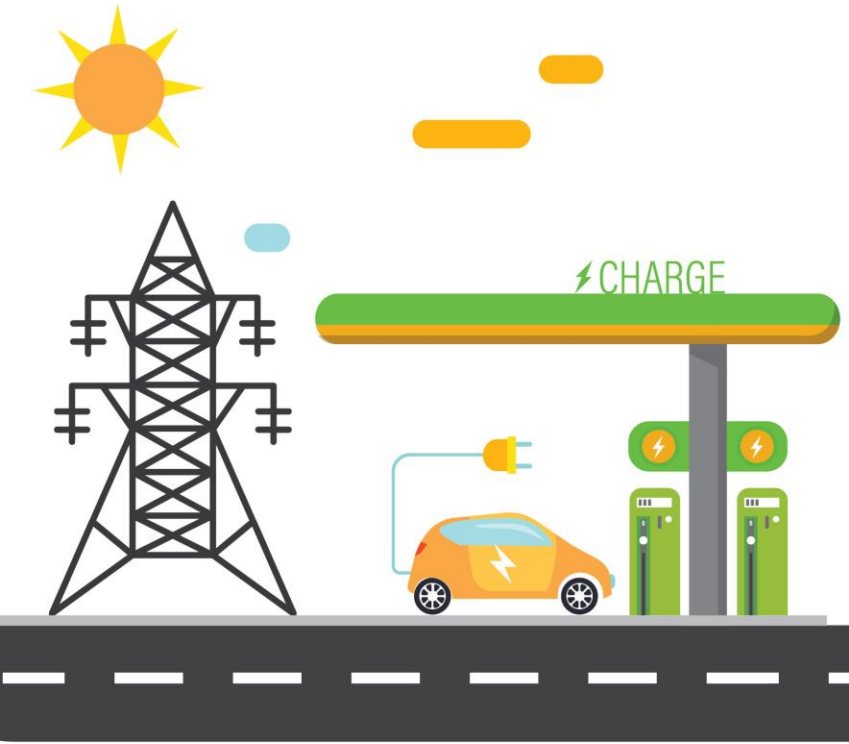

ELECTRIC MOBILITY FORUM

ENGAGE
Connecting Big Ideas To Action

Impact of Electric Vehicle (EV) Charging on the Local Grid

September 16, 2019 | 3:00 PM - 4:00 PM (IST)

WRI INDIA
ROSS CENTER

SHAKTI
SUSTAINABLE ENERGY FOUNDATION

Speakers

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Principal Engineer
PRDC

Moderator

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WRI India

giz

Electric Vehicle Charging Technologies

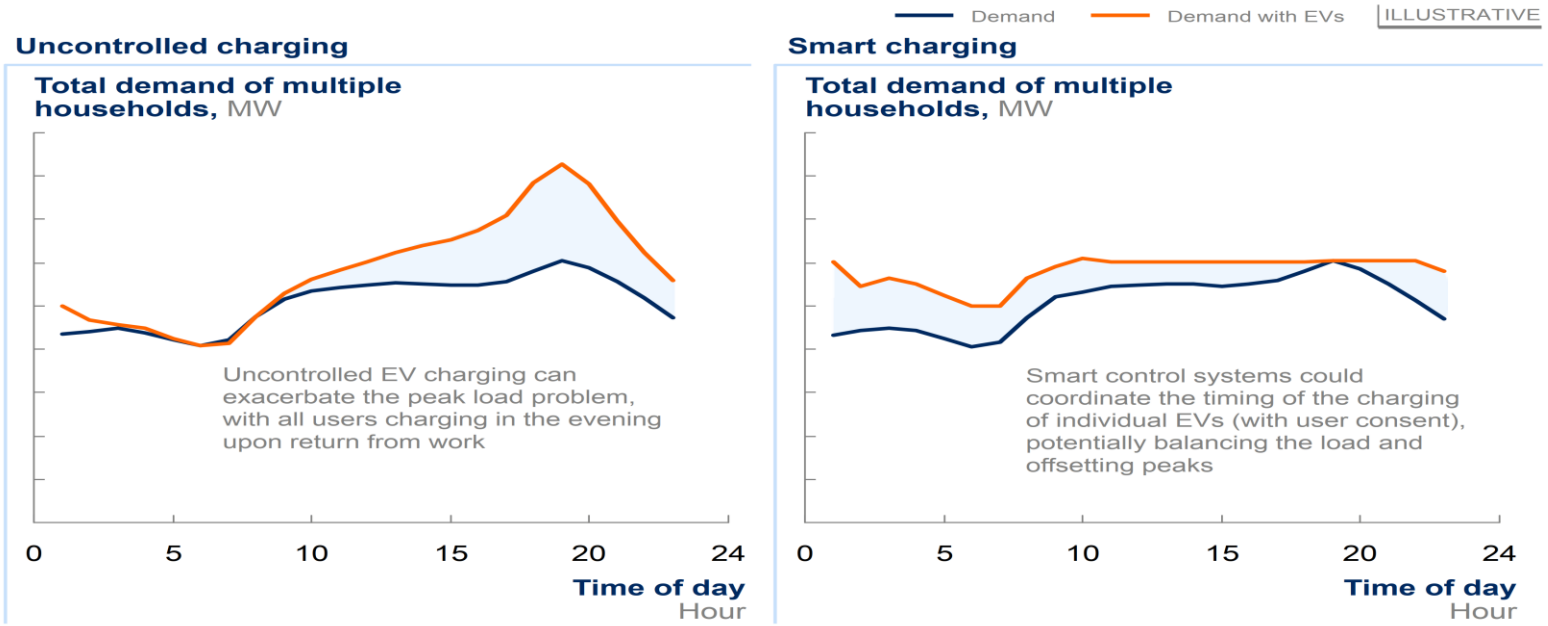
Table: Characteristics of charging levels as defined by the SAE and charging modes as defined by the IEC

Charging level	Voltage	Charging mode	Typical power	Location
Level 1	120 V AC	-	1.2-1.8 kW AC	Primarily residential in North America
Level 2	200-240 V AC	Mode 1	3.6-11 kW AC	Wall socket in Europe; Primarily for 2 & 3 Wheelers
		Mode 2	3.6-22 kW AC	Home and workplace with cable or basic station
		Mode 3	3.6-22 kW AC	Home, workplace and public with hardwired station
Fast Charging	400-1000 V DC	Mode 4	50 kW or more	Public, frequently intercity

Notes: V=Volts; AC= alternating current; DC= direct current; kW=kilowatt

Mitigation of Impacts of Electric Vehicle Charging

The smart charging strategy



Ref: Tom Buck, e-Mobility The charging infrastructure landscape, a UKEVSE perspective

