



CEYLON ELECTRICITY BOARD

Analysis of External Impacts on Electricity Demand Forecast

Eng. Buddhika Samarasekara
Chief Engineer (Generation Planning)
Transmission Division
Ceylon Electricity Board
Sri Lanka
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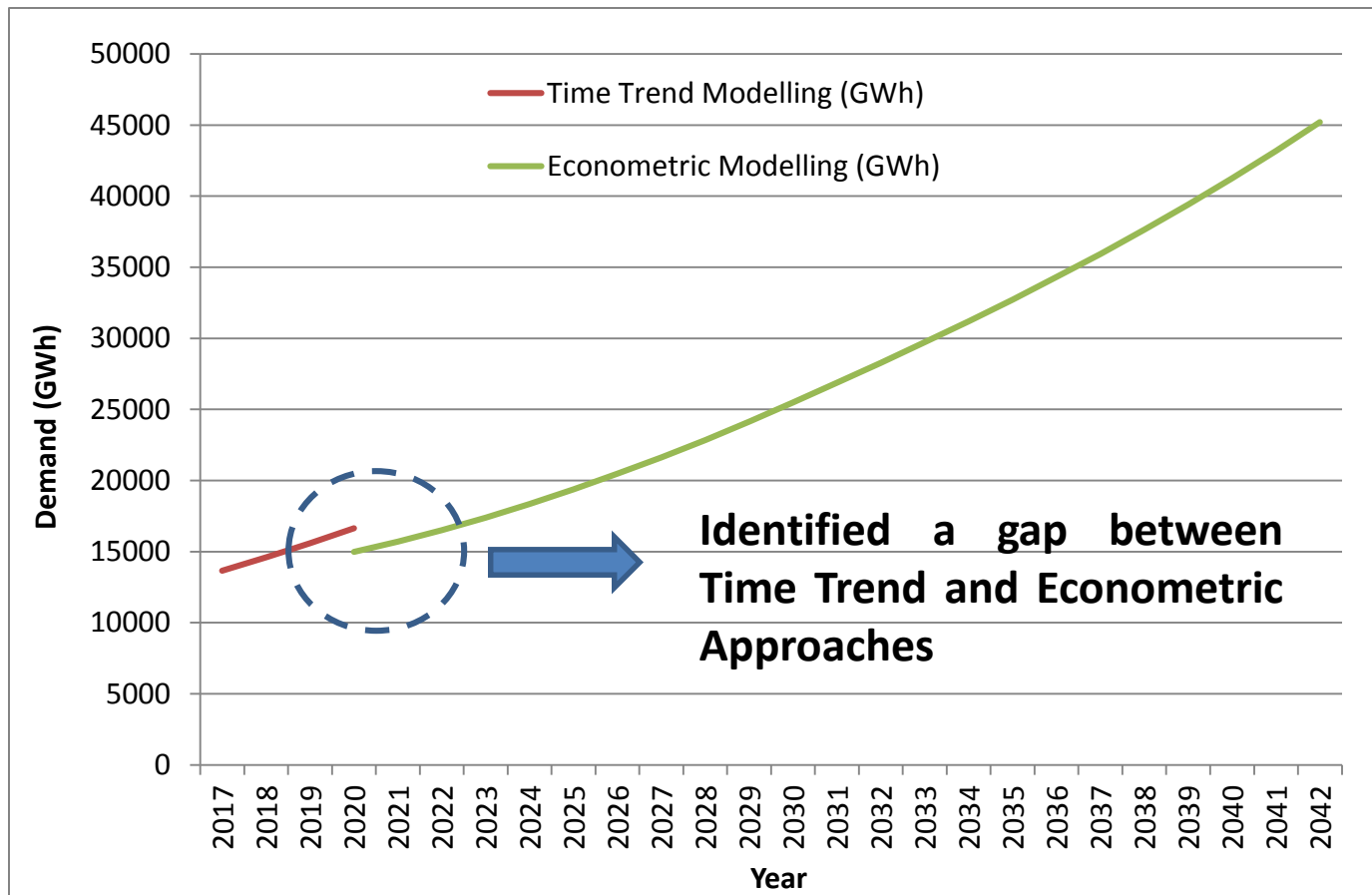


OUTLINE OF THE PRESENTATION

- **Introduction**
- **Identified External Factors on Electricity Demand Forecast 2018-2042**
- **Seasonal Effects on Electricity Demand**
- **Tariff variation on Electricity Demand**
- **Major Development Projects**
- **Energy conservation and Demand Side Management (DSM)**
- **Electric Vehicles (EV) on electricity demand**
- **Electrification of Public Transportation System**
 - Railway Electrification
 - Rapid Transit System (RTS)

