

# FINANCIAL PLANNING FOR THE ELECTRIC BUS TRANSITION: A CASE STUDY OF RURAL AND INTERCITY BUS ELECTRIFICATION IN KARNATAKA

## ANNEXE-I

Table 3:

VARIABLE FOR TCO ESTIMATION	DIESEL BSVI, 12M, NON-AC	BEB, 12M, NON-AC
Bus life (in years)	12	12
Vehicle utilisation (km/bus/day)	350	350
Annual operating days	350	350
Annual vehicle-km per bus	1,22,500	1,22,500
Total cost of bus (w-battery) (in INR)	35,00,000	1,50,00,000
Cost of bus (ex-battery) (in INR)	NA	1,11,60,000
Cost of battery (in INR)	NA	38,40,000
Capex cost of battery/kWh (in INR)	NA	12,000
Annual decrease in battery cost	NA	5%
Capex cost of charger (in INR)	NA	18,00,000
GST payable on purchase of bus and battery	18%	5%
GST payable on purchase of charging infrastructure	NA	18%
Energy cost (diesel price (INR/L) or electricity price (INR/kWh))	80	5
Electricity price annual growth rate (%/yr)	5%	5%
Energy efficiency ((km/L) or (kWh/km))	4	0.93
Applicable subsidy on capex	0	0
End of life salvage value of e-bus as % of original cost	0%	0%
Vehicle maintenance cost/km	1.5	2.0

VARIABLE FOR TCO ESTIMATION	DIESEL BSVI, 12M, NON-AC	BEB, 12M, NON-AC
Charging infrastructure maintenance cost (INR/DLE)	0	1.0
Other administration costs per km	9.0	9.0
Annual change in other operations costs/year	5%	5%
Conductor costs (INR/km)	8	8
Conductor cost annual growth rate (%/yr)	10.0%	10.0%
Battery capacity (kWh)	NA	320 kWh
Years for battery replacement	NA	6
Type of charger	NA	Fast (260 kW)
Charging infra life (years)	NA	20
Rated battery capacity (kWh)	NA	320
Effective e-bus/ICE bus to be replaced ratio	NA	1.0
Cost of depot infrastructure per bus for STU (civil and upstream electrical infrastructure)	NA	INR 5 lakhs per bus

► Table 3: Key assumptions for bus-level TCO analysis

## ANNEXE-II

Table 4:

VARIABLE FOR TCO ESTIMATION	DIESEL STU IN-HOUSE OPERATIONS	ELECTRIC STU IN-HOUSE OPERATIONS	GCC	DRY-LEASE
Driver costs (INR/km)	8	8	5	8
Driver cost annual growth rate (%/yr)	10%	10%	6%	10%
Debt share for capex on e-bus ex-battery	95%	95%	90%	90%
Debt share for capex on battery	95%	95%	100%	100%
Debt share for capex on charging infra	100%	100%	100%	100%
Debt share for capex on ICE bus	95%	95%	90%	90%
Interest rate on loan against bus, battery, charging infra	9%	9%	10%	10%
Tenure for all loans (yrs)	6	6	6	6

► Table 4: Business model-specific TCO assumptions

## ANNEXE-III

Table 5:

COST ITEM	TCO PER KM (350 KM/BUS/DAY) (IN INR)				TCO PER KM (350 KM/BUS/DAY) (IN %)			
	DIESEL BUS	ELECTRIC BUS BUSINESS MODELS			DIESEL BUS	ELECTRIC BUS BUSINESS MODELS		
	STU IN- HOUSE	STU IN- HOUSE	GCC	DRY- LEASE	STU IN- HOUSE	STU IN- HOUSE	GCC	DRY- LEASE
BUS	1.9	6.8	7.1	7.1	3%	10%	12%	10%
BATTERY	0.0	4.4	4.4	4.4	0%	7%	7%	7%
CHARGING IN- FRASTRUCTURE	0.0	0.5	0.5	0.5	0%	1%	1%	1%
TOTAL INTER- EST	0.8	4.1	4.6	4.6	1%	6%	8%	7%
INSURANCE	0.0	0.0	1.5	1.5	0%	0%	3%	2%
CREW	28.5	28.5	21.3	28.5	40%	44%	35%	42%
FUEL	26.5	6.2	6.2	6.2	37%	9%	10%	9%
MAINTENANCE & ADMINISTRA- TION	13.4	14.9	14.9	14.9	19%	23%	25%	22%
TOTAL	71.1	65.5	60.6	67.8	100%	100%	100%	100%

(Currency conversion: 1 USD ≈ INR 80) (TCO values based on real cash flows and not adjusted for inflation)

► Table 5: Per-km TCO over 12 years for alternative business models (12m non-AC bus)

## ANNEXE-IV

Table 7:

FINANCIAL METRIC	SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4
	BS VI + EV PURCHASE	BS VI ON GCC + EV PURCHASE	BS VI + EV ON GCC	BS VI PURCHASE +
Total current fleet size of 3 STUs	17,558	17,558	17,558	17,558
Total number of new buses to be procured up to 2030	25,323	25,323	25,323	25,323
Number of diesel buses to be procured up to 2030	12,669	12,669	12,669	12,669
Number of e-buses to be procured up to 2030	12,654	12,654	12,654	12,654
PV of capex TCO (in INR Cr)	15,300 (USD 1.9 b)	11,191 (USD 1.4 b)	684 (USD 0.1 b)	4,939 (USD 0.6 b)
PV of opex TCO (in INR Cr)	79,878 (USD 10.0 b)	80,501 (USD 10.1 b)	68,436 (USD 8.6 b)	85,960 (USD 10.7 b)
PV of financing costs TCO (in INR Cr)	13,810 (USD 1.7 b)	9,983 (USD 1.2 b)	-	3,793 (USD 0.5 b)
Total TCO (in INR Cr)	1,08,987 (USD 13.6 b)	1,01,675 (USD 12.7 b)	69,120 (USD 8.6 b)	94,692 (USD 11.8 b)

(Currency conversion: INR 1 Cr ~ USD 125,000)

► Table 7: Summary of fleet-level TCO between 2022 and 2030 for the 3 STUs in Karnataka

## ANNEXE-V

Table 8:

Interest on loan	Loan tenure	Equity share of capital	Total capital cost (in INR Cr)	Total financing cost (in INR Cr)	Total operations cost (in INR Cr)	Total cost (in INR Cr)	Total capital cost (in %)	Total financing cost (in %)	Total operations cost (in %)	Total cost (in %)
10 % loan interest rate	5 yrs	10%	28,268	30,280	73,989	1,32,538	21%	23%	56%	100%
		20%	28,268	38,382	73,989	1,40,639	20%	27%	53%	100%
		30%	28,268	47,129	73,989	1,49,386	19%	32%	50%	100%
	6 yrs	10%	28,268	30,105	73,989	1,32,363	21%	23%	56%	100%
		20%	28,268	39,428	73,989	1,41,685	20%	28%	52%	100%
		30%	28,268	49,614	73,989	1,51,871	19%	33%	49%	100%
	7 yrs	10%	28,268	29,707	73,989	1,31,965	21%	23%	56%	100%
		20%	28,268	40,123	73,989	1,42,380	20%	28%	52%	100%
		30%	28,268	51,613	73,989	1,53,871	18%	34%	48%	100%
20 % loan interest rate	5 yrs	10%	28,268	30,616	73,989	1,32,874	21%	23%	56%	100%
		20%	28,268	38,808	73,989	1,41,066	20%	28%	52%	100%
		30%	28,268	47,652	73,989	1,49,910	19%	32%	49%	100%
	6 yrs	10%	28,268	30,440	73,989	1,32,697	21%	23%	56%	100%
		20%	28,268	39,866	73,989	1,42,123	20%	28%	52%	100%
		30%	28,268	50,165	73,989	1,52,423	19%	33%	49%	100%
	7 yrs	10%	28,268	30,037	73,989	1,32,295	21%	23%	56%	100%
		20%	28,268	40,569	73,989	1,42,826	20%	28%	52%	100%
		30%	28,268	52,187	73,989	1,54,444	18%	34%	48%	100%

Interest on loan	Loan tenure	Equity share of capital	Total capital cost (in INR Cr)	Total financing cost (in INR Cr)	Total operations cost (in INR Cr)	Total cost (in INR Cr)	Total capital cost (in %)	Total financing cost (in %)	Total operations cost (in %)	Total cost (in %)
30 % loan interest rate	5 yrs	10%	28,268	30,953	73,989	1,33,210	21%	23%	56%	100%
		20%	28,268	39,235	73,989	1,41,492	20%	28%	52%	100%
		30%	28,268	48,176	73,989	1,50,433	19%	32%	49%	100%
	6 yrs	10%	28,268	30,774	73,989	1,33,032	21%	23%	56%	100%
		20%	28,268	40,304	73,989	1,42,561	20%	28%	52%	100%
		30%	28,268	50,716	73,989	1,52,974	18%	33%	48%	100%
	7 yrs	10%	28,268	30,367	73,989	1,32,625	21%	23%	56%	100%
		20%	28,268	41,014	73,989	1,43,272	20%	29%	52%	100%
		30%	28,268	52,760	73,989	1,55,018	18%	34%	48%	100%

(Currency conversion: INR 1 Cr ≈ USD 125,000)

► Table 8: PV of TCO: Sensitivity analysis for cost of financing