Simulation Methodology – Data collection, feeder selection criteria

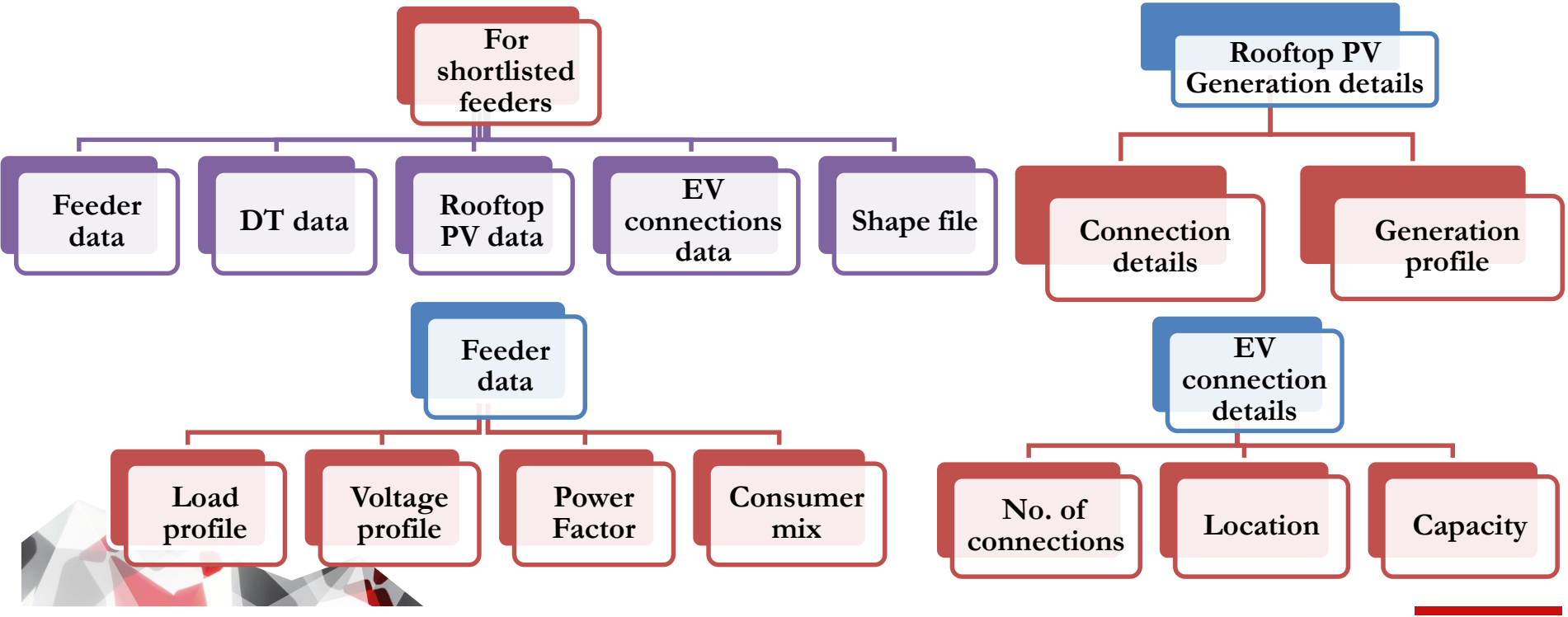
12 Feeders shortlisted by BYPL before the site visit by project team

Arya samaj road nalha
DDA flats pocket B
DSR Mill
E block Vikas Marg
Janta Colony
Karkardoma Court
Karol Bagh - 2
Parade ground
District Center EROS Hotel
Vikas Bhawan
IHBAS Mental hospital
Marjinal Bandh

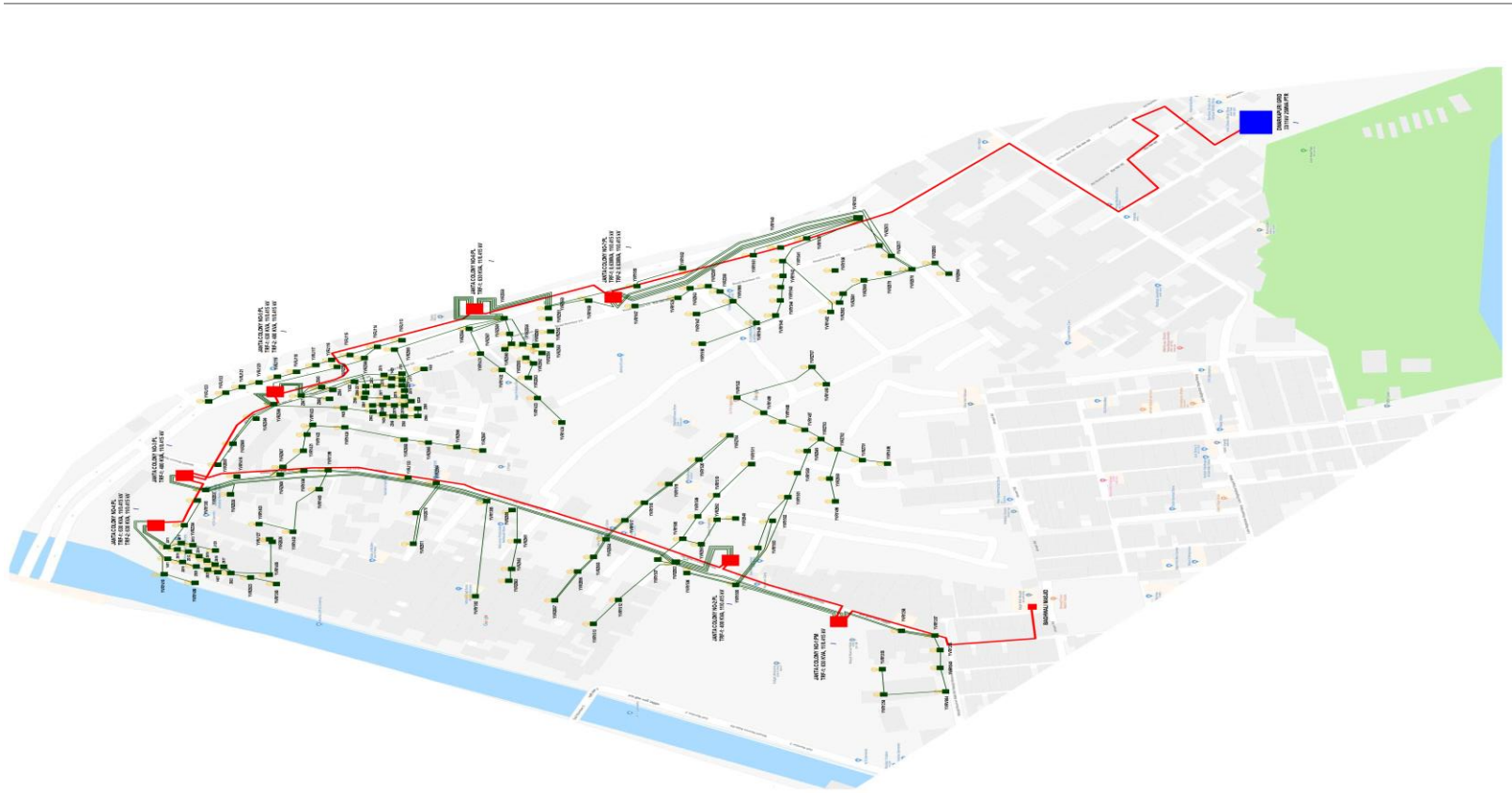
Criteria For Selection Of Feeders
EV charging stations already exist in the feeder
Solar roof top penetration
Loading of the feeder
Priority for Level 2 chargers and DC Fast Charging
DT loading in the feeder
Voltage profile of the feeder
Consumer mix in the feeder
Monthly energy consumption in the feeder

