

EV Charging Infrastructure Business Models

28th January 2020

India EV Policy Goals

	Policy	Target
National Level	National Electric Mobility Mission Plan 2020	6-7 million EV sales by 2020 (~30% vehicle sales to the EVs)*
State Level	Telangana Draft EV Policy	100% EV sales for public transport vehicles by 2030**
	Gujarat Draft EV Policy	100,000 EV sales by 2022***

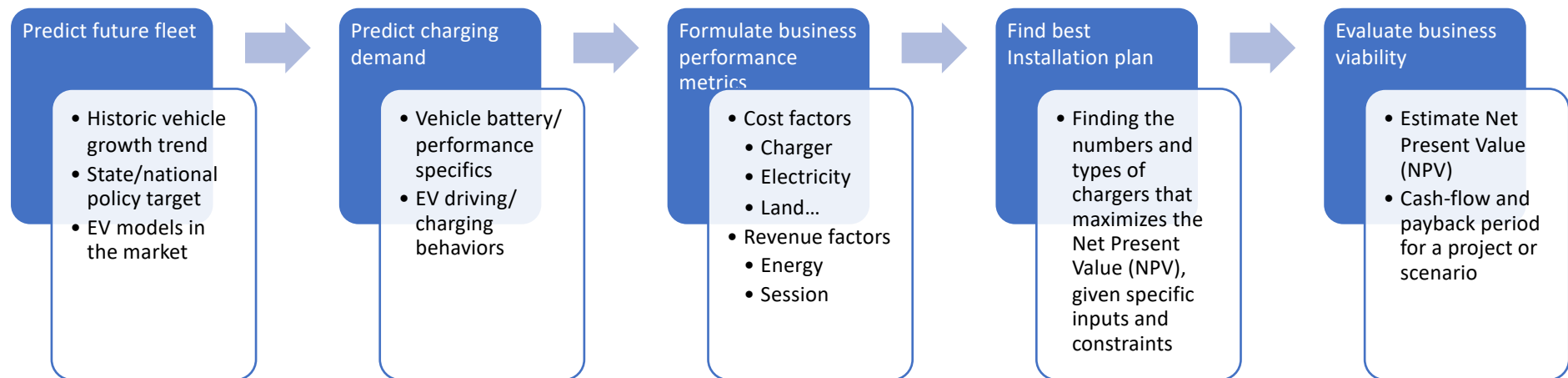
* Includes all vehicles. Current EV sales = 0.28 million (1.7% EV sales). Therefore the same target is taken for 2030. This was proposed by Society of Indian Automobile Manufacturers as well.

** Public transport includes buses, 3W (commercial), 4W taxis

*** 100,000 EVs include 80,000 2W, 14,000 3W, 4500 4W taxis and 1500 buses

Model Description

Find the most attractive business and policy interventions for EV charging infrastructure in a city/region



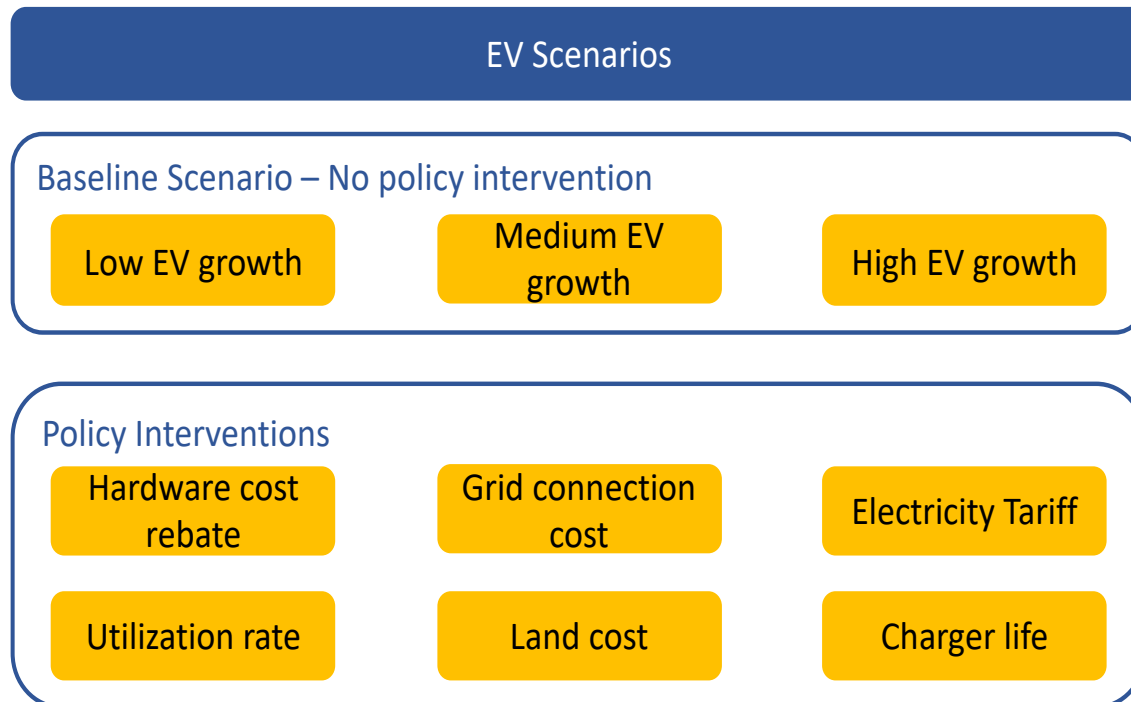
- Model inputs are specific to Hyderabad and Ahmedabad
- Can include transportation network companies (e.g. Ola/Uber), private 4-wheelers, buses, and 2/3 wheelers
- Data is obtained from primary and secondary research of the Indian EV market and through exchange with experts and state partners

