Action Plan for Electric Utility/Supply Companies of SAARC Countries to Introduce EV Charging Infrastructure

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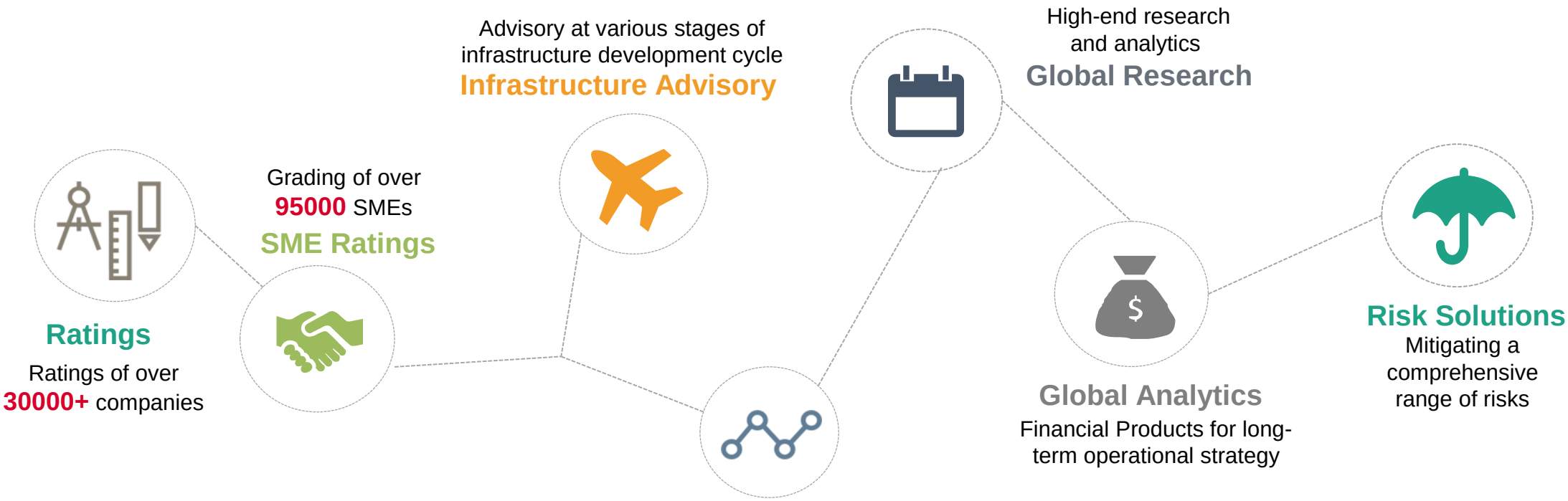

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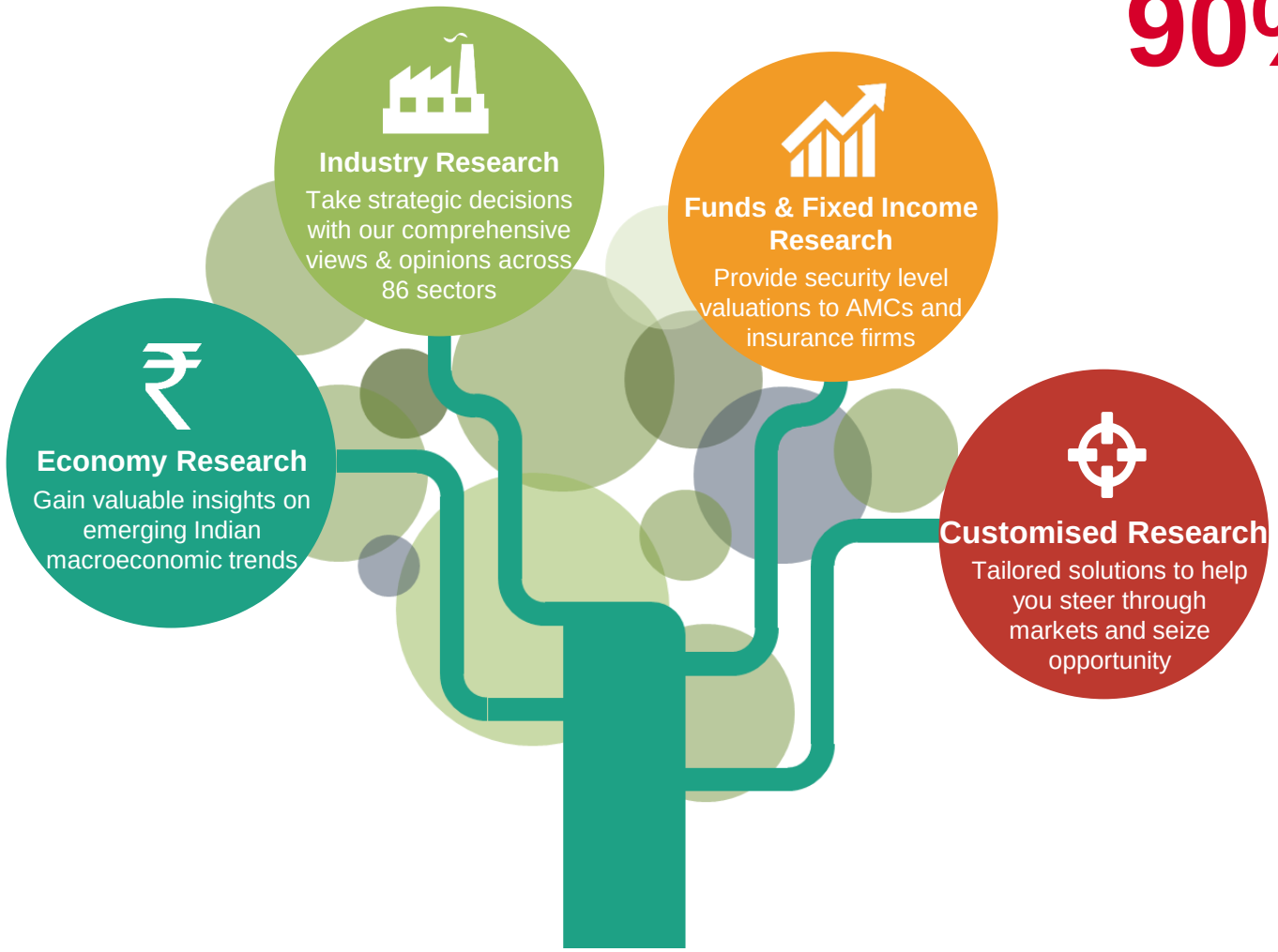

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- **Opportunity mapping for planning**
  - Market dynamics, capacity utilization, economics
  - Policies and regulations
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- **Commodity price tracking**
  - Short term/long term, regional markets, brand-wise assessments

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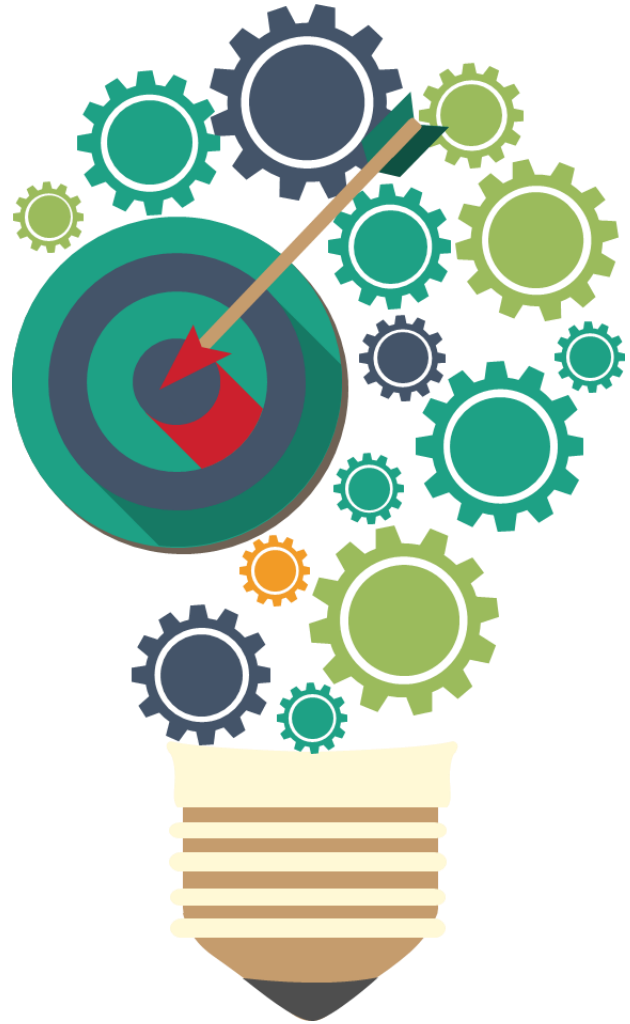
- **Pre-investment commercial due-diligence**
  - Market assessment
  - Channel feedback
  - Financial assessment
  - Management assessment
- **Post investment monitoring**
  - Market feedback, end-user and growth outlook
  - Exit strategy
- **Assessment of partners and tie-ups**
- **Market entry strategy**



Fund raising & valuations

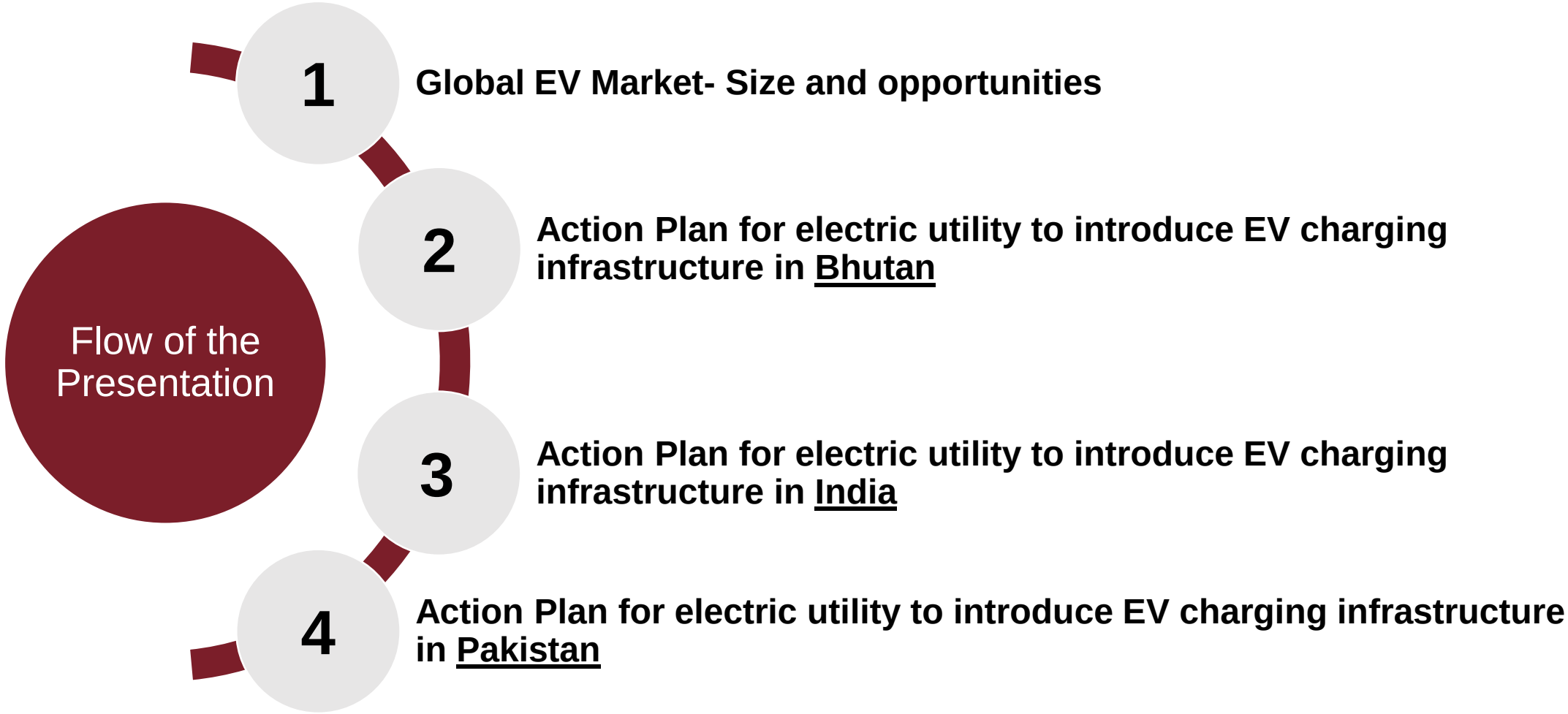
- Feasibility/Viability studies /Credit Assessment
- Valuations including structured instrument valuation
- Exit diligence

Competitor Benchmarking

- Competitor strategy – expansion, value addition, supply chain assessment, channel feedback, market intelligence
- Cost Benchmarking

Flow of the Presentation

In this presentation we will covering the following topics



Section 1: Global EV Market- Size and Opportunities

Brief about the study

The purpose of the report is to assess the EV market in the three SAARC Member States (SMS), namely India, Pakistan, Bhutan, and devise an action plan for an electric utility in each of the three geographies to deploy EV charging infrastructure in their respective licensee areas.