Simulation Methodology – Data collection, feeder selection criteria

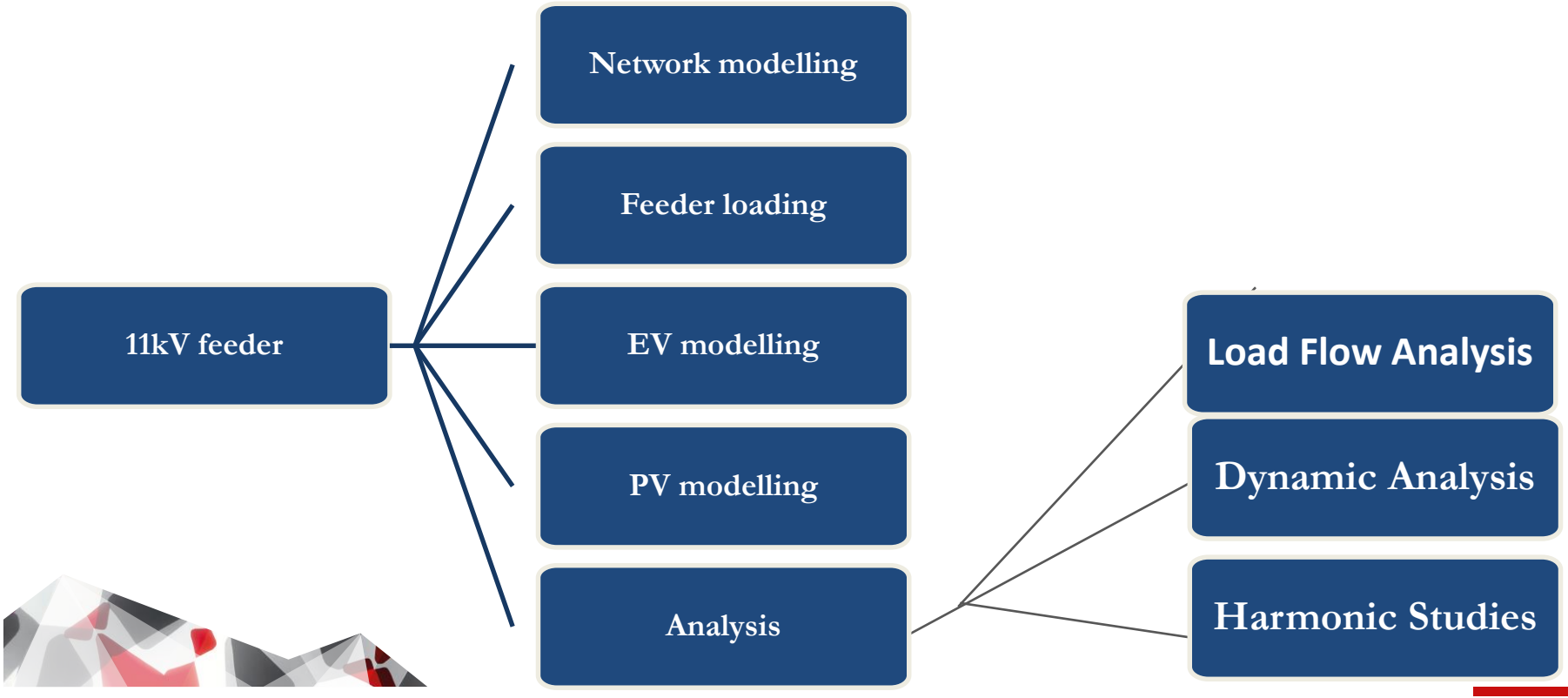
Data Collected



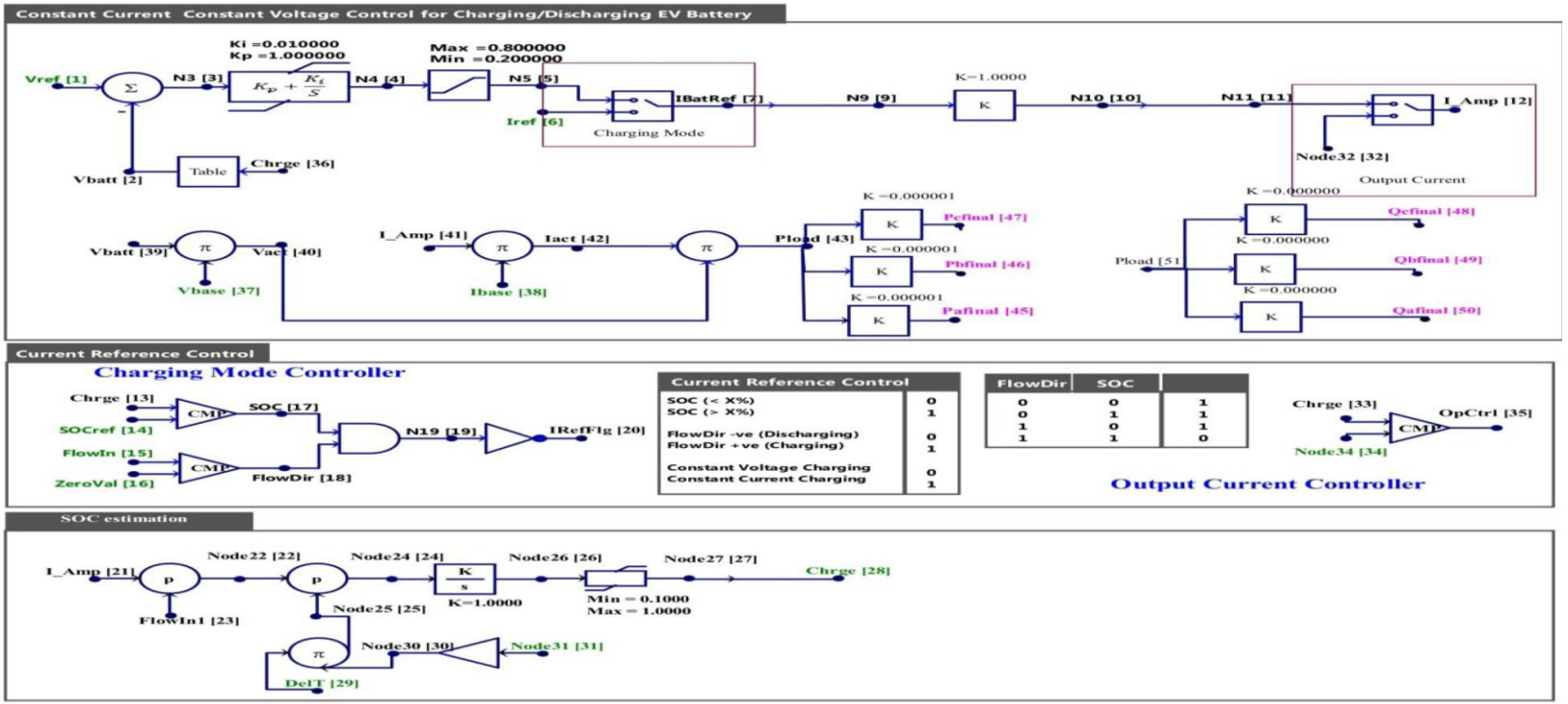
Simulation Studies for Sample Feeders



Simulation Study: Modeling

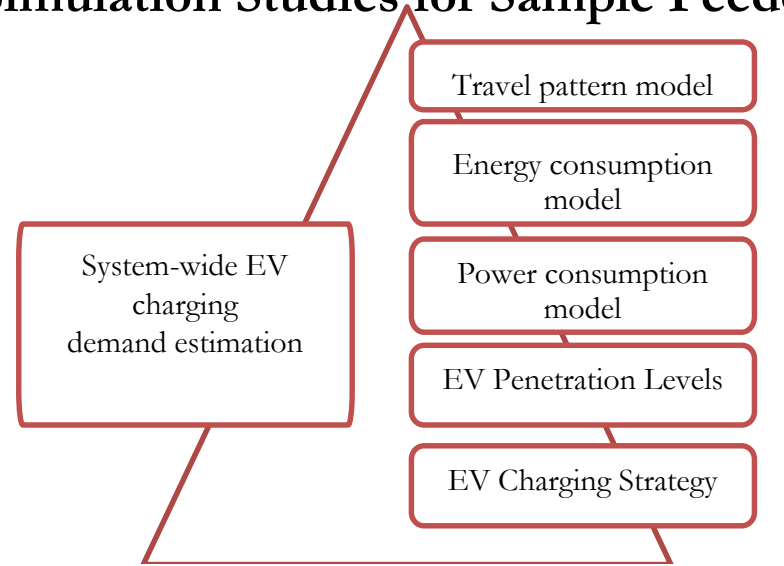


Simulation Studies for Sample Feeders