Model Inputs

1. Electric vehicle projections
2. Electric vehicle models (specifying electric range, battery capacity, max. charging capability)
3. Annual utilization rate of installed EV chargers
4. Costs:
 - Cost and kW rating of charging equipment (INR)
 - Power grid upgrade cost (INR/connection)
 - Land cost (INR/sqft/month)
 - Labor & materials cost (INR/connection)
 - Payment system cost (INR/kWh)
 - Maintenance cost (INR/kWh)
 - Electricity rate (INR/kWh)
5. Charger installation time span (years)
6. Charger life span (years)
7. Years meeting demand after installation (years)
8. Discount rate (%)
9. Loan interest rate (%)
10. Loan tenure (years)
11. Revenue Factors:
 - Charging fee (INR/kWh)
 - Session fee (INR/session)
 - Idle fee (INR/hr)

Scenarios Analyzed

City-specific scenarios for Ahmedabad and Hyderabad were analyzed. The performance of a project was explored by evaluating the differences between the baseline scenarios and policy intervention scenarios.



Four electric vehicle use cases are evaluated based on FAME II incentives:*

- Two-wheelers (both private and commercial use)
- Three-wheelers (commercial use)
- Four-wheelers – ride-hailing companies (e.g. Uber/Ola)
- Buses

* FAME II incentives do not apply to private 4 wheelers.

Policy Interventions - Evaluation Results

There are a number of policy interventions to advance and accelerate electric mobility in India.

For the Indian market, the following policy interventions focused on charging infrastructure are important to improve the economics:

Reducing upfront capital cost

- Financial incentives on the hardware cost of charging infrastructure for service providers
- Rebate on the grid connection cost

Reducing the operating expenses

- Reduction in land cost – identify land parcels owned by government and lease it to the charging infrastructure providers at discounted costs and for longer time periods.
- Lower electricity tariff for EV charging by introducing Time of Day (ToD) charging to manage peak power demand

Improving charger utilization

- More optimal siting of public chargers to improve charger utilization and economics
- Regulation on charging equipment lifespan to promote high-quality chargers with longer service life, reduced maintenance costs and repairs
- Ensure universal access to chargers installed by different companies to improve interoperability by introducing a common payment system.

Financing

- Work with banks and financing institutions to implement innovative financing mechanisms like low-interest loans (keeping in mind the low utilization of EV)

Scenarios Analyzed

The following vehicle use-case scenarios have been analyzed:

EV Use Case	City	2030 EV Sales Scenario	Multi-policy scenario
2W	Ahmedabad	10% and 30%	<ol style="list-style-type: none"> Charging Equipment Rebate – 50% incentive on the cost. Rebate available for 3 years. Charger lifespan increased from 6 years to 9 years
	Hyderabad	30% and 100%	
3W	Ahmedabad	10% and 30%	<ol style="list-style-type: none"> Charging Equipment Rebate – 50% incentive on the cost. Rebate available for 3 years. Grid connection cost per charging station reduced from INR 155,000 to 120,000 Charger lifespan increased from 6 years to 9 years
	Hyderabad	30% and 100%	
4W Taxis	Ahmedabad	10% and 30%	<ol style="list-style-type: none"> Charging Equipment Rebate – 50% incentive on the cost. Rebate available for 3 years. Grid connection cost per charging station reduced from INR 155,000 to 120,000 Charger lifespan increased from 6 years to 9 years
	Hyderabad	30% and 100%	
Private buses	Charging business viability of a private bus company like Shuttl is assessed assuming it runs 300 buses on 60 routes daily.		