The broad areas that were assessed and analyzed in this study include

1 | Global Perspective

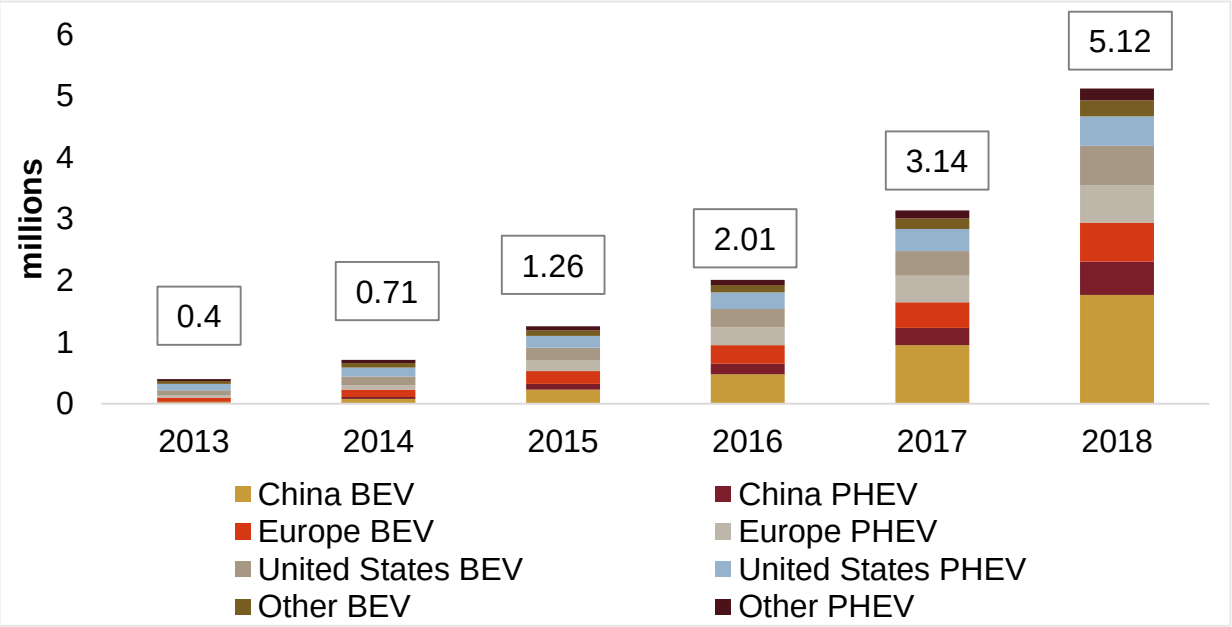
- Global EV market
- Evolution of battery technologies
- Battery swapping system

2 | Additionally, for the 3 SMS, the following have been covered in detail

- Present EV and Charging Infrastructure
- Selection of one electric utility using benchmarking
- Devising action plan for the utility to introduce EV charging infrastructure

Global EV Sales: Strong rise in sales, backed by China

Global EV Market



- As of end-2018, the global stock of EVs surpassed 5 million, an increase of 63% (3.14 million in 2017) from the previous year (IEA estimates). China led the deployment, accounting for ~45% of the electric car fleet, followed by Europe (24%) and the US (22%)
- The biggest EV penetration (in terms of volume and sales) occurred in China. The nation outperformed all other countries on both the market side (EV sales, available models, investment in charging infrastructure) as well as the industry side (component manufacturing).

Drivers for Adoption

- Financial incentives
- Economic Advantages in certain countries and vehicle types
- Rise in customer demand

Barriers to Adoption

- High cost
- Limited Enabling infrastructure
- Consumer scepticism towards advantages of EV
- Lack of supply chain development

Evolution of Battery Technologies and Chemistries

- Battery technologies play a pivotal role in delivering advancements in several industries, from power storage to EVs
- The fast growth of the EV market is hinged on the development of new battery technologies that help make more efficient and advanced vehicle powertrains
- There are majorly three types of batteries used in EVs now:
  - Lead acid batteries
  - Nickel metal hydride (NiMH batteries)
  - Li-ion batteries
- Manufacturers design batteries keeping in mind five major trade-offs: *a)* Specific energy, which is the capacity of storing energy per kilogram of weight; *b)* specific power, which is the amount of power that batteries can deliver per kilogram of mass; *c)* performance, which means endurance of a battery during extreme climates and difficult terrains; *d)* life span; and *e)* cost.

Trade-offs of 5 five principal Li-ion battery technologies

	Specific energy	Specific power	Performance	Life span	Cost
NCA	High	High	Moderate-High	High	Moderate
NMC	High	Moderate-High	Moderate-High	Moderate-High	Moderate-High
LMO	Moderate-High	Moderate-High	Moderate	Moderate	Moderate-High
LTO	Moderate	Moderate-High	High	High	Low
LFP	Moderate	Moderate-High	Moderate-High	High	Moderate-High

Lithium-nickel-cobalt-aluminium (NCA), lithium-nickel-manganese-cobalt (NMC), lithium-manganese-spinel (LMO), lithium titanate (LTO) and lithium iron phosphate (LFP)

Battery Swapping System (BSS)

- In a battery swapping model, a depleted battery, residing in the vehicle, is replaced by a fully charged battery of the same architecture
- Although the technical parameters for the battery swapping system would depend on the charging point of batteries and the swapping infrastructure
- All batteries swapped in/out from the vehicle have to be homogenous. This is critical to maintain optimum battery life. Therefore, all battery swapping stations must stock the same battery (common battery technology and chemistry) to cater to the common swapping ecosystem in the country
- All vehicle manufacturers across a segment (2-W/ 3-W) who intend to be part of the battery swapping ecosystem need to form a cohort and finalise battery technology which can then be rolled out across models and manufacturers

Advantages for BSS

- Low cost of ownership for EVs
- Reduction in charging time and extension in travel range
- Postponement of charging of batteries at BSS to night time or off-peak hours

Challenges for BSS

- Standardisation of EV li-ion battery packs
- Reliability of leased/ rented battery packs
- Commercially viable business models

Conclusion

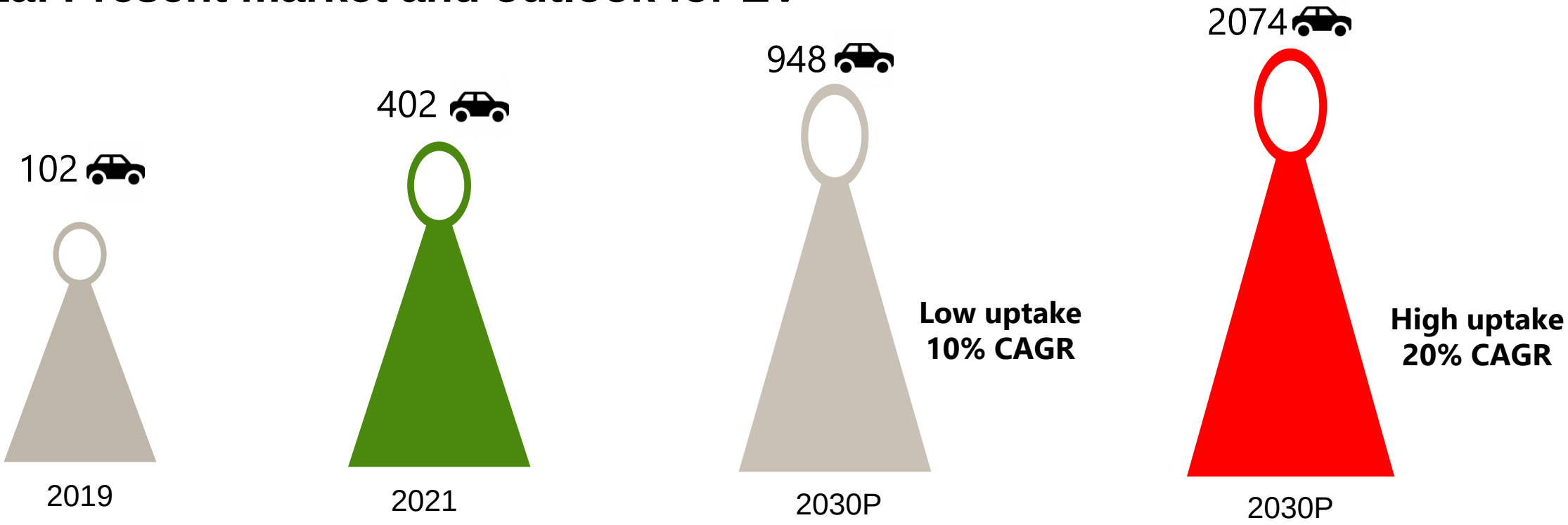
- The Electric Vehicle (EV) market has been growing steadily across the world, driven by developed economies.
- With maturing battery technologies and reduction in prices, the cost economics of EVs is expected to be strong going forward
- Battery swapping system is an evolving concept, however, Majority of the auto OEMs prefer to keep tight control over their design strategies of battery packs, leading to lack of standardisation of EV li-ion battery packs

SECTION 2: Country in Focus- Bhutan

Methodology followed for the study

1. **Country EV Outlook**
   - Present market and outlook for EV
   - Regulatory and federal policies driving EV adoption
2. **Shortlist one distribution utility**
   - Shortlisting of the utility
3. **Charging standards**
   - Types of chargers and charging standards
4. **Charging Requirement in licensee area**
   - Outlook of charging requirement in the shortlisted utility's area
5. **Location planning for PCS**
   - Location Planning of EV Charging stations
6. **Capex Requirement for utility**
   - Capex and opex requirements
   - Financial viability for EVCS based on station utilization rates and power prices charged
7. **Business Model for setting up PCS**
   - Business Model Development for EVCS installations
8. **Organizational Capacity building**
   - Organizational Capacity Planning for the private utility
   - Costs associated with a distribution company

Step 1a: Present market and outlook for EV



Year	Drivers for EV adoption
2021	• Replace 300 taxi fleet in Thimphu, Paro, Haa, Wangdue, Punakha, and Phuentsholing through UNDP-GEF • The Royal Government of Bhutan will provide 20% subsidy (max of $5,500) and financial institutions will provide loan equity of 50%
2030	• The government continues to support with financial subsidy/tax rebate and policy regulations to make EVs affordable to general public • There is easily accessible public electric vehicle charging stations (EVCS) and the EV users do not face operational challenges

Step 1b: Regulatory and federal policies driving EV adoption

1.

NDC Commitment

- The Royal Government's target of remaining carbon neutral pledged in 2009 at the 15th session of the United Nations Framework Convention on Climate Change (UNFCCC).
- As the emissions from the transport sector are showing a rapidly increasing trend and identifies the promotion of low carbon transport system as a key mitigation measure.

2.

Bhutan National Transport Policy 2017

- Seeks to provide a safe, and environment-friendly transport system in support of strategies for socio-economic development" .
- The policy supports the principles of inclusiveness and an emphasis on low carbon transport solutions such as EVs

3.

Bhutan Vision 2020

A national strategy and action plan for low carbon development has been prepared, which seeks to reduce GHG emission significantly – by 15% by 2040, which is on top of the expected decrease of 8% in the business-as-usual scenario

4.

12th Five Year Plan

12th Five Year Plan (2019-2024) also identifies promotion of EVs as one of the key programmes of the transport sector to address environmental issues and reduce dependency on fossil fuels, and contribute to national key results, such as remaining carbon neutral.

Step 2: Shortlisting of the utility

Bhutan Power Sector

01

Bhutan Electricity Authority (BEA)

Regulatory agency

02

Department of Renewable Energy (DRE)

Mandate to promote renewable/alternative energy, energy conservation and efficiency

03

Druk Green Power Corporation (DGPC)

Generating Company

04

Bhutan Power Corporation (BPC)

Transmission and Distribution Company

In Bhutan, the sole distribution utility, BPC was selected for detailed study and development of roadmap of EV charging infrastructure in the country.

Step 3: Types of Chargers and charging standards

Four EV models: Nissan LEAF e-NV200 (Hatch Back from Nissan Motors), loniq (Hatch Back from Hyundai Motors), BYD–T3 (Mini Van from BYD Group), and iEV7S AUDA EU5 AUDA (SEDAN from Auda Motors).

Based on the specification of the current EVs and proposed EV taxi project, it is recommended to have either CCS Combo-2 QC or CHAdeMO fast DC chargers

Existing QC

Preferred QC

Step 4: Outlook of charging requirement in the public utility's area

One of the issues raised by the users is EV users sometimes had to wait as there were others already charging at a station. The users recommend two chargers per QC station

Every EV is supplied with slow AC/home chargers and EV drivers/owners prefer slow chargers to QCs as it adversely affects the life of the battery

2019	4 Quick Chargers, CHAdeMO
2021	27 QCs, one QC for 15 Evs (23 new QCs)
2030P (LU)	47 QCs (one QC for every 20 Evs)
2030P (HU)	104 QCs (one QC for every 20 Evs)

- Same EV model selected for taxi fleet will be continued beyond 2021
- Minimum range of fully charged EV is approximately 200 km for new EVs.
- Charging stations are distributed along the highway and core public place

Step 5: Location Planning of EV Charging stations

Apart from the initial cost of EV and its operational range, the accessibility to EVCS and cost of charging will have a direct impact on the adoption of EV. Therefore, the location of EVCS is critical to improve the adoption of EV as well to enhance business viability of EVCS.

Overall demand side planning to assess the number of QCs within a geographical area shall take into consideration the following factors:

1. *Floating EV population in an area*
    - Commercial hot-spots (office complexes, multiplexes, shopping centres, monastery, market complexes)
    - Beside highways/ expressways
2. *Charging Behavior*: Degree of charging via public charging stations and potential number of chargers per EV

Tentative location of EVCS by 2021 (UNDP-GEF, 2018)

Region	Location	No. of EVCS
Paro	Core area, Taktsang Base	2
Punakha	Khuruthang	1
Thimphu-Wangdue highway	Menchuna	1
Wangdue	Core area	1
Thimphu	Core area, Dechencholing, Tango base, Khasadrupchu	11
Thimphu-Phuentsholing highway	Wangkha, Gedu	3
Phuentsholing	Core area	2
Paro-Haa highway	Bitekha	1
Haa	Core area	1

Step 5: Location Planning of EV Charging stations (contd.)