INTRODUCTION

- It is important to consider the **external factors on electricity demand forecast** which doesn't reflect with long term econometric approaches



IDENTIFIED EXTERNAL FACTORS ON ELECTRICITY DEMAND FORECAST 2018-2042

- Considered external factors on electricity demand forecast:
 - **Seasonal effects (Temperature)**
 - **Tariff Variation**
 - **Energy Conservation and Demand Side Management (DSM)**
 - **Electric Vehicles**
 - **Electrification of Public Transportation System**
 - **Major Development Projects**

SEASONAL EFFECTS ON ELECTRICITY DEMAND

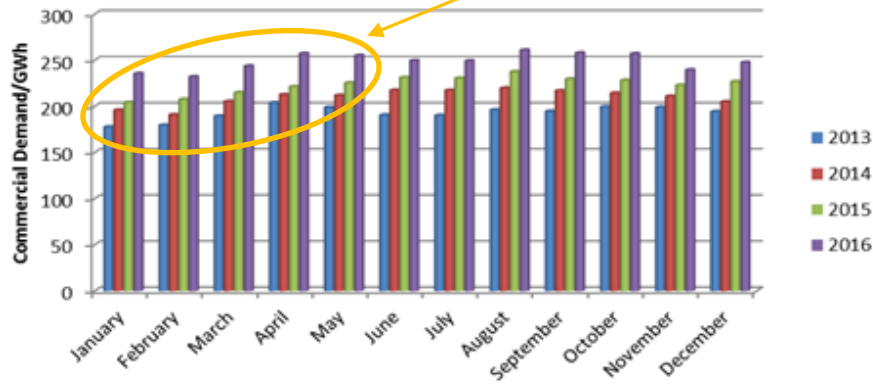
- Temperature Increase → Increase in electricity consumption for cooling appliances. Eg: Air conditioning
- Considered Commercial and Industrial sector demand variation in 2013 - 2016

Commercial Demand (GWh)					Year to Year Growth (%)		
	2013	2014	2015	2016	13/14	14/15	15/16
Total	2316	2520	2681	2987	8.8%	6.4%	11.4%
Industrial Demand (GWh)					Year to Year Growth (%)		
	2013	2014	2015	2016	13/14	14/15	15/16
Total	3343	3498	3608	3864	4.6%	3.1%	7.1%

SEASONAL EFFECTS ON ELECTRICITY DEMAND

- Year 2016 showed the higher temperature compared with past 4 years and higher consumption of electricity for cooling appliances

Higher year on year growth rate than other months



- 4% to 5% demand increase in Commercial and Industrial sectors than the normal trend due to temperature variation

TARIFF VARIATION ON ELECTRICITY DEMAND

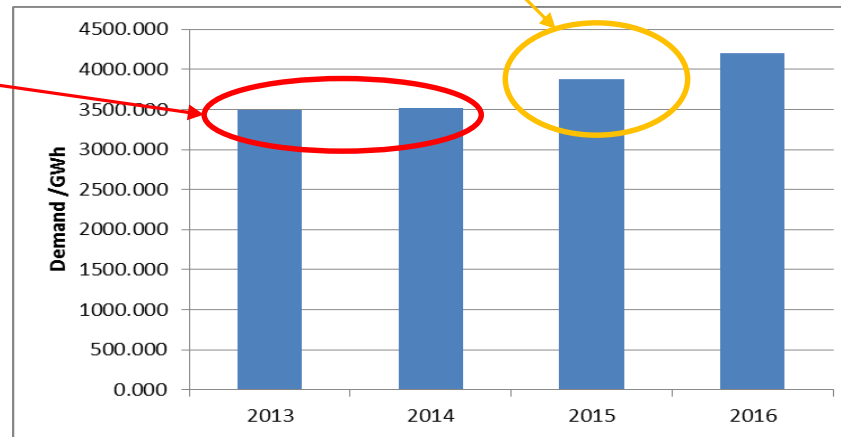
- Domestic tariff decrease  Increase in domestic sector electricity consumption
- Government decreased the domestic tariff with effective from November 2014
- Observed higher domestic demand growth in 2015

	2013	2014	2015	2016
Total Domestic Demand (GWh)	3488	3521	3876	4198
Growth		0.9%	10.1%	8.3%

TARIFF VARIATION ON ELECTRICITY DEMAND

Higher growth rate compared to past two years

Negligible
growth rate
in 2014



- 10% domestic sector demand increase with domestic tariff variation and diminished gradually over the years