Evaluation of policies to improve the
charging service business model for 4-
Wheel Taxis
(Hyderabad Example)

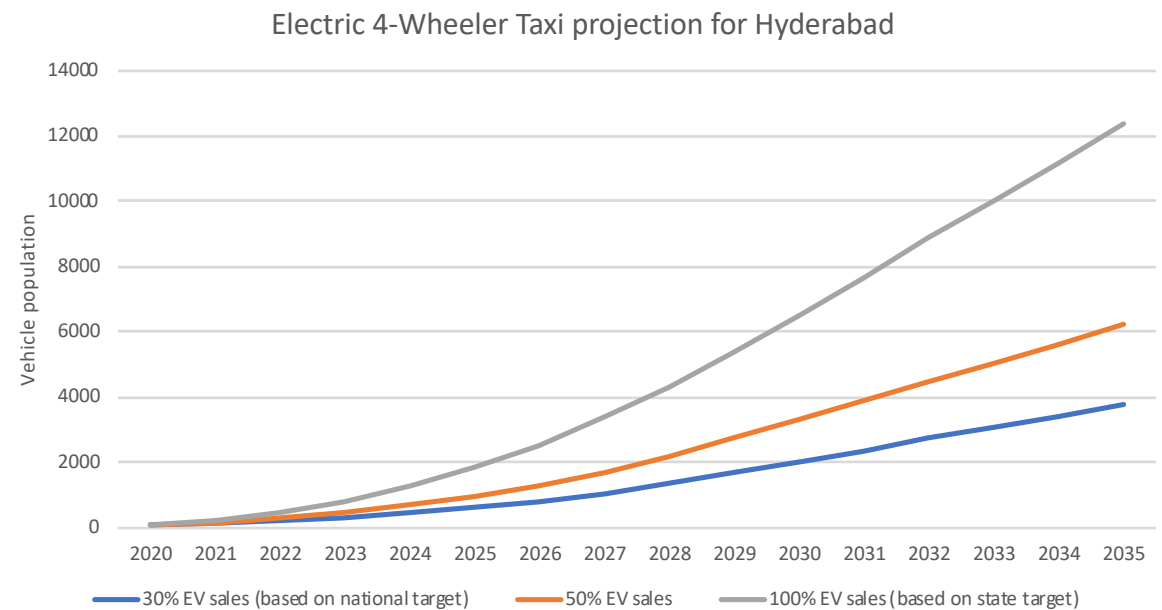
4-Wheel Taxi Use Case Description

- Per the FAME II program, incentives are focused on shared mobility compared to private vehicles
- EV growth will be dominated by shared mobility vehicles, such as taxis.
- Taxi drivers will prefer **DC fast charging** and will utilize more “opportunity” charging during the day compared to people driving personal vehicles.
- Decreasing charging times would allow for more rides and greater flexibility for long trips

EV Vehicle Population

EV projection

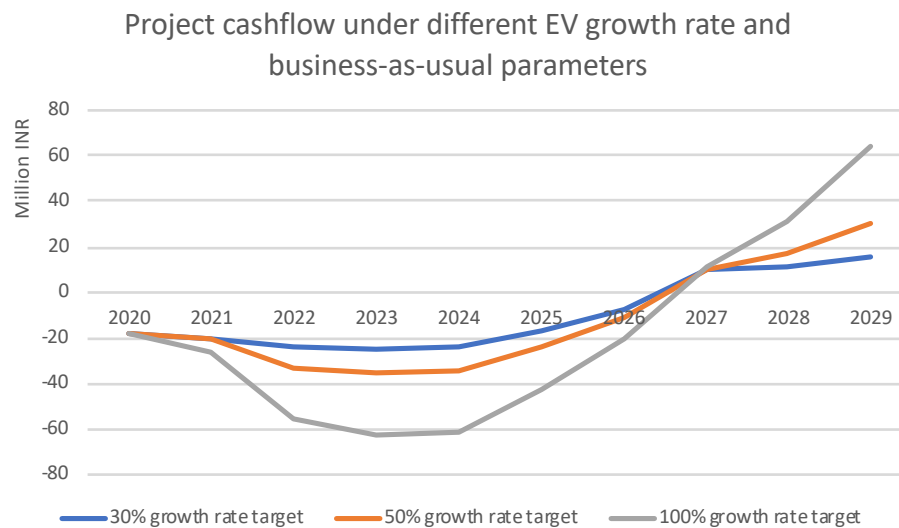
- Historic EV registration data used to predict future 4-wheel taxi growth by linear extrapolation
- EV sales percentage applied to yearly growth to project future 4-wheel taxi growth, based on state/national EV targets.