EV Modeling– MiPower Model

Simulation Studies for Sample Feeders



Charger locations

- Home charging
- Office/Work charging
- Public charging Station
- Mall/ Parking charging
- Private dedicated charging
- Battery swapping

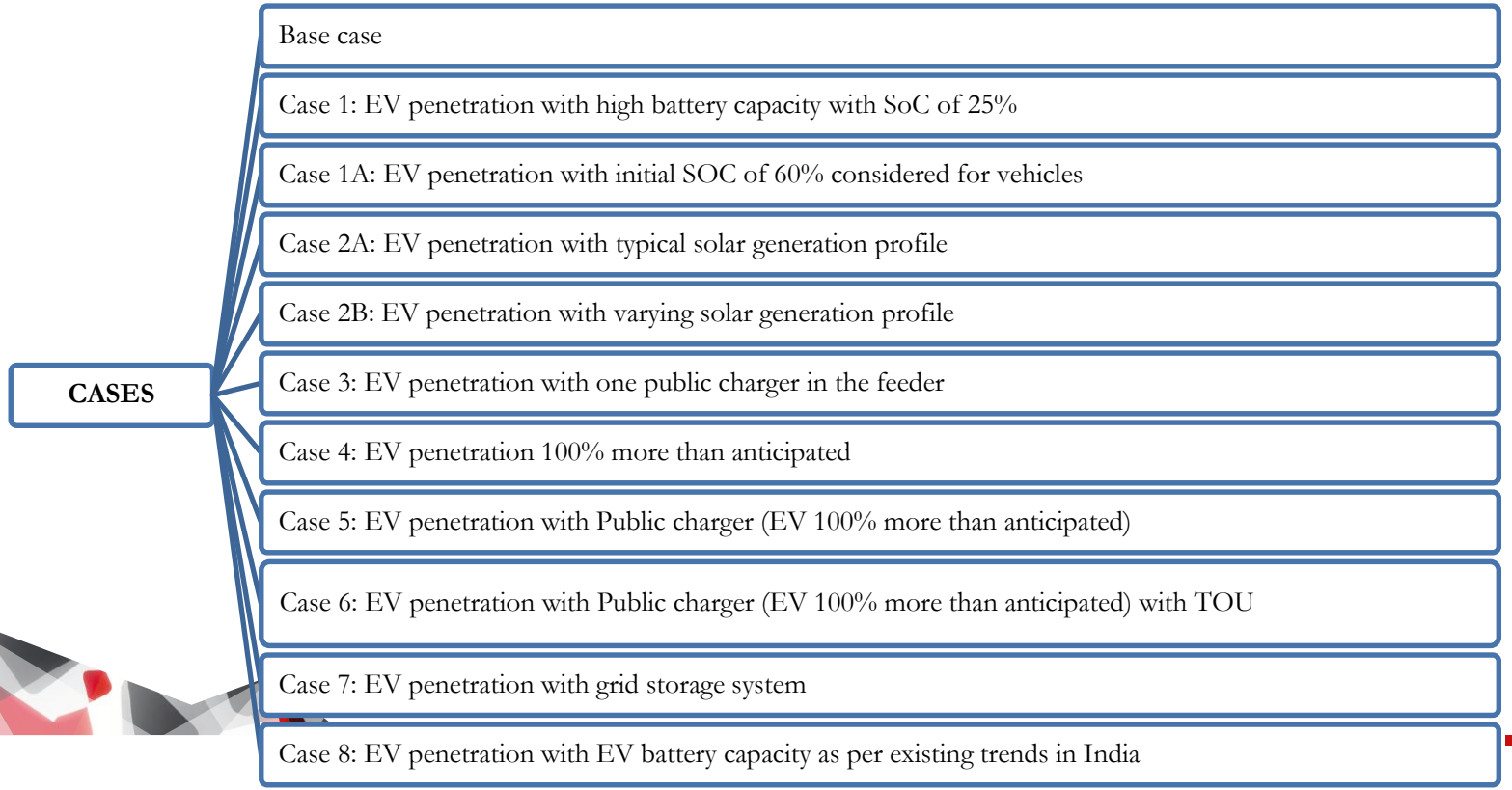
Table 8.1.10: % EV sales assumed for each vehicle category for future years