Tentative location of EVCS for low uptake by 2030

Region	Location	No of EVCS		Total No of EVCS by 2030
		As of 2022	Additional between 2022-30	
Paro	Core area	1	2	3
	Taktsang Base	1	1	2
Punakha	Dzong parking	-	1	1
	Khuruthang	1	1	2
Thimphu-Wangdue highway	Dochula	-	1	1
	Hongtsho	-	1	1
	Menchuna	1	1	2
Wangdue	Bajo	-	1	1
	Metsina	1	1	2
Thimphu	Core area	8	2	10
	Dechencholing	1	1	2
	Tango base	1	1	2
	Buddha point	-	1	1
	Motithang Takin Reserve	-	1	1
	Khasadrupchu	1	1	2
Thimphu - Phuentsholing highway	Wangkha	2	1	3
	Taktikothi	-	1	1
	Gedu	1	1	2
Phuentsholing	Core area	2	1	3
Paro-Haa highway	Bitekha	1	1	2
Haa	Core area	1	1	2
Thimphu-Paro highway	Chhudzom	-	1	1

Step 5: Location Planning of EV Charging stations (contd.)

Tentative location of EVCS for high uptake by 2030

Region	Location	No of EVCS		Total No of EVCS by 2030
		As of 2022	Additional between 2022-30	
Paro	Core area	1	3	4
	Taktsang Base	1	6	7
Punakha	Dzong parking	-	5	5
	Khuruthang	1	3	4
Thimphu-Wangdue highway	Dochula	-	4	4
	Hongtsho	-	2	2
	Menchuna	1	2	3
Wangdue	Bajo	-	4	4
	Metsina	1	3	4
Thimphu	Core area	8	5	13
	Dechencholing	1	5	6
	Tango base	1	4	5
	Buddha point	-	6	6
	Motithang Takin Reserve	-	4	4
	Khasadrupchu	1	3	4
Thimphu - Phuentsholing highway	Wangkha	2	4	6
	Taktikothi	-	4	4
	Gedu	1	2	3
Phuentsholing	Core area	2	5	7
Paro-Haa highway	Bitekha	1	2	3
Haa	Core area	1	2	3
Thimphu-Paro highway	Chhudzom	-	3	3

Step 6a: Capex Requirement for EVCS ≅ Nu 2.755 mill per EVCS

1 | Charger Costs

Type of Charger	Power Output [kW]	Approximate costs (Nu. thousands)
Charger cost	50 kW	1,820

2 | Other Costs

Parameters	Approximate costs (Nu. thousands)
New Electricity Connection, Transformer, Cabling (100 meters), Panels, Breakers, Energy Meter	789
Civil Works (Flooring, Boards, Painting, Brandings, Shed/ Cover etc.	100
EVSE Management Software - Integration with chargers and payment gateway	45

Total Capex for Low Uptake ≅ Nu101 mill

Total Capex for High Uptake ≅ Nu 190 mill

Step 6b: Opex Requirement for EVCS

- EV charges for 30 minutes per charge, which is equal to 25 kWh of electricity consumption, given a QC is rated at 50 kW
- Constant annual inflation rate of 3% for five years.
- Each station needs a leased line internet connection @Nu 1300/Mbps, based on existing rate from the internet service provider
- Each QC requires 5 m^2 land, but no land lease rental
- Same installation cost in all districts.
- Financial analysis was done at a discount rate of 10%.

Parameters	Approximate costs (Nu. thousands)
Technicians (1 technician @25k/month considered for first 6 months	150
Site Maintenance Staff (6 personnel @25k/month/person throughout year)	1,800
Network Service Provider Fee	60
EVSE Management Software Fee (considered as 10% of net margin on electricity charges)	212
Advertising	60

Step 6c: Financial viability for EVCS

- Current status: EVCS constructed and managed by government through a private contractor.
- EVCS are maintained by a private enterprise through an annual maintenance contract, but the electricity bill is paid by the government to utility.
- Four business models are being proposed

- Net Present Value (NPV) was used to ascertain the financial viability of EVCS investment
- Payback period was calculated on differential cost of EV and conventional vehicle

Assumptions

- Net Present Value (NPV) was used to ascertain the financial viability of EVCS investment
- Every EV will have a home charger for which user will pay domestic tariff.
- EV users prefer slow charger to quick charger.
- The minimum mileage for a fully charged battery is 200 km, so more than one quick charging may not be required in a day.
- Taxis will not be used in the night.

Step 7: Business Model Development for EVCS installations

Utility Investment Models

Options	Modality	Minimum price of charging (Nu/kWh)	Remarks
Option-1	Business as usual: Government installs EVCS, manages and provides free charging to EV users	Free	▪ Not sustainable option
Option-2	Government installs EVCS and manages but charge EV users for using EVCS	5	▪ Minimum of 20% EVCS utilisation rate
Option-3	Government installs EVCS and leases out to utility to manage, operate and maintain for a fixed term	7	▪ Minimum 27% EVCS utilisation rate ▪ Viable option
Option-4	Utility company or through PPP will invest in EVCS, operate, collect charging fee from the users and upkeep the EVCS.	7	▪ Minimum 33.33% EVCS utilisation rate

Step 7: Business Model Development for EVCS installations (contd.)

Option-1

- Price of a new Nissan Leaf EV in Bhutan is US$ 32,857.
- Fuel cost/year for a taxi is US$ 5,143 (Nu 360,000 for 6,000 litres/year @ Nu 60/litre of diesel/petrol). This amount is saved if EV users need not pay for charging.
- Cost of the commonly used car in Bhutan is US$ 10,714.
- Government will continue to provide subsidy beyond the year 2023.
- Payback period of differential cost is 3.2 years.
- Payback period of total EV cost is 6.4 years.

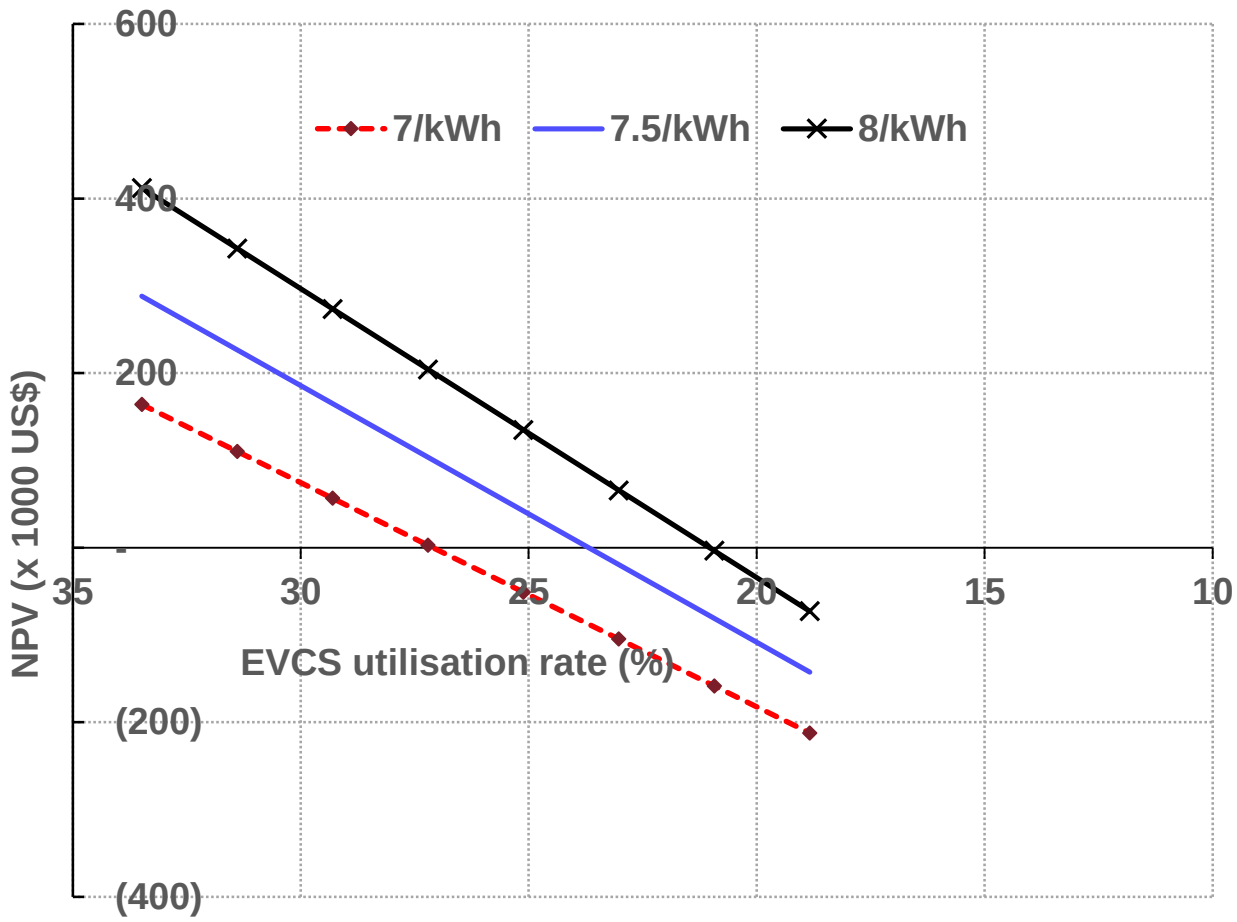
Option-2

- Payback period of differential cost is 5.1 years.
- Payback period of total EV cost is 7.6 years.

Step 7: Business Model Development for EVCS installations (contd.)

Option-3

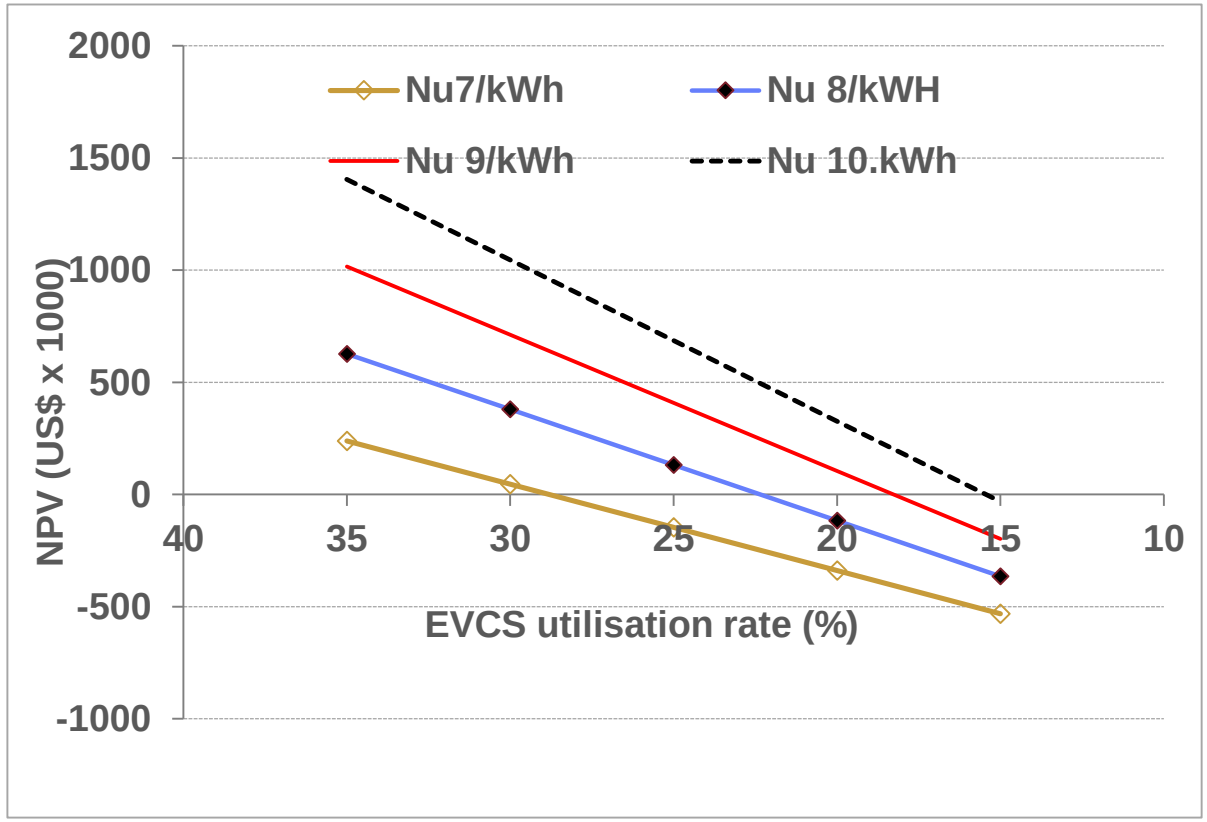
Electricity selling price (Nu/kWh)	7	7.5	8	9
Charging cost/annum (US$)	1125	1205	1286	1446
Payback period of differential EV cost	4.27	4.35	4.44	5.99
Payback period of total EV cost	9.42	9.61	9.81	10.24



NPV variation with utilisation rate and different electricity selling price

Step 7: Business Model Development for EVCS installations (contd.)

Option-4



NPV variation with utilisation rate and different electricity selling price

- At 33.33% EVCS utilisation rate and electricity selling price of Nu 7/kWh, NPV is positive at bank lending rate of 5% and 10%, respectively, indicating that the investment is worthwhile at either of the bank lending rates

- Even at 25% EVCS utilisation rate and Nu 8/kWh electricity selling rate, NPV is positive. Therefore, the recommended minimum electricity selling price in this option is Nu 9/kWh.

Step 7: Business Model Development for EVCS installations (contd.)

Business model	Initial investment	Operation & maintenance	Electricity selling price (minimum)	EVCS utilisation rate (minimum)	Remarks
Option-1	Government	Government	Free	-	Not recommended
Option-2	Government	Government	Nu 5/kWh	21%	Not recommended
Option-3	Government	Private/utility company	Nu 8/kWh	25%	Most sustainable option
Option-4	Utility company or through PPP	Utility company or through PPP	Nu 9/kWh	25%	Risky option

Step 7: Business Model Development for EVCS installations (contd.)