Scenario construction

Three year initial installation period	Continuous installation until target year 2030
<ul style="list-style-type: none">• Installation happens in the first 3 years of the project• Assume chargers last 6 years, so the project concludes at Year 9• Shows how a typical private charging service company performs• BAU scenario is compared against scenarios where policy levers are applied to assess the effectiveness	<ul style="list-style-type: none">• Installation can happen at any year until policy target year 2030• Makes sure charging demand is met until target year 2030• Shows the scale of investment needed to meet the policy target

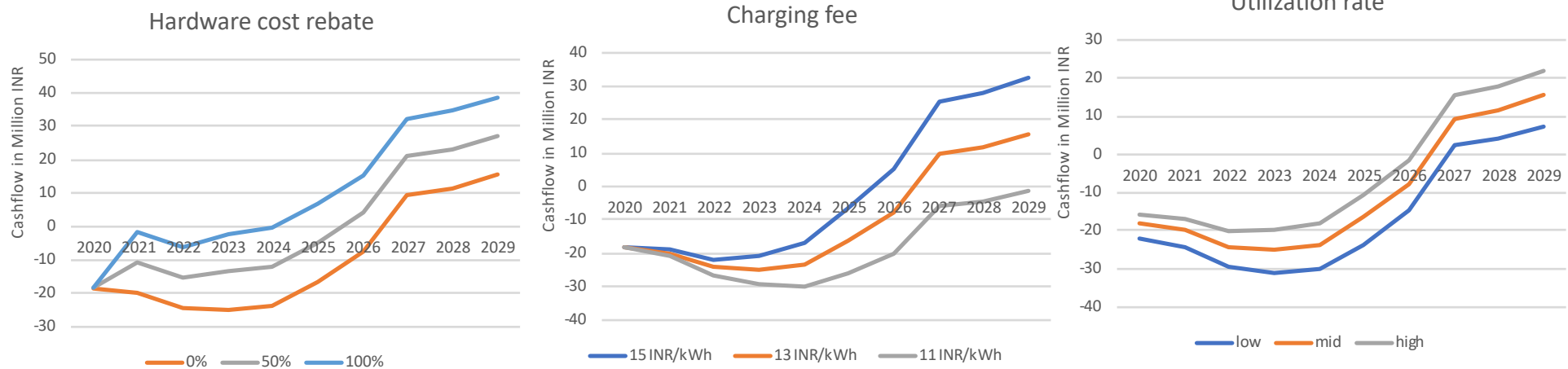
Result: Installation only in the initial 3 years (FAME II period)



- Under business-as-usual parameters, a 9 year long charging service project achieve payback at around the 7th year, which is challenging for a prospective private company
- Higher EV penetration affects the scale of debt and profit but does not impact the payback period much