Vehicle category	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
2W	1%*	3%	5%	10%	15%	25%	27%	30%	33%	35%	37%	40%	40%
3W - PV	5%	10%	15%	20%	25%	25%	30%	40%	50%	60%	70%	80%	100%
3W - CV	0%	3%	5%	10%	15%	25%	30%	35%	40%	45%	50%	60%	70%
4W - PV	1%	1%	5%	10%	15%	25%	25%	25%	26%	27%	28%	29%	30%
4W - CV	1%	5%	10%	15%	20%	25%	30%	40%	50%	60%	70%	80%	100%
Bus	0%	5%	10%	15%	20%	50%	55%	60%	65%	70%	80%	90%	100%

**1% of all 2W sales in 2018 are considered as 2W EV, similarly for all vehicle categories for future years*

As per Niti Ayog and GoI targets

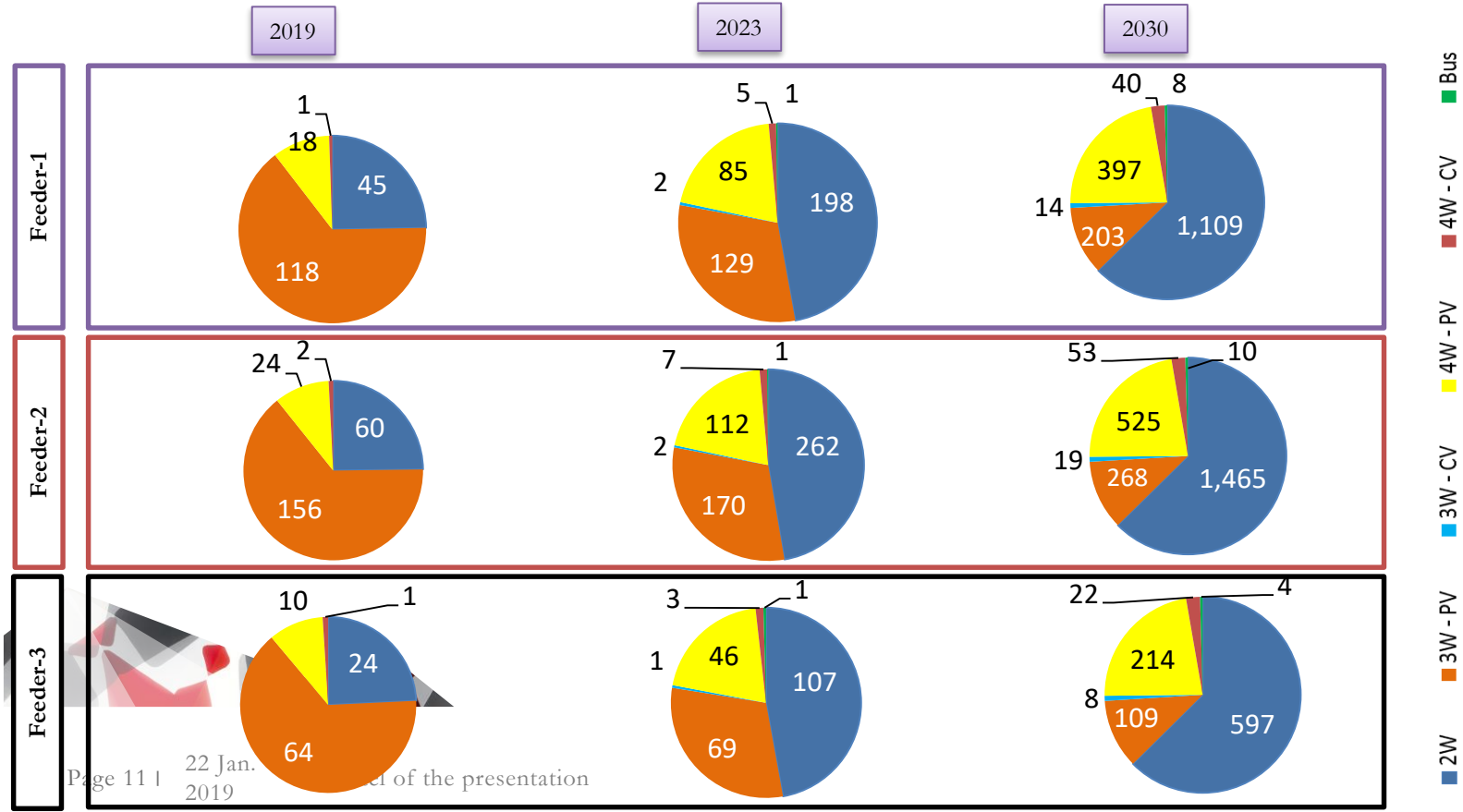
Simulation Studies for Sample Feeders



Case Studies Simulated for Selected Feeders for Future Years

Simulation Studies for Sample Feeders

Projected EV's



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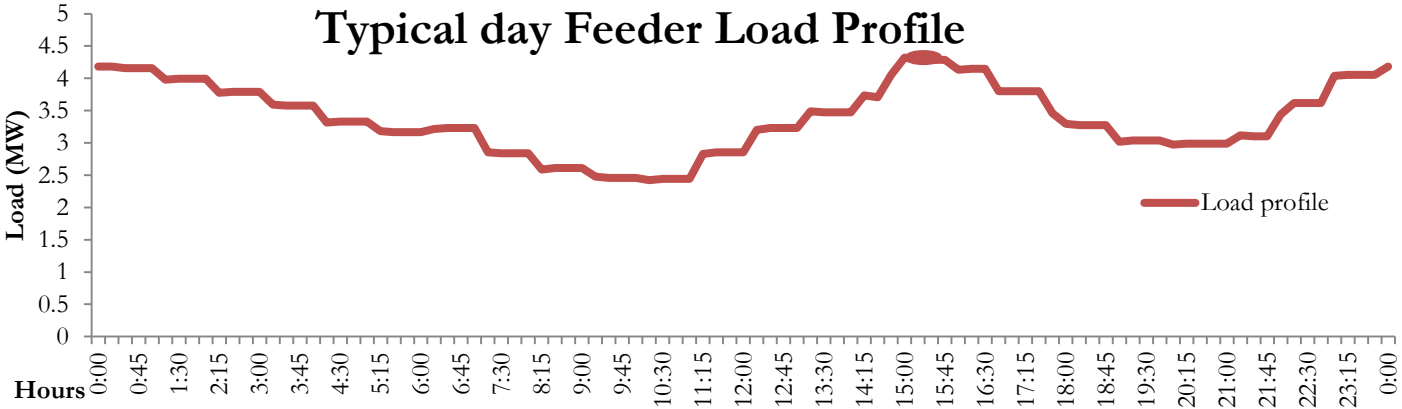
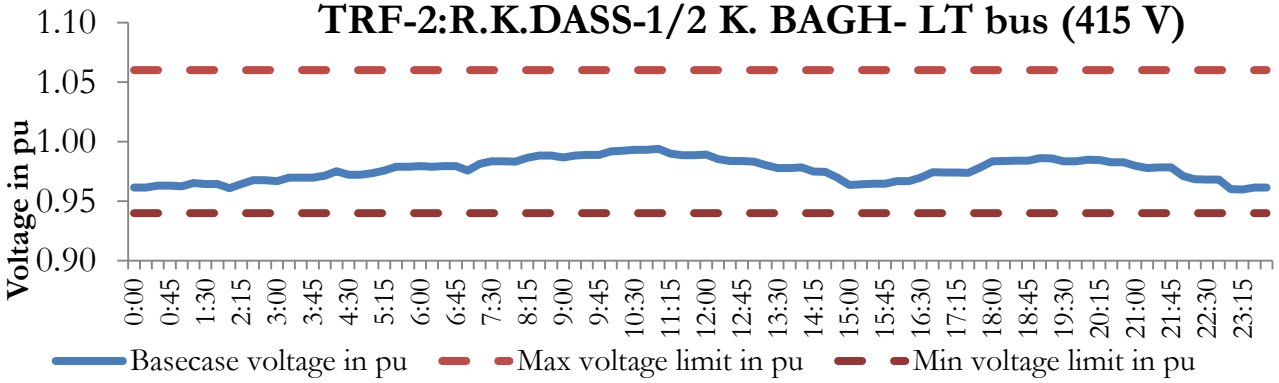
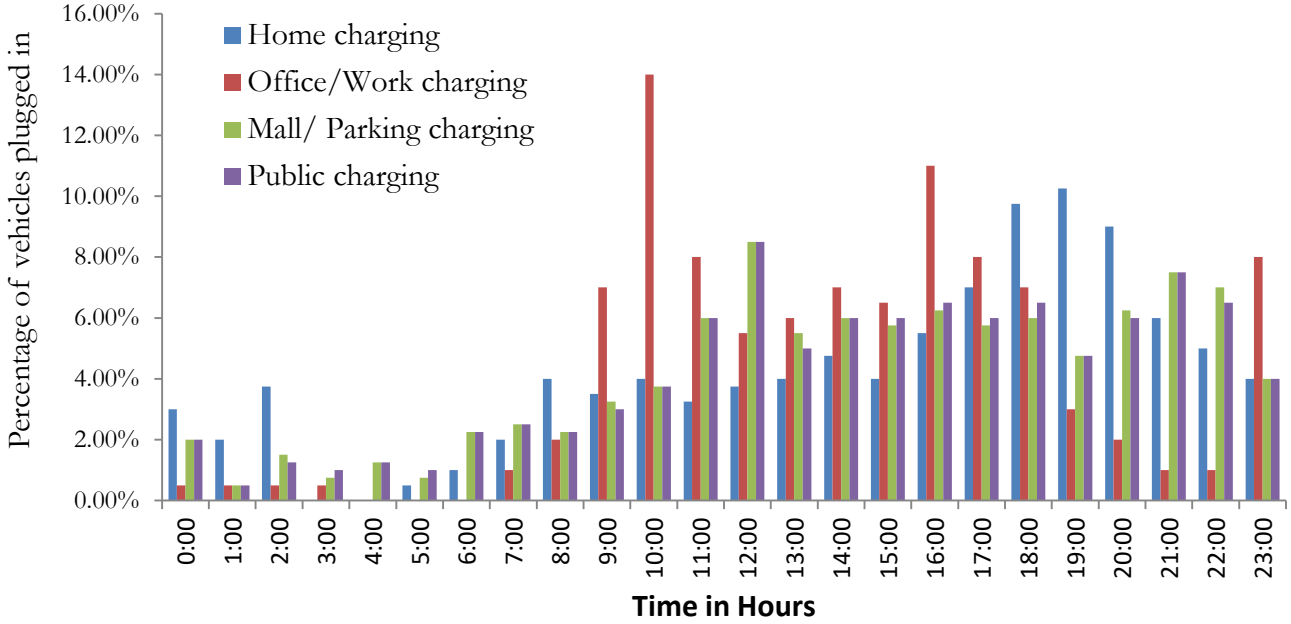
Simulation Results – Sample Feeders