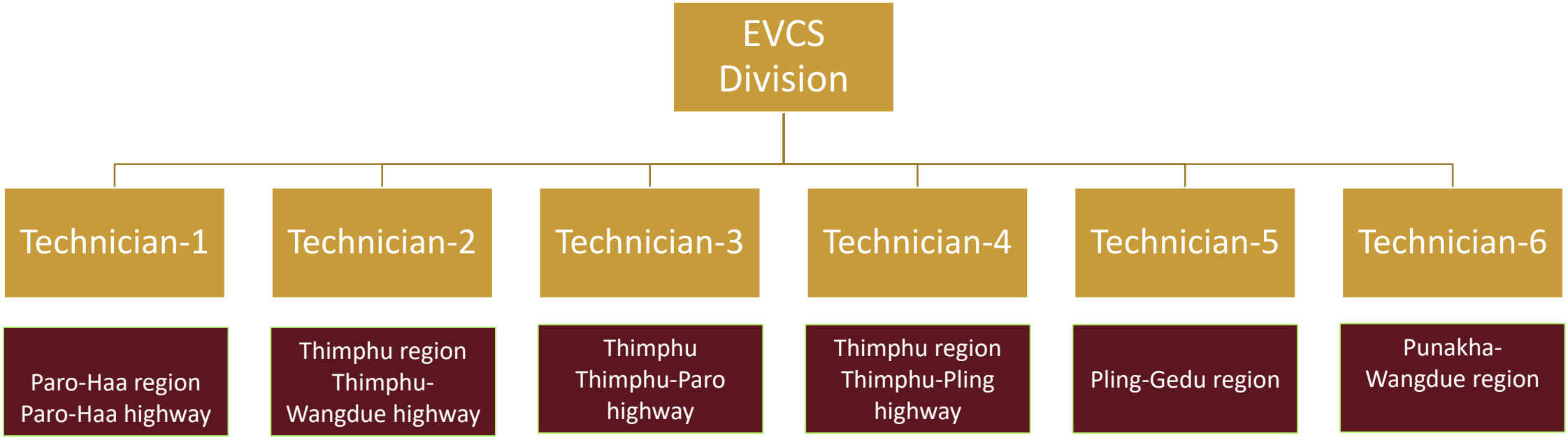
- Option-1 could promote and encourage people to switch from a conventional vehicle to an EV, as there is potential for substantial saving in fuel cost, it is not recommended as this option would not be sustainable in the long run.

- Under Option-2, EVCS users have to pay a minimal price but the government will not be able to recover the investment. Therefore, it is also not recommended.

- Under Option-3, the government does not have any risk and will also be able to recover the investment at the end of the lease period. Therefore, this option is recommended as a good business model.

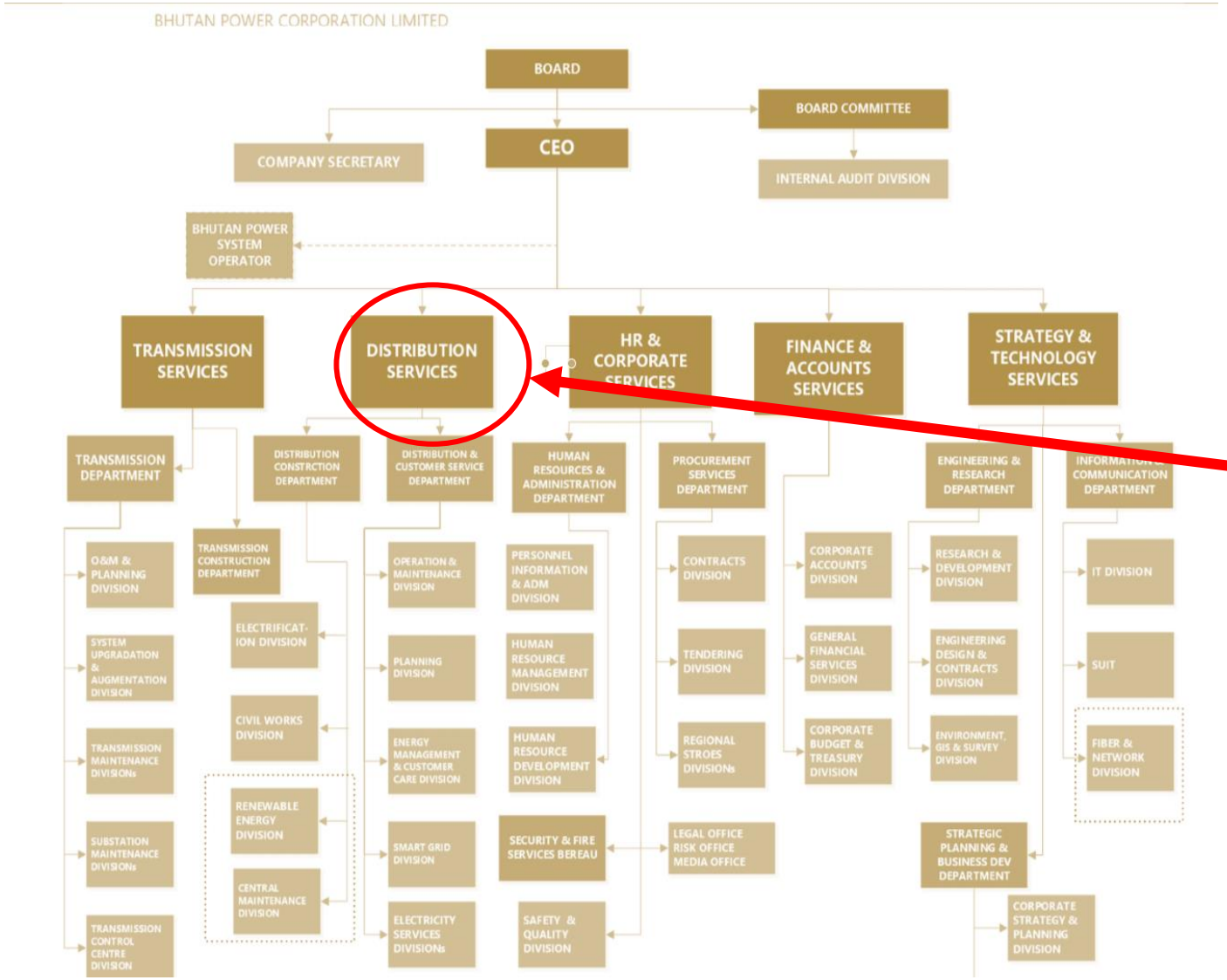
- Option-4 to invest and operate by utility company or through PPP also seems to show a reasonably good business perspective. But there is associated risk of failure if the EVCS utilisation rate is below 33.33% and the banks charge a high lending rate. Therefore, this option could be pursued with caution.

Step 8a: Organizational Capacity Planning for the public utility



- In case if the utility decides to takeover EVCS infrastructure or Royal Government mandates BPC to be involved, then we propose to create a separate division under the Distribution and Customer Service Department of Distribution Services.
- Inorder to operate and manage EVCS business, 7 additional staff are required. The number of staff is considered based on the number of EVCS, and distance between the EVCS.
- If the utility decides to take up EVCS business, then we recommend to invest in training human resource to operate and maintain EVCS. The current pool of BPC staff is involved in delivering the mandated services to the consumers.

Step 8a: Organizational Capacity Planning for the public utility (contd.)



Distribution Services

EVCS Division

Step 8b: Costs associated with a distribution company

- From simulation of Distribution Network, minimal impact on the existing distribution network, so no additional investment required on transmission and distribution network.

Year	Low uptake		High uptake	
	Capex (Nu)	Opex (Nu)	Capex (Nu)	Opex (Nu)
2022	60,685,176	2,282,291	66,137,102	2,301,591
2023	5,608,492	2,370,638	14,021,230	2,420,334
2024	8,412,738	2,464,419	16,825,477	2,543,931
2025	5,608,492	2,550,179	19,629,723	2,679,387
2026	8,412,738	2,647,854	22,433,969	2,826,758
2027	11,216,984	2,757,505	28,042,461	2,996,043
2028	8,412,738	2,859,313	33,650,953	3,187,303
2029	11,216,984	2,973,220	39,259,445	3,400,601
2030	11,216,984	3,089,352	50,476,430	3,655,880

Conclusion

- Exorbitant land price: Currently, there is no issue with the land as EVCS is owned and operated by the government. If the land need to be leased from private owners, then the urban land is very expensive and it will increase the electricity selling price. As a consequence, EV users may be dissuaded from using QCs.
- Up-front cost of EVCS: The cost of QC is quite significant and could present a significant barrier to charging infrastructure deployment for the utility. Taking loan from the financial institutes will further increase the electricity selling price to EV users. As a consequence, EV users may be dissuaded from using QCs.
- Business viability: One of the motivating factors to shift from conventional ICE cars to EV is free charging provided by the government. Unless the government allows the utility to charge the EV users for using EVCS, the utility may not be keen to take up EVCS. On the other hand, if EV users are charged for using EVCS, then this may dissuade EV users from using EVCS.

SECTION 3: Country in Focus- India

Methodology followed for the study

1 Country EV Outlook

- Present EV sales (across vehicle categories)
- Effectiveness of federal policies
- Change in Total Cost of Ownership of EVs vis-à-vis ICEs

2 Shortlist one distribution utility

- Evaluation of all major distribution utilities using a financial benchmarking model
- Rank utilities on each parameter and derive composite score

3 Charging standards

- Charging Standards for EV Charging Stations (EVCS)
- Type of chargers to be used in EVCS

4 Charging Requirement in licensee area

- Assessment of EV population in licensee area
- Outlook on EVs to travel from adjoining areas to licensee areas

5 Location planning for PCS

- Analysis of divisions (circles) under shortlisted licensee area
- Devise prospective locations for Public Charging Stations (PCS) in each division

6 Capex Requirement for utility

- Capex and opex requirements for setting up a PCS
- Financial viability for EVCS based on station utilization rates and power prices charged

7 Business Model for setting up PCS

- Assessment of utility investment models
- Assessment of capex side and revenue side interventions
- Proposition of suitable business models for PCS

8 Organizational Capacity building

- Organizational structure to achieve the e-mobility goal
- Potential organogram for the utility to oversee the EV and EV charging business

Step 1: Long term Electric Vehicle penetration to be driven by 3Ws and 2Ws

Vehicle Segment	EV Penetration (Sales)		
	FY19	FY24 P	FY30P
	0.1% (~3,600)	3-5% (~1,76,000)	25% (1,299,000)
	0.6% (~126,000)	12-17% (~3,497,000)	50% (13,168,000)
	0.5% (~500)	2-4% (~4,500)	20% (~42,000)
	0% (~100)	3-5% (~24,000)	10% (~86,000)
	0.01% (~700)	43-48% (2,97,000)	70% (~931,000)

Vehicle Type	Drivers for EV adoption for the period FY20-FY24	Drivers for EV adoption for the period FY25-FY230
Two Wheelers	E-Scooters to have better TCO than ICE scooters but weaker than ICE Motor cycles by FY24	Scooters to majorly shift to EV, motorcycles below 125 cc will begin conversion, majorly in the urban and semi urban regions
Three Wheelers	E- Auto to have favorable TCO and cost of acquisition (COA) as compared to a CNG powered three wheeler by FY24	Better cost economics, low running costs and rise in CNG prices to allure auto owners towards EV
PV and CV	Low annual running will hinder EV adoption in personal cars by FY24 while higher daily running to aid EV adoption in cab aggregators	CV segment expected to majorly convert to EV; PV segment will begin showing traction due to lowering cost and conducive economics
Bus	Subsidies will drive EV adoption for State Transport Undertakings (STUs)	Government push, lowering of battery prices to drive adoption

Step 1: Regulatory and federal policies driving EV adoption

1 | *National Electric Mobility Mission Plan*: The scheme intended to catalyse market development (demand generation, technology development, pilot projects and charging infrastructure) for creation of an EV ecosystem

2 | *FAME II*: The FAME-II intends to support 10 lakh two-wheelers, 5 lakh three-wheelers, 55,000 four-wheelers, and 7,000 buses that operate on lithium-ion batteries or other electric power-trains. As much as 10% of the outlay (Rs 100 crore) is earmarked for charging infrastructure

3 | *Amendments to model building by-laws:* mandates parking provisions for EVs in residential and commercial buildings, additional load requirement and minimum requirement of chargers

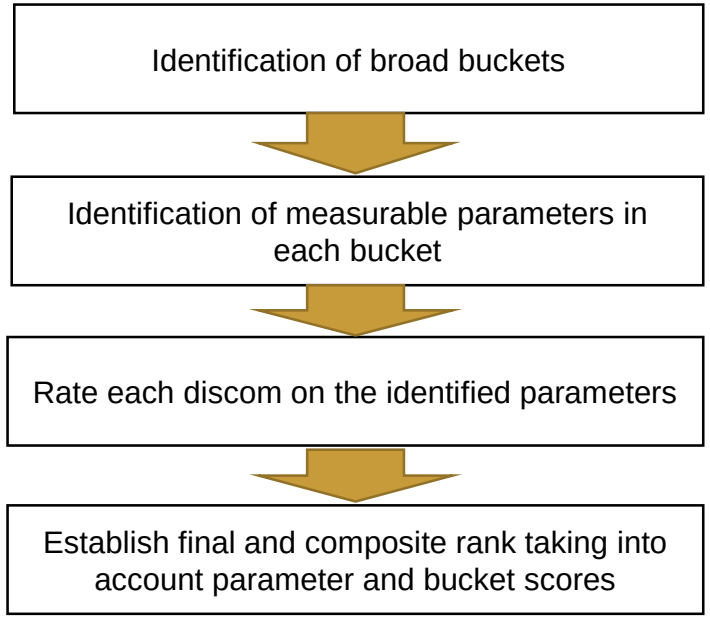
4 | *Announcements of Guidelines for EV charging stations: T*he Ministry of Power (MoP) has announced guidelines and standards for development of EV charging infrastructure in India

5 | *Reduction of taxes for EVs and spare parts:* The Central Board of Indirect Taxes and Customs (CBIC) has lowered customs duty on import of EV components to 10-15% from 15-30%, lowered applicable Goods and Services Tax (GST) on lithium ion batteries from 28% to 18%. On EVs, the GST has been slashed to 5% from 12%

6 | *De-licensing EV charging station operations:* The MoP has clarified that no licence is required to operate EV charging stations in the country

Step 2: A private electric utility was shortlisted for the study

Benchmarking Model and Parameters Used



Bucket	Parameter
Operational Metrics	Aggregate Technical and Commercial (AT&C) Losses, Distribution Losses, Collection efficiency, billing efficiency
Financial Metrics	Total Power Sales, ARR/ Sales, O&M/ Sales/ Gap (as % of ARR, ACS_ARR Gap, APPC per unit of energy sales, age of creditors
Other Key Parameters	Surplus (+)/ Deficit (-) of the state, Peak Surplus (+)/ Deficit (-) of the state, upcoming industrial and commercial clusters, policy/ implementation framework rolled out by the utility

Shortlisted utilities and outcome

Name of discom	Area of Operation
Tata Power	Mumbai
Maharashtra State Electricity Distribution Company Limited (MSEDCL)	Maharashtra (except Mumbai region)
BSES Yamuna Private Limited (BYPL)	East, North-East and central Delhi

Research

CRISIL Research has finalized a private electric utility based on interest evinced by the shortlisted utilities and intention to mutually work on the project

Step 3: Types of Chargers and charging standards to be used

- The Bureau of Indian Standards (BIS) had set up the ETD 51 Committee for formulating the standards pertaining to EV charging (sockets, plugs, and vehicle couplers). It has already finalised and released the IS:17017 standards, which pertain to charging systems in the country.