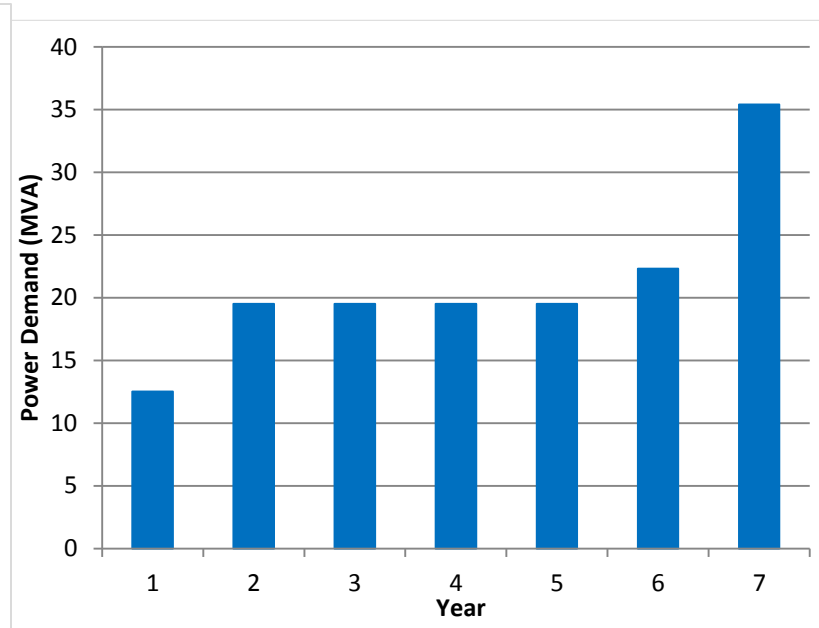
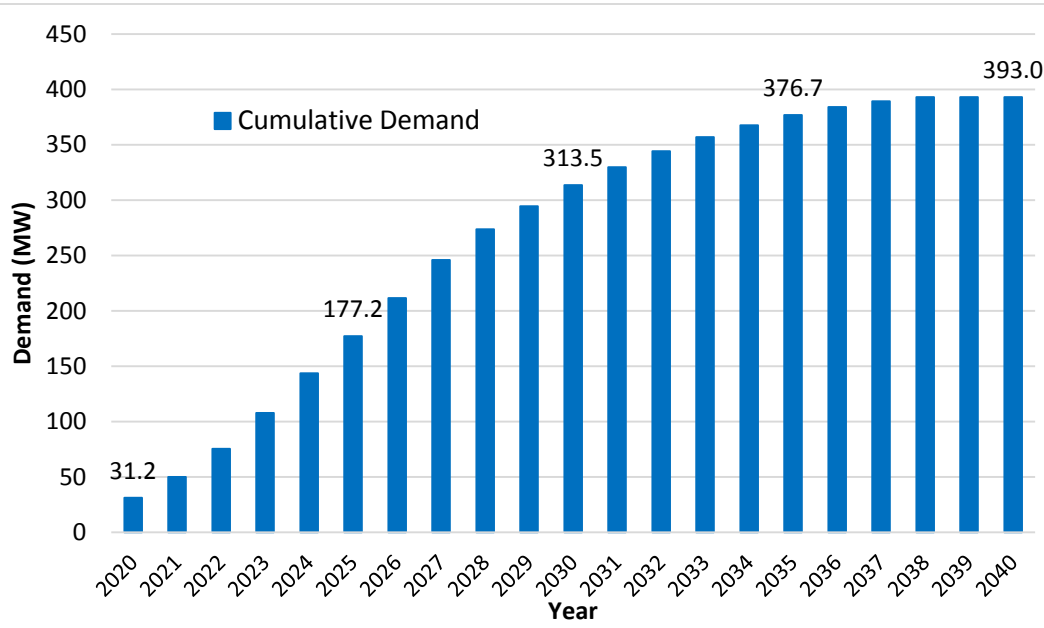
MAJOR DEVELOPMENT PROJECTS

- Proposed and planned large scale developments by the government will lead to increase in electricity demand in future
- All major projects are phase developments
 - Lower demand requirement in initial stages
 - Increase the demand requirement with project development
- Identified major developments in Sri Lanka
 - Western Region Megapolis Plan
 - Colombo Port City Development
 - Hambantota Port Development Plan
- For the long term planning purpose, it is required to identify the **time based load requirement to determine the load pattern** which would impact on electricity demand

DEMAND FORECAST OF MAJOR DEVELOPMENTS PROJECTS

Colombo Port City Development

Hambantota Development



This demand includes dock yard, LNG power plant, cement grinding plant and refining plant.
Indicative Demand for 8th Year onwards = 417MVA