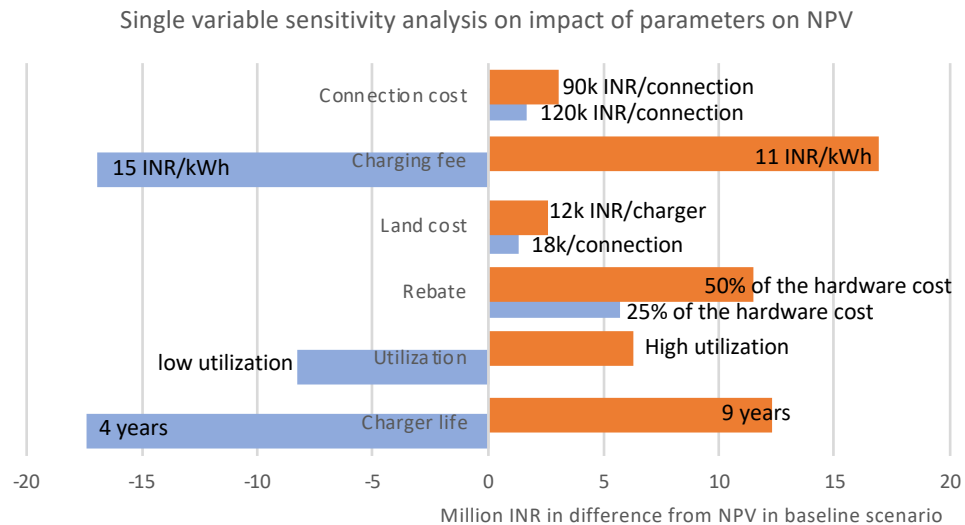
Result: Installation only in the initial 3 years (FAME II period)

High impact parameters (with 30% EV sales)



- The financial performance is positively impacted with higher rebates, ability to charge service fees, and the station's utilization rates
- A payback of 4 years is achieved if the rebate covers 100% of the hardware costs (rebate is offered under FAME II)
- Increases in service fees will be limited by the EV customer's willingness to pay.
- Land costs, the charger life span, and the connection cost have a smaller impact
- **An effective policy bundle should at least include policies that target hardware cost, charging fee, utilization rate**
- An experimental strong policy bundle of 100% hardware cost rebate and an additional 2 INR/kWh margin between electricity tariff and charging fee will be effective enough to shorten the payback period to 3 years

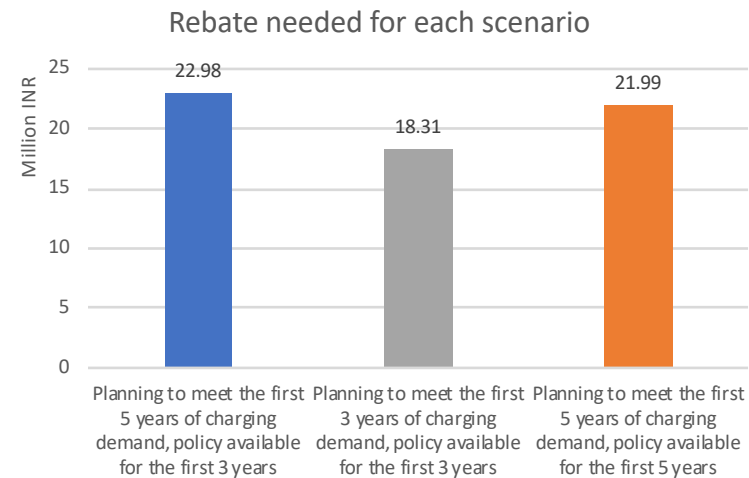
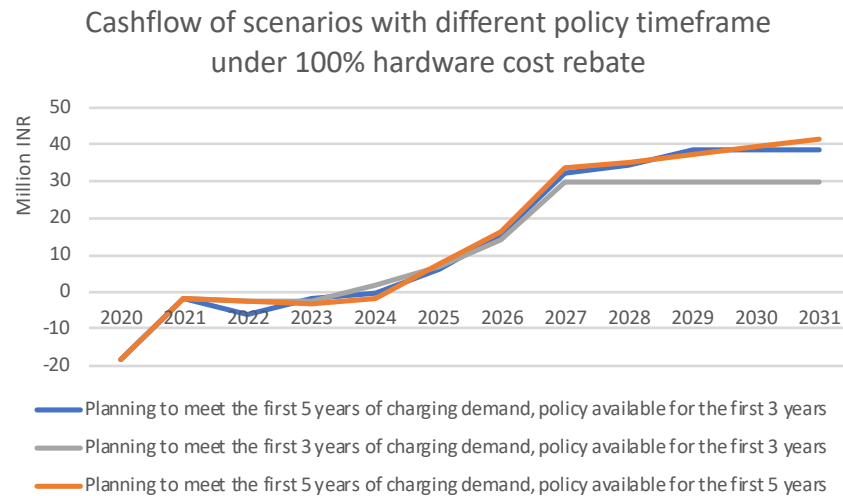
Result: Installation only in the initial 3 years (FAME II period)