- As per Ministry of Power's notification on charger types, the following charger connectors and rated voltages have been stated

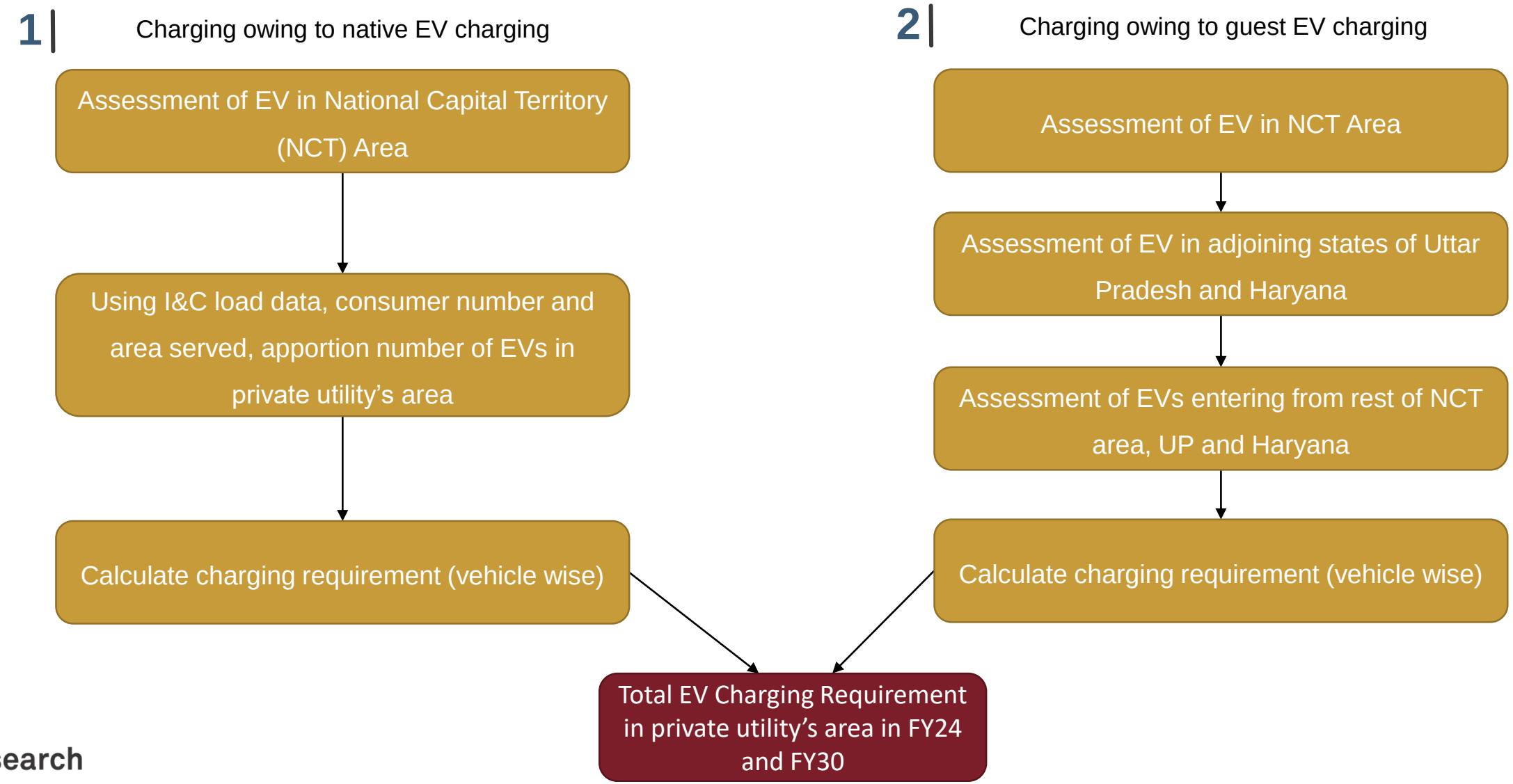
Charger type	Charger connectors	Rated voltage (V)
Fast	CCS (min 50 kW)	200-1000
	CHAdeMO (min 50 kW)	200-1000
	Type 2 AC (min 22 kW)	380-480
Slow/ moderate	Bharat DC-001 (15 kW)	72-200
	Bharat AC-001 (10 kW)	230

Potential roadmap for EV charger adoption in the country

Initial phase	Slow chargers	EV parking bays equipped with charging facilities; vehicles will be charged at home / office/ parking lots
Intermediate phase	Fast chargers	EV charging stations on major highways, thoroughfares in tier 1 cities
Maturity phase	Fast chargers with Charging Management Systems	Connected EV charging stations enabling smart charging, secure transactions, V2G

Step 4: Estimating the outlook for charging Requirement in private utility area

CRISIL performed a detailed analysis of the prospective number of EVs which are expected to charge in the private utility's area using a two-pronged method



Step 4: Estimating the outlook Charging Requirement in private utility's area (contd.)

Additional Load Emanating from EV charging in licensee area (in Million kWh)

Type	FY24	FY30
Native Charging	136	571
Guest Charging	122	149
Total	**258**	**719**

- By using ToD and ToU differential tariffs, peak demand from EVs can be met to an extent
- In other cases, additional DTs may be installed where aggregation of EVs are found to be more

Remediation Strategies for address challenges emanating from EV charger adoption

Optimal placement of charging stations	Distribution network planning along with adoption of distributed generation	Reconfiguration of distribution networks
Time of use charging	Managed Charging	Vehicle to Grid

Step 5: Location Planning of EV Charging stations in private utility's licensee area

Overall demand side planning to assess the number of PCS within a geographical area shall take into consideration the following factors:

1. *Static EV population in an area* (High-end residential pockets)
2. *Floating EV population in an area*
    - Commercial hot-spots (office complexes, coffee shops, restaurants, multiplexes, shopping malls, eatery spots, market complexes)
    - Beside highways/ expressways
3. *Charging Behavior*: Degree of charging via public charging stations and potential number of chargers per EV

Potential locations considered in private utility's licensee area for setting up of charging stations

Type of Area	Prospective Locations for Charging Stations
Urban Areas	Parking lots of residential complexes/ housing societies
	Premises of public offices/ government hospitals/ government educational institutions
	Near commercial establishments (coffee shops, restaurants, movie theatres, shopping malls, eatery hot spots, market complexes)
	Technology parks
	Municipal parking lots
	Petrol Stations
	Dedicated parking spots on roads
Highways	Rest areas
	Wayside amenities (coffee shops, restaurants, eatery hot spots)
	Petrol Stations

Step 5: Location Planning of EV Charging stations in private utility's licensee area- Six out of 14 divisions found to be suitable for station installations

- The private utility serves 14 divisions in Central, Eastern and North-Eastern Delhi.
- In order to ascertain locations for prospective PCS installations, CRISIL has assessed each location based on four major parameters: (a) Economic Profile (b) Connectivity (c) Availability of public spaces (d) Proximity to commercial hotspots.
- Using a detailed feasibility analysis, each of the shortlisted division was ranked and based on a composite score, the priorities for setting up a PCS was decided

Devising priority of PCS locations in private utility's licensee area

Division	Economic Profile	Connectivity	Public Spaces available	Proximity to commercial hotspots	Priority
Mayur Vihar	Medium	High	High	Medium	P1
Shankar Road	Medium	High	Medium	Medium	P2
Laxmi Nagar	Medium	High	Medium	Medium	P3
Patel Nagar	Medium	Medium	Medium	Medium	P3
Yamuna Vihar	Medium	High	Medium	High	P3
Daryaganj	Medium	High	Medium	Medium	P3

- *The other eight divisions have not been found suitable for PCS installations*
- *Furthermore, in each location, major areas for prospective PCS installations have been mapped*

Step 6: Capex Requirement for PCS- ~Rs. 20L-24L required for a PCS with 5 chargers

1 | Charger Costs

Type of Charger	Power Output [kW]	Approximate costs (Rs. thousands)
CCS	25	700 -800
CHAdeMO	25	700-800
Type 2 AC	22	110-130
Bharat DC 001	15	200-300
Bharat AC 001	3.3	20-50
Total costs		**1,700-2,000**

2 | Other Costs

Parameters	**Approximate costs (Rs. thousands)**
New Electricity Connection and grid upgradation costs	200
Civil Works	75
EVSE Management Software and miscellaneous costs	55
Total costs	330

- In the current market scenario, where EV sales have not picked up in the country and proliferation of e-four wheelers is at least five years away, PCSs with all charger models seem to be unviable
- However, government support, in the form of subsidies and grants, can drastically bring down costs
- GoI may initially take the subsidy route to develop the bare bone charging infrastructure with the hope that EV sales will rise and private entities will find the PCS business attractive, driving the market forward.

Step 6: Financial viability for PCS: Fast chargers not viable presently even with subsidies; slow chargers to lead installations until EV adoption rises

Financial viability of a charging station depends on:

- Upfront cost for setting up of station
- Station utilisation
- Federal, state and local government support towards EVSE

Assumptions considered for estimating financial viability of a charging station

Parameters	Year 1	Year 2	Year 3	Year 4	Year 5
Utilization levels of PCS	15%	25%	40%	40%	50%
Margin on Electricity Tariff (Rs./unit)	2.5	2.5	2.5	2.5	2.5

Outcome on financial viability of a charging station

		IRR (for 5 years)
SCENARIO 1	0% of EVSE subsidized	-25%
SCENARIO 2	50% of EVSE subsidized	-14%
SCENARIO 3	70% of EVSE subsidized	-5%
SCENARIO 4	100% of EVSE subsidized	36%

Step 7: Business Model Development for PCS installations

1 | Utility Investment Models

Model	Modality	Pricing	Risk
Make-Ready	The utility invests in “make-ready” installations, by providing electrical infrastructure (wiring, cabling, transformer set-up etc.) required for the EVSE	Not more than 15% of ACS of state	Minimal
Rebates for EVSEs, if any	Utilities provide host sites with financial incentives, such as rebates for the costs of the EVSE and/or the make-ready infrastructure portion	As per determined tariff	Moderate
Public private partnerships	Joint exercise between two entities in PCS development through JV or SPV	Based on station utilization levels	Moderate
Owner-Operator	Full build-out and operation of EVSEs at host sites	Based on station utilization levels and allowable cross subsidization between the EV owners and its own power consumers	High

- While the federal and state government’s role in giving the initial push to public charging infrastructure is critical, private investments can also accelerate the development
- Public investments can help improve the viability of charging infrastructure projects in the short run.
- This needs to bring in more private participation as the market begins developing at a faster pace.