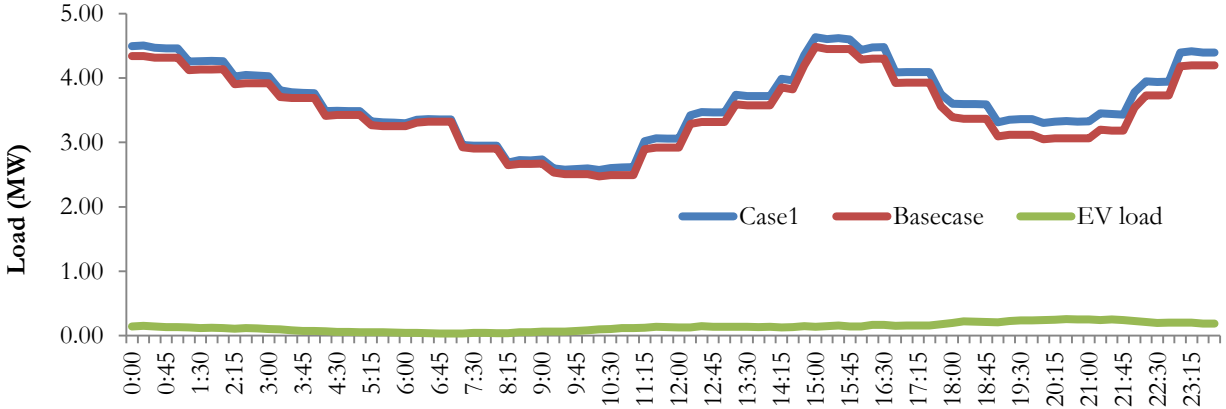


Simulation Results – Sample Feeders



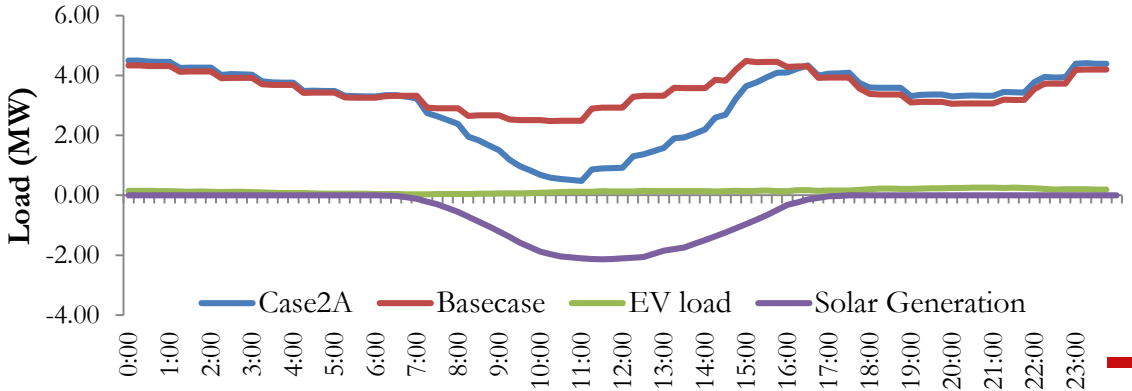
Vehicle Category	Battery Capacity (kWh)	No. of charges per year per vehicle (with SoC of 25%)
2W	4	65
3W - PV	7	487
3W - CV	9	389
4W - PV	80	48
4W - CV	80	292
Bus	250	389