- The financial performance is positively impacted with higher rebates, ability to charge service fees, and the station's utilization rates
- A payback of 4 years is achieved if the rebate covers 100% of the hardware costs (similar policy offered under FAME II)
- Increases in service fees will be limited by the EV customer's willingness to pay.
- Land costs, the charger life span, and the connection cost have a smaller impact
- **An effective policy bundle should at least include policies that target hardware cost, charging fee, utilization rate**
- An experimental strong policy bundle of 100% hardware cost rebate and an additional 2 INR/kWh margin between electricity tariff and charging fee will be effective enough to shorten the payback period to 3 years

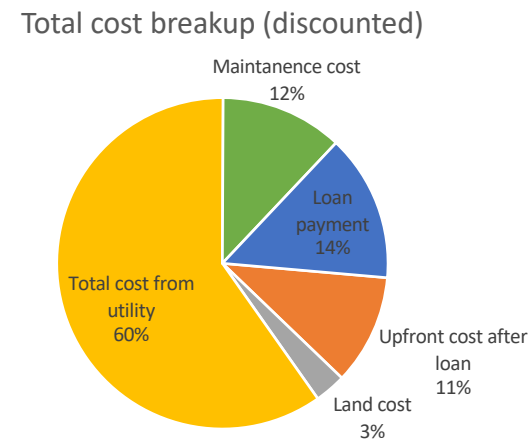
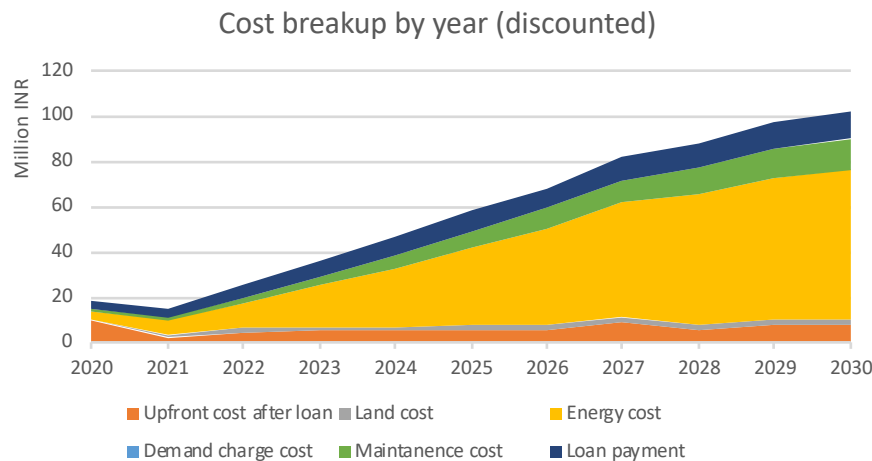
Result: Installation only in the initial 3 years (FAME II period)

Evaluating the timeframe of incentive policy



- Extended FAME II will result in highest NPV, followed by normal FAME II period but installing extra chargers for the future 2 years of demand. Installing chargers that meet the charging demand only when FAME II is effective results in the least competitive NPV.
- Advantages of extended FAME II are:
 - keeping the debt level in the starting stage lower
 - less public money for rebate
 - Higher NPV

Result: 2030 Telangana state policy target (100% EV sales)



- In Hyderabad, almost 510 chargers will need to be installed from 2020 to 2030 for charging infrastructure to meet the charging demand from taxis being entirely electrified, the ratio between taxis and public chargers will be about 10:1
- Capital investment and ongoing cost (present value) will total 640 million INR between 2020 to 2030 to establish and operate the charging infrastructure network. The overall infrastructure project will in the end create positive monetary value of 65 million INR (NPV).
- 60% of the cost is payment to the utilities, which indicate charging infrastructure can be a great revenue source for utilities
- Hardware cost dominates the first few year, energy cost dominates afterwards

Conclusions and recommendations

- Absent policy interventions, a private charging service providers that starts at 2020 will have to expect payback at the 7th year, which makes the business case risky and unattractive
- Policy interventions are needed to make the business case attractive so the utility and private capital will enter in the initial years to support EV growth
- Effective policy interventions should at least target hardware costs, charging fees and utilization rates
- To meet the Telangana EV policy target, nearly 510 chargers will need to be installed over the years, and just over 640 million INR investment in present value is needed. Utilities can expect a big revenue flow.
- Although policy intervention is needed to get the charging infrastructure business started the business itself is sustainable and will result in positive NPV in the long run in most scenarios