Step 7: Business Model Development for PCS installations

Under the current market conditions, it is unlikely that the initial investment will be recovered within the investor's preferred duration of five years, by relying solely on direct revenue from the provision of charging services

2 | Possible Business Modalities for setting up of PCS in India

1	Grants and subsidies from the government to reduce capex towards station deployment
2	EV owners shall pay a monthly fee to EV manufacturers which will be bundled in the initial cost of the EV
3	City governments / municipalities / highway authorities may be mandated to allot space on long lease at concessional rates/ for free
4	Bundle EVCS in new buildings making it mandatory for residential/commercial centers exceeding a certain built up area. The impact of EVSE infrastructure cost as a proportion of total per square meter cost of the buildings will be negligible
5	EVSE infrastructure may be clubbed with highway construction cost –it will have negligible impact on per kilometer cost of highways
6	Oil distribution companies may be mandated to create EVSE infrastructure in their retail outlets
7	Public sector undertakings and large private companies (above certain turnover) may be mandated to setup (or contribute towards) EVSE infrastructure in their area of operation
8	Fleet operators and car rental companies may be allowed to setup EVSE networks
9	Allot land to setup large EVSE stations at strategic locations which will have other facilities: (a)Café (b)Gaming Stations (c) Convenient Store/ Grocery/Vegetables Shops; revenue generation from the entire commercial center can be aggregated, covering the costs of EVCS

Step 7: Business Model Development for PCS installations

3 | Risks from PCS business

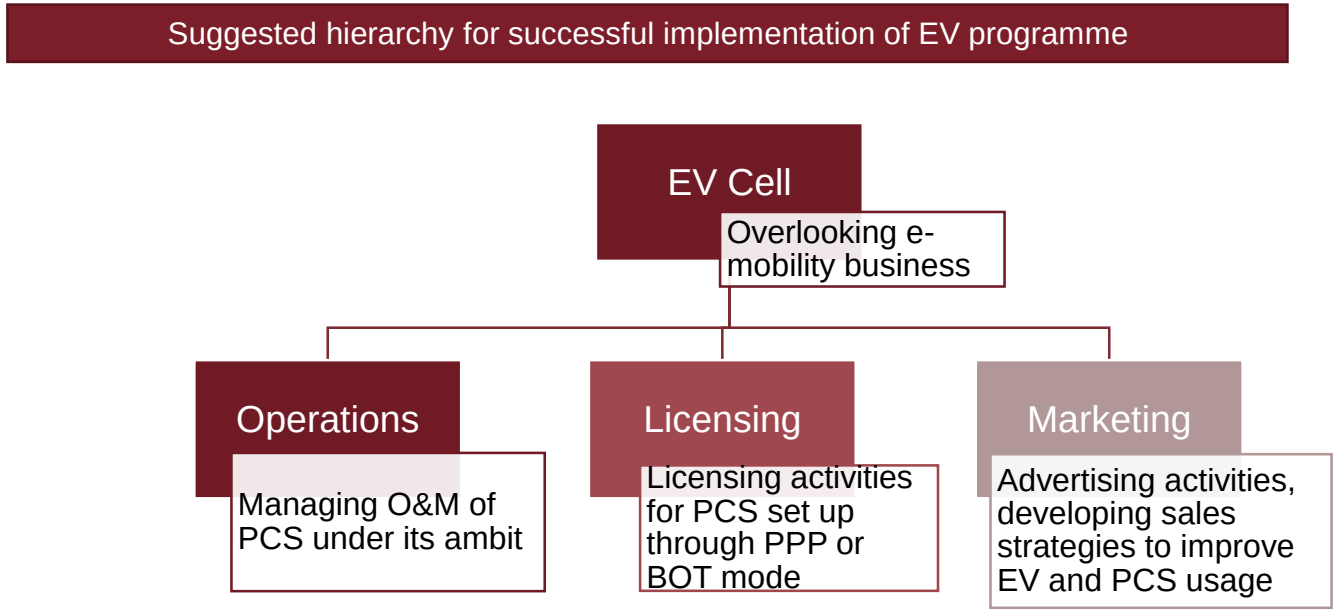
Sl. No.	Risk	Outcome	Impact
1	Differential of electricity and gasoline prices rise	Low running costs of EV vis-à-vis an ICS; adoption rates improve for EV	Positive
2	Improvements in battery technologies	Reduction in upfront costs of EVs	Positive
3	Lack of indigenisation and domestic manufacturing of EV/ EV parts	Transition from ICE based Indian auto industry to EV to take longer	Negative
4	Low station utilization	High stranded costs of PCS	Negative
5	Lack of subsidies by the government towards PCS	Sluggish development of bare bone PCS infrastructure	Negative
6	Lack of federal support in the form of conducive polices	Slacking of investor sentiment, sluggish development of PCS	Negative
6	Lack of private investment in the PCS space	PCS as a business do not scale up	Negative
7	High cost of funds, lack of financing options for setting up of PCS	Prohibitive capex costs thereby hampering investor sentiment	Negative
8	Improvement in battery swapping ecosystem	New business opportunity; to enable faster EV adoption in 2W, 3W and e-bus space	Positive

Step 7: Business Model Development for PCS installations

4 | Roadmap of business model for PCS installations by the private utility

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Penetration of EV	Low					Medium - High					
Requirement of PCS	Low					Medium - High					
Recommended Model for setting up of PCS	PPP mode					PPP mode, owner-operator mode (in strategic locations)					
Type of PCS	• With subsidies: DCFC • Without subsidies: Slow					• In high EV penetration areas: DCFC • In other areas: Slow					
Key to success	• Setting up PCS in places of early EV adopters • Availing government subsidies					• Making PCS as a self-sustaining business model • Divesting maturing stations to invest in new-growth stations					

Step 8: Organizational Capacity Planning for the private utility



- The organisational structure of the utility needs to be rejigged to align resources and skill sets towards the new areas of interest
- We do not propose creating a new vertical for EVs and e-mobility at present as it is a niche market. Utilities in the country are still studying the sector in terms of viability and business interest. Therefore, a carve-out at this juncture does not make economic sense.
- We however propose creating a new horizontal under the operational portfolio of the utility, which will look after new energy business areas like distributed generation, energy storage and e-mobility
- As e-mobility becomes a more sustainable business area, it can be carved out into a new vertical.

Conclusion

- While there are close to 1.7 million EVs in the country (with majority being e-rickshaws), the same is expected to reach ~80.4 million by fiscal 2030.
- Fast chargers will not be viable in today's time due to high upfront charger costs and potential stranded costs (owing to non-utilization)
- However, economics are expected to be more conducive as EV sales grow and market matures, thereby bringing down charger costs and improving station utilization.
- The private electric utility, based on market conditions and viability, has been advised to set up PCS, either through the PPP mode or by making strategic investments in make-ready installations in phase 1 (fiscals 2020-2024)
- In phase 2 (fiscals 2025-2030), as battery technologies mature, the owner-operator route may be explored in strategic locations while keeping the PPP model as the main stay

SECTION 4: Country in Focus- Pakistan

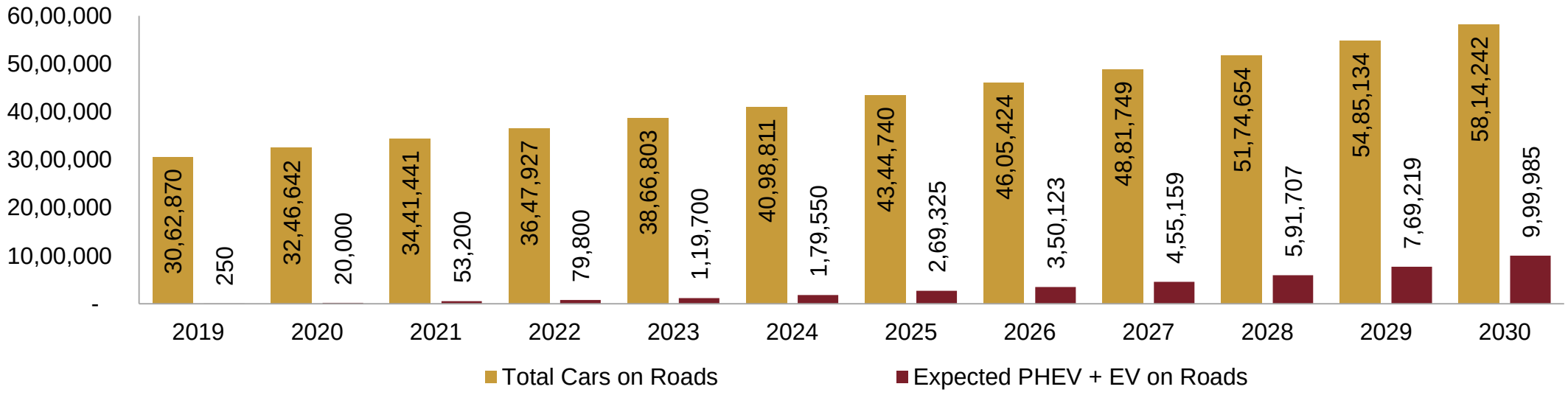
Methodology followed for the study

1. **Country EV Outlook**
   - Present EV sales (across vehicle categories)
   - Effectiveness of national support policies
2. **Shortlist one distribution utility**
   - Evaluation of all major distribution utilities using a financial benchmarking model
   - Rank utilities on each parameter and derive composite score
3. **Charging standards**
   - Charging Standards for EV Charging Stations (EVCS)
   - Type of chargers to be used in EVCS
4. **Charging Requirement in licensee area**
   - Assessment of EV population in licensee area
   - Outlook on EVs to travel from adjoining areas to licensee areas
5. **Location planning for PCS**
   - Analysis of areas under shortlisted licensee area
   - Devise prospective locations for Public Charging Stations (PCS)
6. **Capex Requirement for utility**
   - Capex and opex requirements for setting up a PCS
   - Financial viability for EVCS based on station utilization rates and power prices charged
7. **Business Model for setting up PCS**
   - Assessment of utility investment models
   - Assessment of capex side and revenue side interventions
   - Proposition of suitable business models for PCS
8. **Organizational Capacity building**
   - Organizational structure to achieve the e-mobility goal
   - Potential organogram for the utility to oversee the EV and EV charging business

Step 1: Long term Electric Vehicle penetration to be driven by 4Ws and 2Ws

- Till June 2019, a total of only 250 plug-in hybrids and full EVs were registered in Pakistan. Of these, 90% were plug-in hybrid cars. All Pakistan Motor Dealers Association (APMDA)
- BMW has tried to set up EV charging stations in seven cities across Pakistan. Three of them were installed and others are planned, and one of them was in the Islamabad Electric Supply Company (IESCO) region at Dewan Farooque Motors
- With the increase in population, consistent GDP growth, increase in foreign direct investment and new auto manufacturers coming in, conservative estimates show that Pakistan will have about 1 million electric vehicles by 2030
- Of these one million EVs, 90% will constitute cars/jeeps/SUVs. The rest will be 2-3 wheelers and a small number of hybrid busses for mass transit.

Projection of Cars and EVs on Roads of Pakistan by 2030



Step 1: Regulatory and federal policies driving EV adoption

1 | *Automotive Development Policy 2016-2021:* The policy intended to support adoption of PHEV's and EV in 4 wheel segment through reduced sales tax and custom duties.

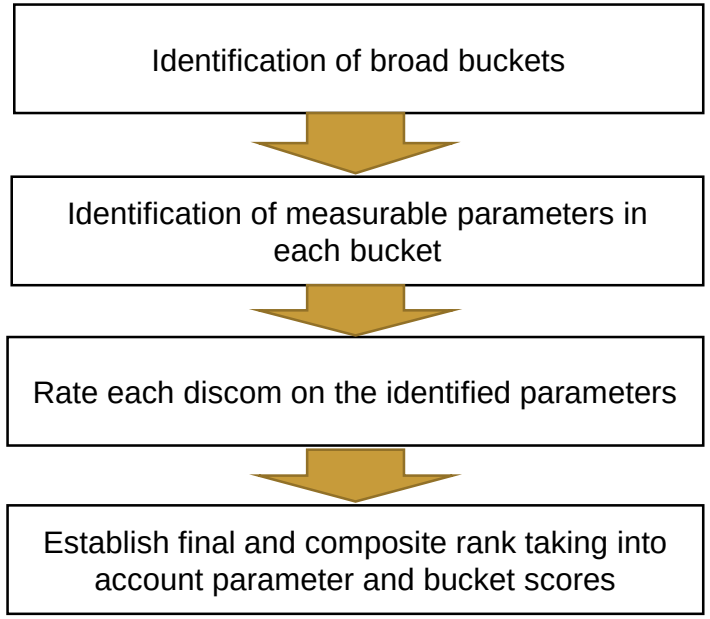
2 | *National Electric Vehicle Policy:* The policy intends to support local manufacturing of 2,3 & 4 wheelers to increase its market share. It also provide support in form of subsidies in taxes and custom duties for equipment for charging infrastructure.

Regulatory Hurdles

- Regulatory authority or distribution companies have yet to work on policy for the development of the EV market.
- No tariff regimes or incentives for early adopters have been worked out. Load flow studies and required planning to accommodate the power requirement for charging has yet to be done by DISCOs

Step 2: A public electric utility was shortlisted for the study

Benchmarking Model and Parameters Used



Bucket	Parameter
Operational Metrics	Aggregate Technical and Commercial (AT&C) Losses, Distribution Losses, Collection efficiency, billing efficiency
Financial Metrics	Total Power Sales, ARR/ Sales, O&M/ Sales/ Gap (as % of ARR, ACS_ARR Gap, APPC per unit of energy sales, age of creditors
Other Key Parameters	Surplus (+)/ Deficit (-) of the state, Peak Surplus (+)/ Deficit (-) of the state, upcoming industrial and commercial clusters, policy/ implementation framework rolled out by the utility

Shortlisted Utilities and outcome

Name of discom	Area of Operation
Islamabad Electric Supply Company (IESCO)	Islamabad region
Faisalabad Electric Supply Company (FESCO)	Faisalabad region
Gujranwala Electric Power Company (GEPCO)	Gujranwala region, Punjab

CRISIL Research has finalized a pubic electric utility based on interest evinced by the shortlisted utilities and intention to mutually work on the project

Step 3: Types of Chargers and charging standards to be used

- Due to less penetration of PHEV & EV's, till date no specific charging standards have been devised
- Globally recognized standards are expected to be followed in the initial phase.