Simulation Results – Sample Feeders



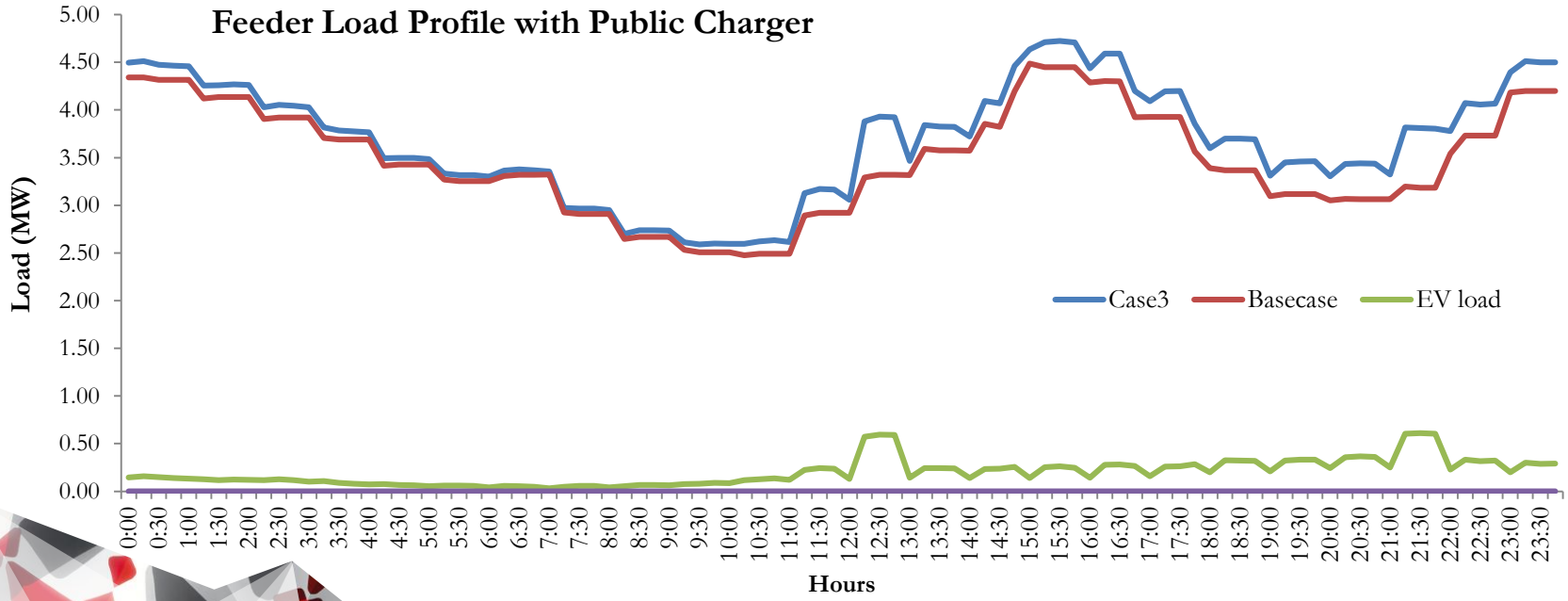
Feeder Load Profile with EV load

Feeder Load Profile with EV and solar penetration

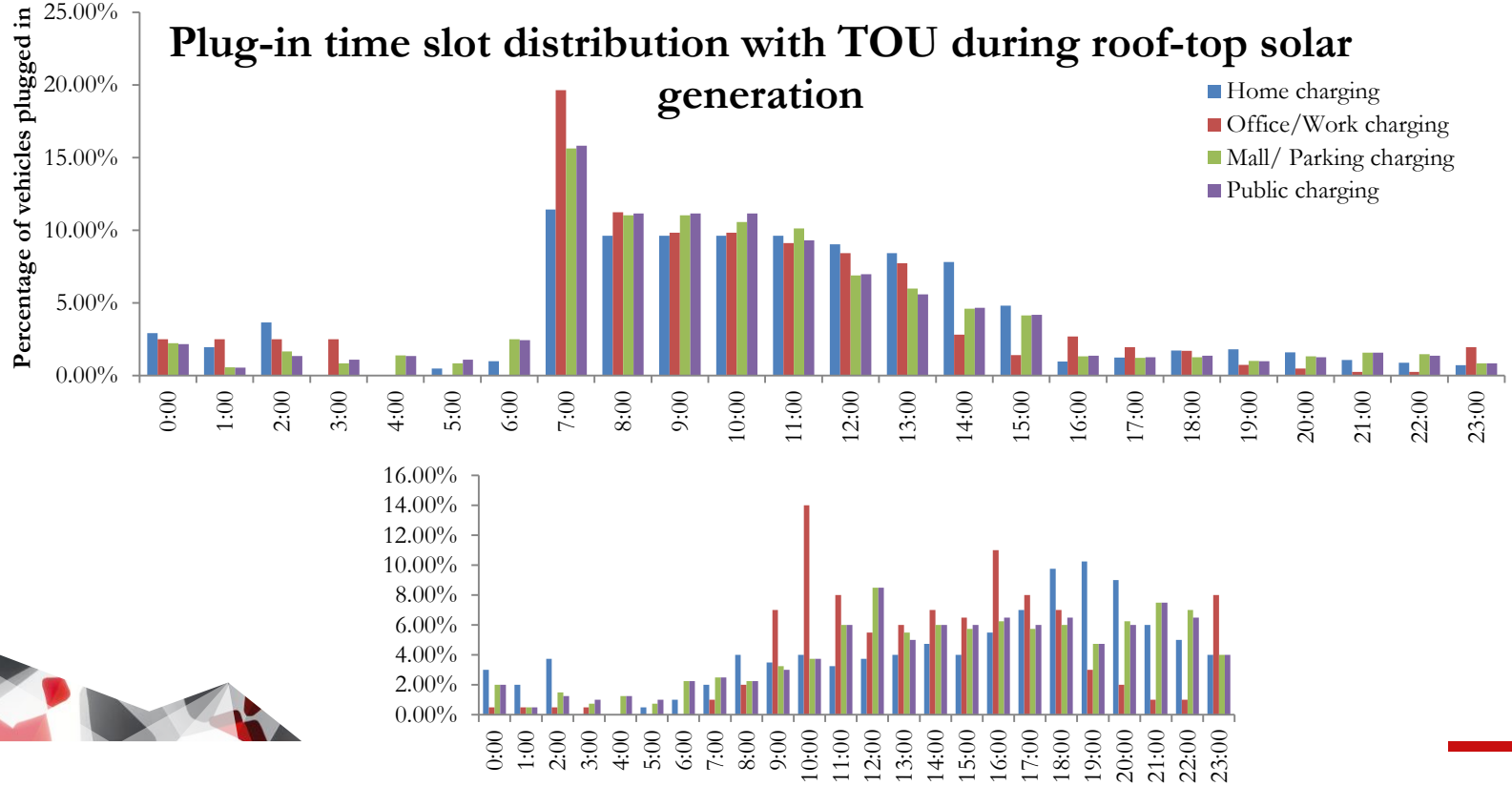


Simulation Results – Sample Feeders

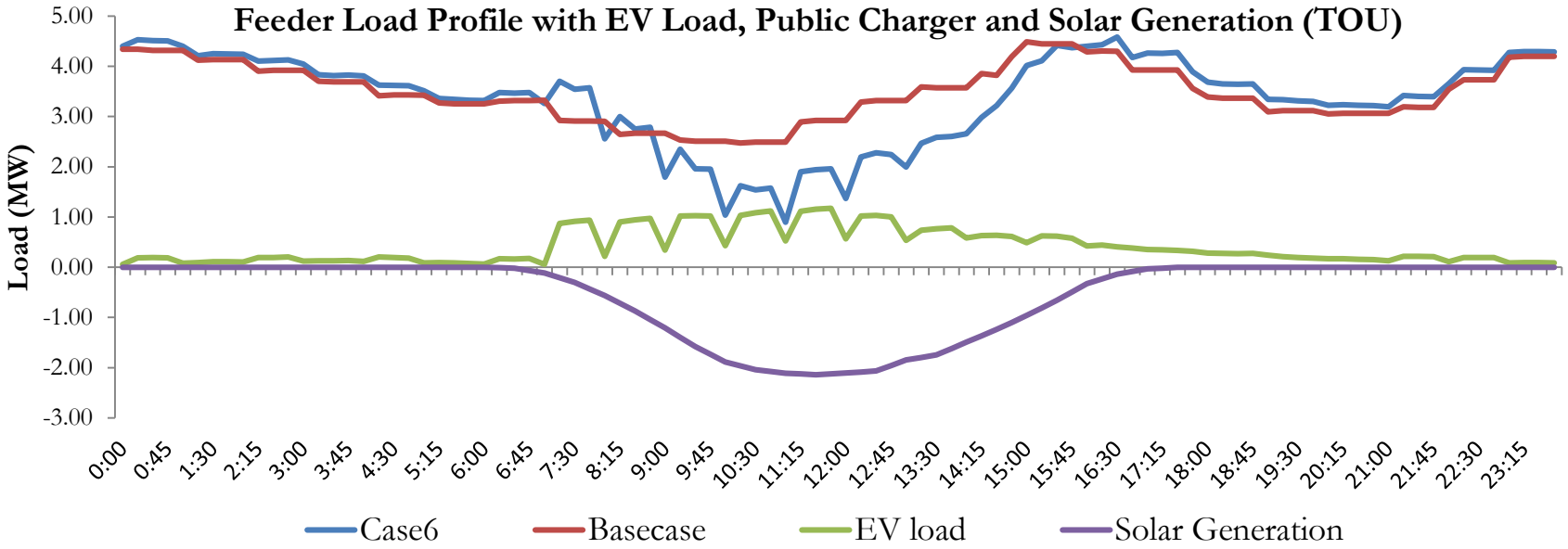
Name of the DT	No of EV's charged with public charging	Cumulative battery capacity (kWh)
DT-Public Charging (Capacity: 800 kVA)	96	2167



Simulation Results – Sample Feeders



Simulation Results – Sample Feeders



Conclusions & Recommendation

Extrapolation of the Results to the Entire DISCOM for the Year 2030

Energy and Peak demand requirement for EV charging for the year 2030

EV type	Battery Capacity	EV charging Energy per charge in kWh	No of EVs	No of Charges per EV per year	EV charging Energy in MU
2W	4	3	509281	65	99
3W - PV	7	5.25	93083	594	290
3W - CV	9	6.75	6571	441	20
4W - PV	80	60	182467	48	526
4W - CV	80	60	18478	292	324
Bus	250	187.5	3547	389	259
Total					**1517 MU**

Conclusions & Recommendation

Summary Of EV Penetration Impact DISCOM system

Projected Energy requirement for year 2019-20 without losses, projected by DISCOM	6925 MU
Energy projection by 2030 without EV and without losses considering growth rate of 4.76%	11022 MU
Projected Peak demand for the year 2019-20 by DISCOM	1640 MW
Projected Peak demand for the year 2029-30 by CAGR of 6% as per historical growth without EVs	2943 MW
Additional energy requirement with EV penetration for the year 2030	1517 MU
% Energy consumption by EV for the year 2030 with reference to energy sales without EVs	13.8%
Energy requirement of DISCOM with EV penetration for the year 2030	12539 MU
Peak demand contribution of EVs as per the DISCOM current load factor of 0.48	361 MW
% peak demand consumption by EV for the year 2030 with reference to peak demand without EVs in the system	12.3%

Conclusions & Recommendation

From the simulations, **peak load** coming from EV charging may not pose a significant toll on the existing business-as-usual infrastructure upgradation plan.

As per the EV projections and EV charging patterns presented in the methodology, un-controlled EV charging will contribute around 13.8% of energy sales for the year 2030.

Similarly, un-controlled EV charging will contribute around 12.3% of peak demand for the year 2030

it is recommended to adopt controlled charging and/or Time of day or Time of Usage tariff to minimize the impact on peak load. This will minimize the grid infrastructure cost considerably.

The impact of EVs on local grid needs to be studies for each system considering the considering the existing infrastructure loading, load profile and solar roof-top PV generation and expected EV profile.

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