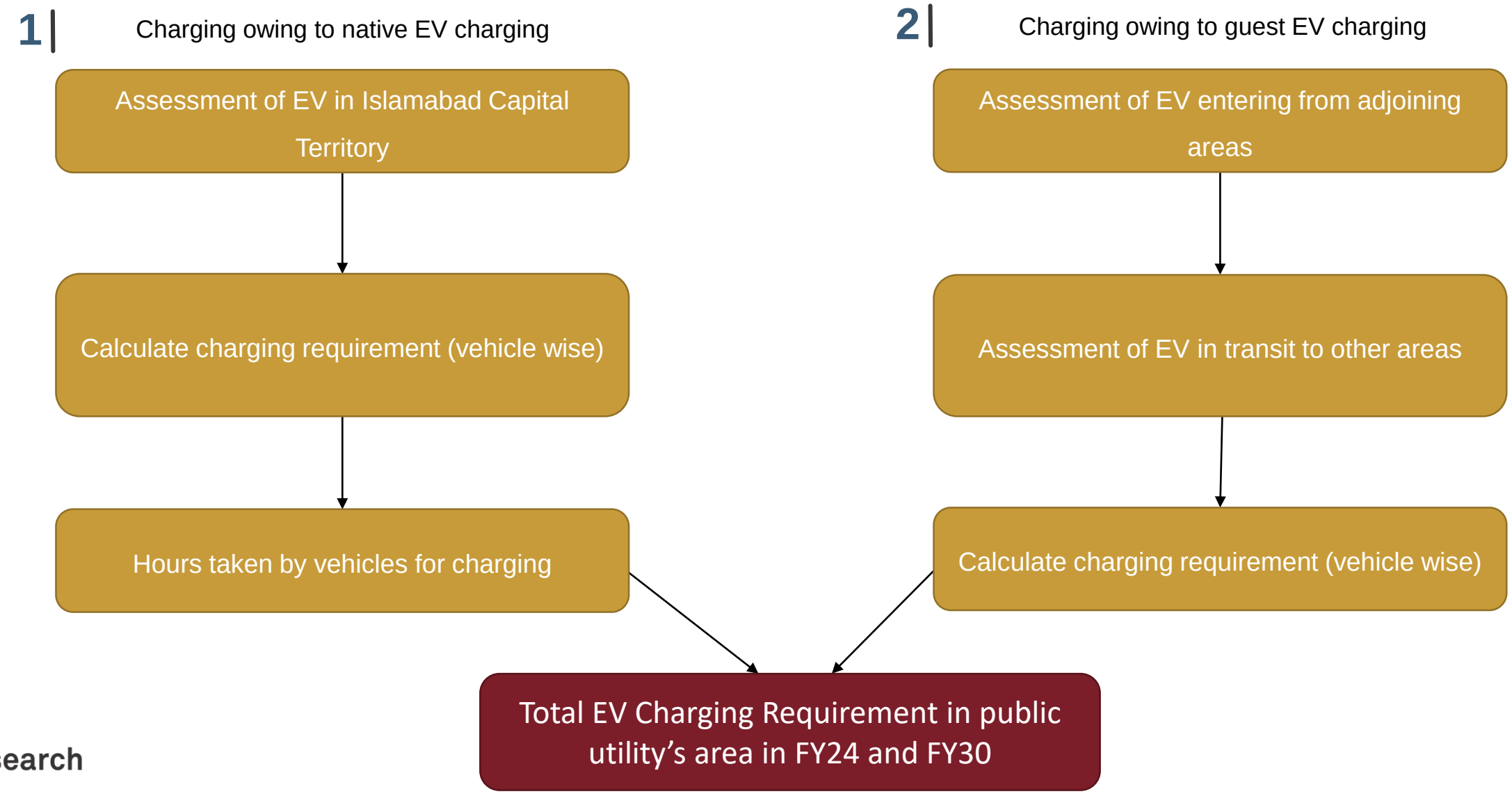
Charger type	Charger connectors	Rated voltage (V)
Fast	CCS (min 50 kW)	200-1000
	CHAdeMO (min 50 kW)	200-1000
	Type 2 AC (20 - 25 kW)	380-440
Slow/ moderate	Type 2 AC (10 - 15 kW)	380-440

Potential roadmap for EV charger adoption in the country

Initial phase	Slow/ moderate chargers	EV parking bays equipped with charging facilities; vehicles will be charged at home / office/ parking lots
Intermediate phase	Fast chargers	EV charging stations on major highways, public parking, malls, hospitals etc.
Maturity phase	Fast chargers with Charging Management Systems	Connected EV charging stations enabling smart charging

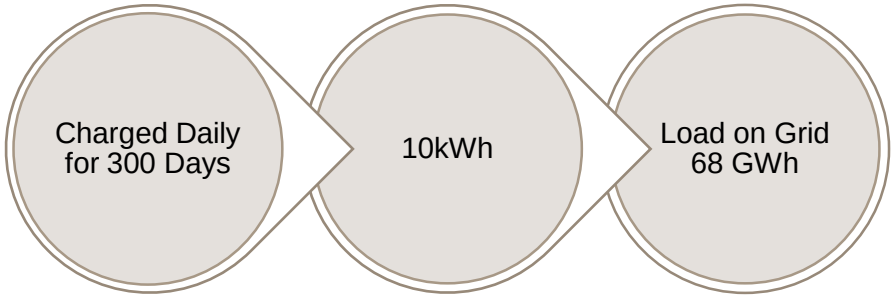
Step 4: Estimating the outlook for charging Requirement in public utility's area

CRISIL performed a detailed analysis of the prospective number of EVs which are expected to charge in the public utility's area

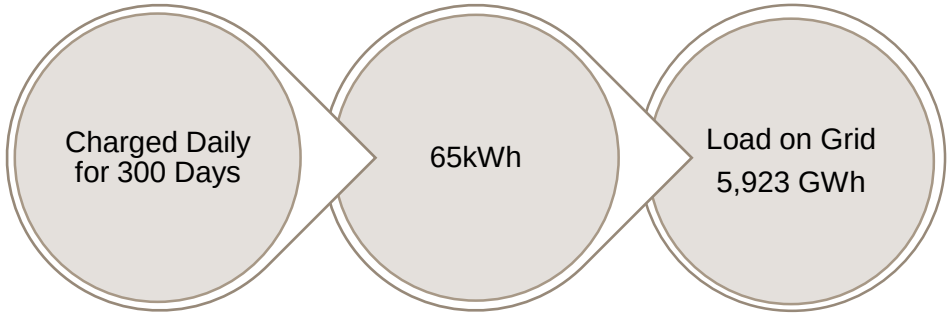


Step 4: Estimating the outlook Charging Requirement in public utility's area (contd.)

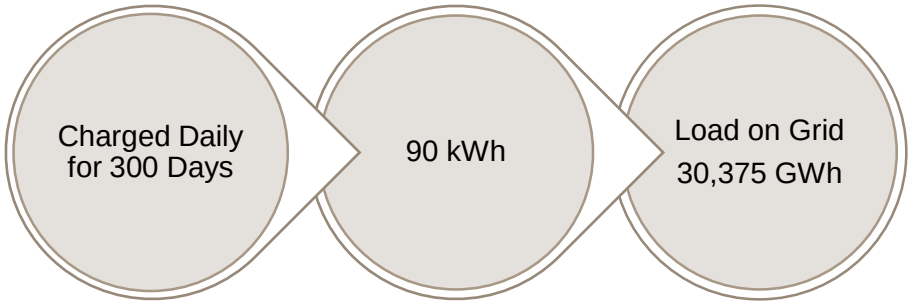
Estimated 20,000 PHEV's + EV's by 2020



Estimated 270,000 EV's by 2025



Estimated 1 million EV's by 2030



Remediation Strategies to address challenges emanating from EV charger adoption

Distribution network planning along with adoption of distributed generation	Reconfiguration of distribution networks
Time of use charging	Vehicle to Grid

Step 5: Location Planning of EV Charging stations in public utility's licensee area

- The public utility serves to urban centers of the federal capital, twin city of Rawalpindi and adjacent suburbs.
- In order to determine locations for prospective PCS installations, CRISIL has assessed each location based on four major parameters: (a) Economic Profile (b) Connectivity (c) Availability of public spaces (d) Proximity to commercial hotspots.
- Using a detailed feasibility analysis, each of the shortlisted division was ranked and based on a composite score, the priorities for setting up a PCS was decided.

Considerations for devising potential PCS locations

Overall demand side planning to assess the number of PCS within a geographical area shall take into consideration the following factors:

1. *Static EV population in an area* (High-end residential pockets)
2. *Floating EV population in an area*
    - Commercial hot-spots (office complexes, coffee shops, restaurants, multiplexes, shopping malls, eatery spots, market complexes)
    - Beside highways/ expressways
3. *Charging Behavior*: Degree of charging via public charging stations and potential number of chargers per EV
4. *Density of public EV chargers in the area*

Step 5: Location Planning of EV Charging stations in public utility's licensee area

Potential PCS locations in public utility's licensee area for Phase 1 (2020-2025)

Location Category	Potential Location	Requirement of slow chargers (up to 15 kW)	Requirement of fast chargers
Parking	Airport, Bahria Town Civic Center, F-9 Park (Mega Zone), G-5 Government Offices, Murree Road - Metro Park & Ride, Saddar Parking Plaza, Saidpur Cultural Village, Daewoo Terminal, DHA Main Market, E-11 Markaz/ Marquees, Fawara Chowk Parking Plaza, Islamic University, Lake View Park, NUST University H-12, COMSATS University, NARC	38	6
Mall	Centaurus Mall, Jinnah Park, Giga Mall RWP	7	1
Hospital	Shifa International Hospital, PIMS Hospital	4	0

Potential PCS locations in public utility's licensee area for Phase 2 (2026-2030)

Location Category	Potential Location	Requirement of slow chargers (up to 15 kW)	Requirement of fast chargers
Parking	Airport, PWD Main Market, F- 9 Park (Mega Zone), Lok Virsa, Saddar Parking Plaza, Daewoo Terminal, F -11 Markaz, Fast University, G-9 Markaz, I-8 Markaz, Lake View Park, Metro Cash and Carry, Murree Road (Metro Park & Ride), F-7 Markaz, PIEAS + Nilore, Abpara Market, F-6 Markaz, G-10 Markaz	18	1
Mall	Centaurus Mall, Jinnah Park	3	0
Hospital	Polyclinic Hospital, NESCOM Hospital	4	0

Step 6: Capex Requirement for PCS- ~PKR. 6.7M- 7M required for a PCS with 3 charger types

1 | Charger Costs

Type of Charger	Power Output [kW]	Approximate costs (PKR. thousands)
CCS	25	2,400-2,500
CHAdeMO	25	2,400-2,500
Type 2 AC	22	900-1,000
Total costs		**5,700-6,000**

2 | Other Costs

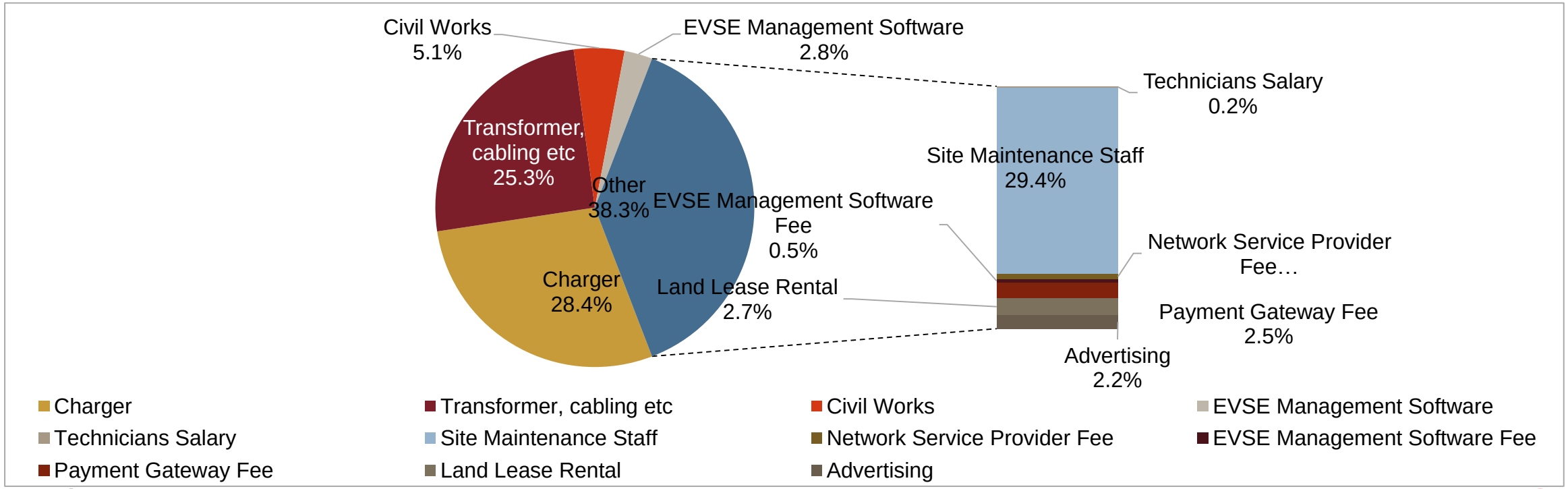
Parameters	Approximate costs (PKR. thousands)
New Electricity Connection and grid upgradation costs	870
Civil Works	65
EVSE Management Software and miscellaneous costs	70
Total costs	1,005

- In the current market scenario, where EV sales have not picked up in the country and proliferation of e-four wheelers is at least five years away, PCSs with all charger models seem to be unviable.
- GoP may initially take the subsidy route to develop the bare bone charging infrastructure at hotspots with the hope that EV sales will rise and private entities will find the PCS business attractive, driving the market forward.

Step 6: Capex Requirement for PCS- ~92 million PKR to be incurred by the public utility towards PCS installations

- For phase 1, capex required by the public utility is approximately 55.4 million PKR and the operational expense is around 20.6 million PKR
- For phase 2, the capex required by the public utility is approximately 36.5 million PKR and the operational expense is around 36 million PKR
- The major portion of the investment will be required for EV chargers and the auxiliary equipment to set up a charging station. The cost will be spent in phases according to the growth of demand for public EV chargers

Cost breakdown of EV charging infrastructure

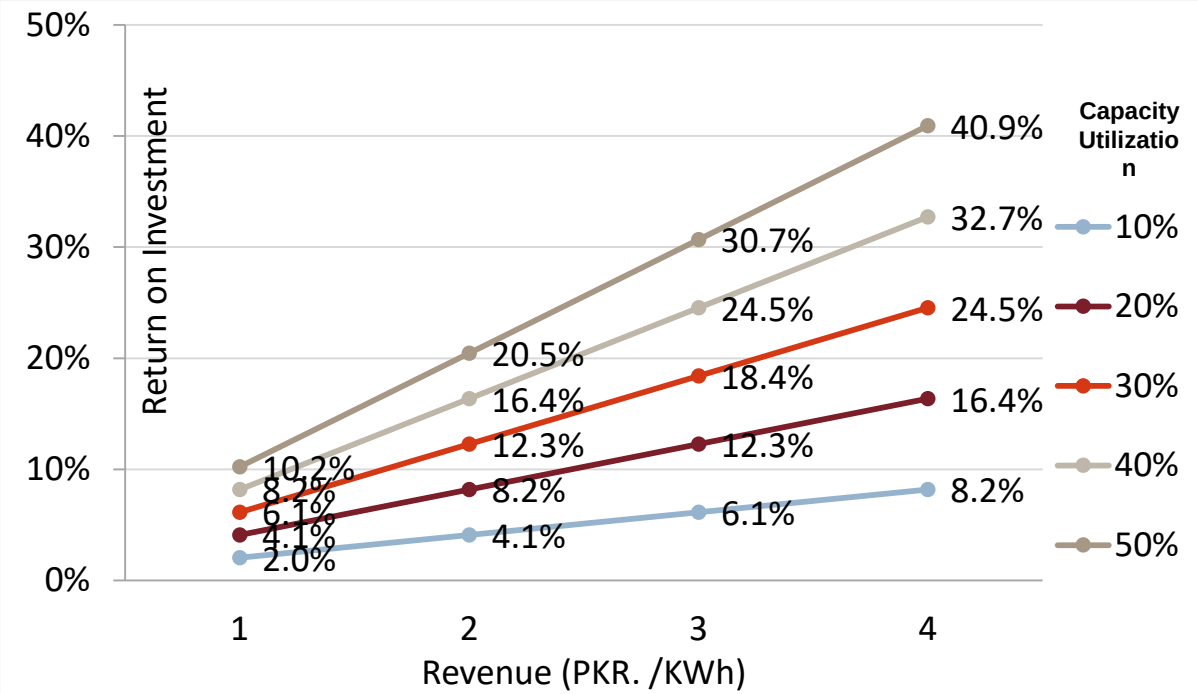


Step 6: Financial viability for PCS: Fast chargers not viable presently even with subsidies; slow/semi fast chargers to lead installations until EV adoption rises

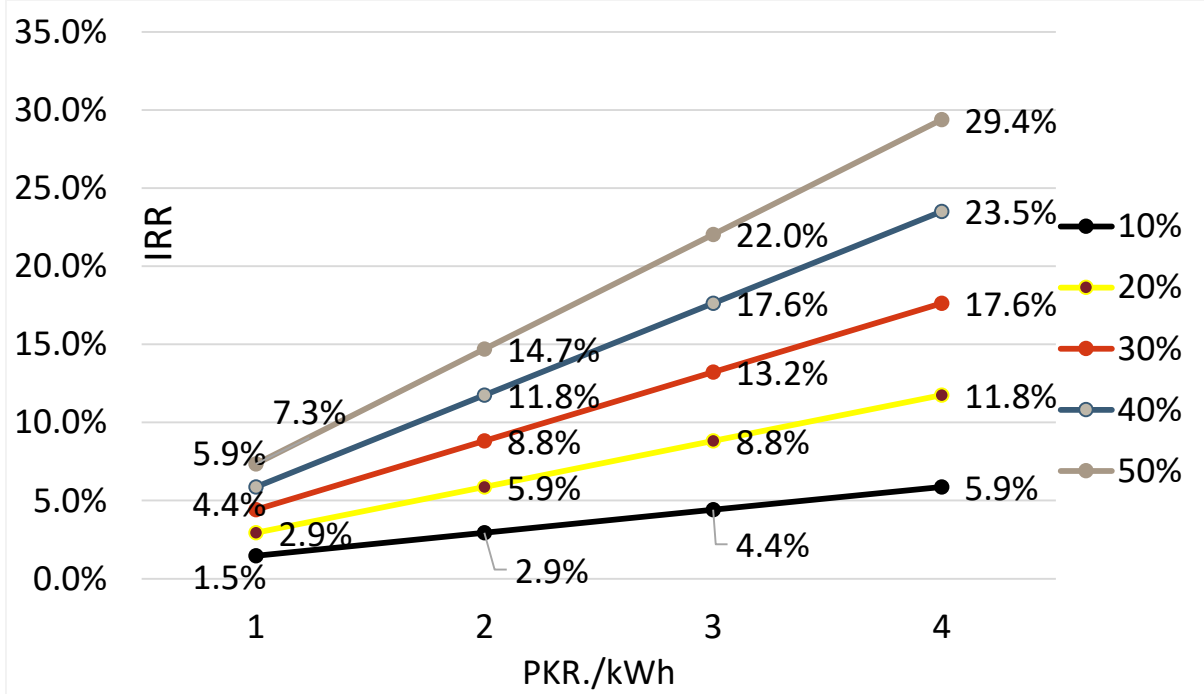
Financial viability of a charging station depends on:

- Upfront cost for setting up of station
- Station utilisation
- Federal, state and local government support towards EVSE

Outcome on financial viability of a Slow charging Station (up to 15 KW)



Outcome on financial viability of a Semi Fast charging station (up to 25 KW)



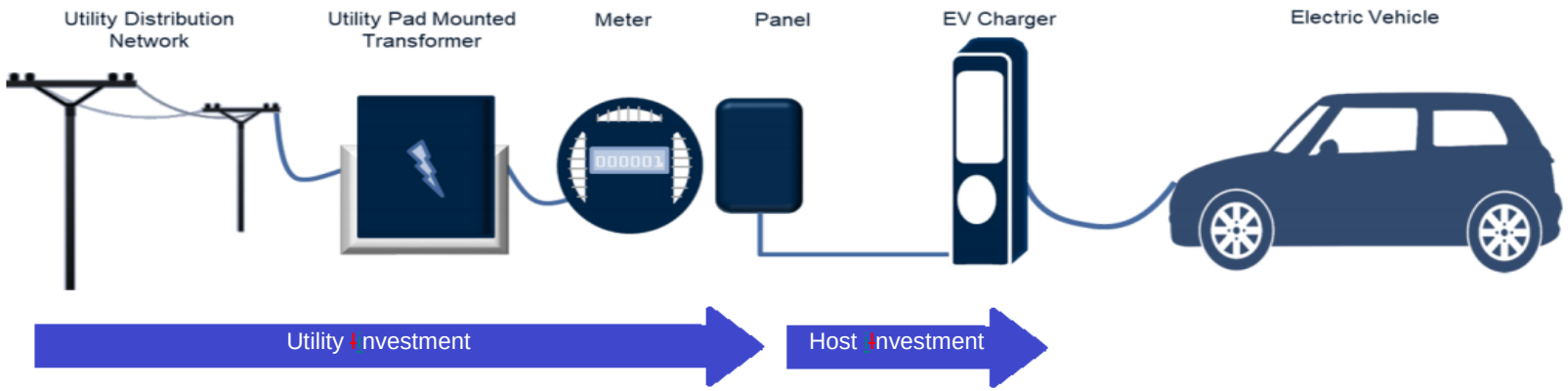
Step 7: Business Model Development for PCS installations

1 | Utility Investment Models

Business Model	Modalities	Risk
Public Private Partnership	Long-term contract (~15 years) between the public party and the private party, for the development and management of PCS, with proposed equity share between public and private parties of 70% and 30%, respectively	High
Build operate transfer (BOT)	The public party delegates to a private sector entity to design and build infrastructure and to operate as well as maintain these facilities for a certain concession period	Low

- Public investments can help improve the viability of charging infrastructure projects in the short run.
- This needs to bring in more private participation as the market begins developing at a faster pace.

Suggested Model



Step 7: Business Model Development for PCS installations

2 | Possible Business Modalities for setting up of PCS in Pakistan

1	Grants and subsidies from the government to reduce capex towards station deployment
2	Special Electricity Tariff for EV public charging infrastructure
3	City governments / municipalities / highway authorities may be mandated to allot space on long lease at concessional rates/ for free
6	Bundle EVCS in new buildings making it mandatory for residential/commercial centers exceeding a certain built up area. The impact of EVSE infrastructure cost as a proportion of total per square meter cost of the buildings will be negligible
7	Public sector undertakings and large private companies (above certain turnover) may be mandated to setup (or contribute towards) EVSE infrastructure in their area of operation

Outcome

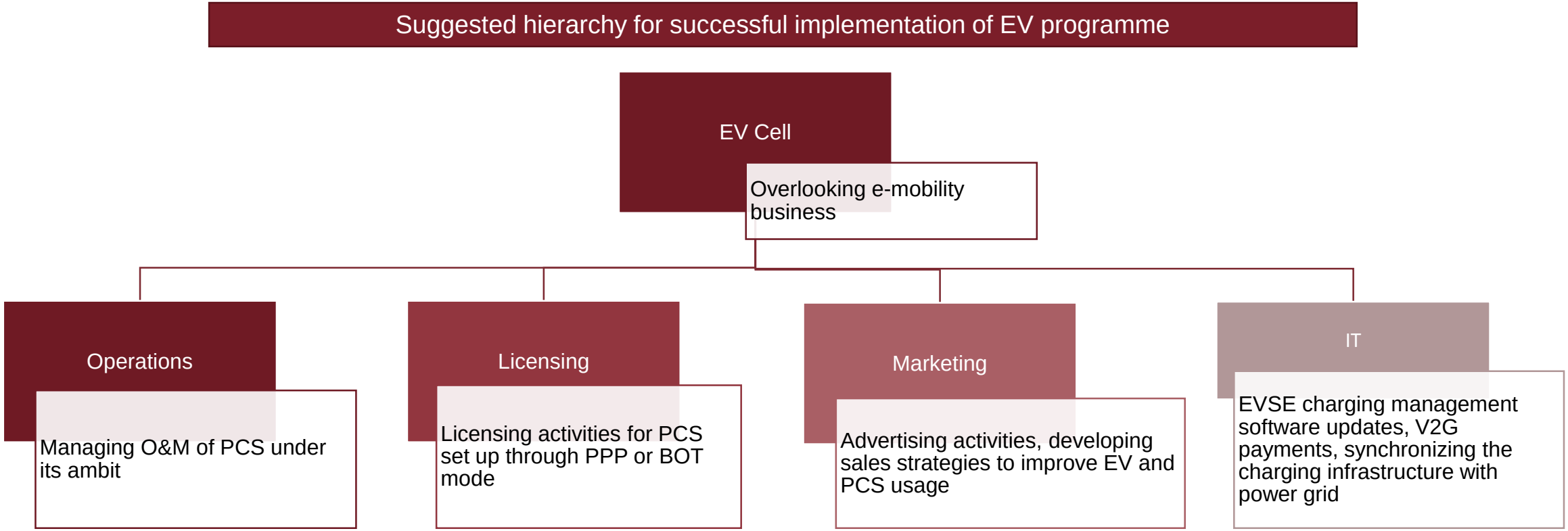
- Based on practicality and feasibility, it is suggested that the public utility invest in make-ready PCS installations by setting up necessary distribution networks, transformers, meters and other electrical equipment
- The charger costs and other EVSE will be set up by interested private parties
- The O&M of the sites will be the responsibility of the host of the EV chargers, where the maintenance can be sublet to service companies and these costs can be incorporated in the tariff models
- Delivering power to ready-to-build sites is a more practical approach to give a push-start for setting up charging infrastructure in the licensee area. This will shield the electric utility from unwanted risks and uncertainties in the EV space.

Step 7: Business Model Development for PCS installations

3 | Roadmap of business model for PCS installations by the public utility

2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Penetration of EV		Low			Penetration of EV			Medium - High		
Requirement of PCS		Low			Requirement of PCS			Medium - High		
Recommended Model for setting up of PCS		Make – Ready Sites PPP mode for strategic locations			Recommended Model for setting up of PCS			PPP mode, owner-operator mode, BOT mode		
Type of PCS		• With subsidies: Semi Fast • Without subsidies: Slow			Type of PCS			• In high EV penetration areas: DCFC • In other areas: Slow/Semi Fast		
Key to success		• Setting up PCS in places of early EV adopters • Availing government subsidies			Key to success			• Making PCS as a self-sustaining business model		

Step 8: Organizational Capacity Planning for the public utility



- The organisational structure of the utility needs to be rejigged to align resources and skill sets towards the new areas of interest
- We do not propose creating a new vertical for EVs and e-mobility at present as it is a niche market. Utilities in the country are still studying the sector in terms of viability and business interest. Therefore, a carve-out at this juncture does not make economic sense.
- As e-mobility becomes more sustainable business area, it can be carved out into vertically integrated model.

Step 8: Organizational Capacity Planning for the public utility (contd.)

Suggested improvements in terms of organizational capacity enhancement

- Understand the nature of complexity, and the skills necessary to manage the implementation of the EV program
- Develop role and skill profiles of staff relative to the requirement of the project
- Ensure the team managers have proper project management skills in order to achieve the KPIs
- The planning staff should be trained to analyze the impact on grid, site evaluation, etc.
- Monitoring, evaluation and audit team to be trained for the program
- Dedicated team of software management staff to be trained according to the country dynamics

Conclusion

- While the population of full-fledged electric vehicles in the country is miniscule, hybrid cars imported into Pakistan has risen steadily. As per CRISIL estimates, electric cars density by 2030 is expected to be 15%, i.e., four electric cars per 1000 people with close to 1 million EVs on the roads cumulatively during the same time.
- Government push, policy incentives and rise in per capita income in the country will lead to increased uptake of EVs.
- Based on practicality and feasibility, it is suggested that the public utility invest in make-ready PCS installations by setting up necessary distribution networks, transformers, meters and other electrical equipment
- Delivering power to ready-to-build sites is a more practical approach to give a push-start for setting up charging infrastructure in the licensee area. This will shield the public utility from unwanted risks and uncertainties in the EV space.
- However, economics are expected to be more conducive as EV sales grow and market matures, thereby bringing down charger costs and improving station utilization.

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