Western Region Megapolis Development

- Transport
- Multi Model Transport Hub (Pettah)
- Colombo Central Business District
- Housing Development
- Horana & Mirigama Industrial Townships
- SME Industry
- Colombo Port City
- Science and Technology City
- Tourism

Indicative Demand Requirement

By 2020	By 2025	By 2030
390 MW	585 MW	974 MW

ENERGY CONSERVATION AND DEMAND SIDE MANAGEMENT (DSM)

- Sri Lanka Sustainable Energy Authority (SLSEA) implement Energy Efficiency Improvement and Conservation (EEI&C) program, Operation Demand Side Management (ODSM)
- Identified key thrust areas for energy saving:
 - Efficient Lighting
 - Efficient Fans
 - Efficient Refrigerators
 - Efficient Air Conditioning
 - Efficient Pumps
 - Efficient Motors
 - Eliminating Incandescent Lamps
 - Green Buildings
 - Energy Management System & Building Management Systems
 - Smart Homes

ENERGY CONSERVATION AND DEMAND SIDE MANAGEMENT (DSM)

- Identified market segments for ODSM:
 - Industrial
 - Commercial
 - Residential/SME/Government
- Programme targets:
 - **1,104 GWh energy saving and 417 MW capacity reduction by 2020 focusing energy efficiency appliances and appliance control initiatives**
 - **Avoid 139 GWh energy and 100 MW capacity by 2020 focusing on Solar PV roof top systems**

ENERGY CONSERVATION AND DEMAND SIDE MANAGEMENT (DSM)

Major problems identified in DSM for the determination of electricity demand forecast:

- Utilities do not have a proper control over the implementation and monitoring of DSM
- Identified DSM measure by SLSEA will purely depend on consumer attitudes
- Ensuring deterministic demand reduction may not be realistic with the subsidies given to the electricity sector in different categories

Ceylon Electricity Board did not consider the DSM in Electricity Demand Forecast 2018-2042

ELECTRIC VEHICLES (EV) ON ELECTRICITY DEMAND

- The number of EVs in the Sri Lankan vehicle market started to increase after January 2015, with reduction of taxes compared to other vehicles
- CEB introduced a new tariff category that has three time blocks for meter and charging separately to avoid peak time charging

EV demand estimation based on Electricity Sector Master Plan Study in Sri Lanka

Estimation of total no. of vehicles in 2040

- Forecast based on past trend is not reliable with changes in government tax policy
- Therefore, total number of vehicles is calculated by the population and ownership ratio of Sri Lanka in 2040
 - Present – 32 nos/Thousand people
 - By 2040 – 100 nos/Thousand people (3 times higher)

ELECTRIC VEHICLES (EV) ON ELECTRICITY DEMAND

Future EV Share

- Considered the forecasts by industrial car companies, research institutes and government agencies:

	2030	2035	2040	2050	Assumption Base
International Energy Agency (IEA)	10%	-	25%	40%	Environment
Energy Company	-	6%	-	-	Market Trend
Industrial Car Company	15%	-	-	-	Sales Target

- Assume 20%-30% of vehicles will be replaced with EVs by 2040

ELECTRIC VEHICLES (EV) ON ELECTRICITY DEMAND

Electricity Demand for EVs

- Purely depend on the charging pattern (how much and when) of EVs
- Analyzed daily charging patterns of other countries
 - Charging at household only
 - Charging at household, commercial building and shopping mall
 - Charging at household, commercial building, shopping mall and working place

Predicted 60MW demand in day time and 100MW demand in the night time beyond 2040

ELECTRIFICATION OF PUBLIC TRANSPORTATION SYSTEM

- Electrification of public transportation system with main two components:
 - Railway Electrification
 - Rapid Transit System (RTS)

EV demand estimation based on Electricity Sector Master Plan Study in Sri Lanka

Railway Electrification in Sri Lanka

- Electricity demand calculated based on the length of the electrified lines

Route	Section	Length
Main Line, Coast Line	Panadura - Veyangoda - Polgahawela	110 km
Puttalam Line with Airport Spur	Ragama – Negombo with Airport Spur	26 km
Kelani Valley Line	(all sections)	59 km
(New Line)	Kottawa to Horana	22 km
(New Line)	Kelaniya to Kosgama via Biyagama, and Dompe	30 km
Total		247 km

ELECTRIFICATION OF PUBLIC TRANSPORTATION SYSTEM

- High Case : Electrification of all major lines

Route	Length (km)	Frequency per day	Stations
Main Line & Matale Line	324	137	98
Puttalam Line with Airport Spur	173	49	24
Coast Line	159	114	68
Kelani Valley Line	59	21	30
(New Line) - Kottawa to Horana	22	-	-
(New Line) - Kelaniya to Kosgama via Biyagama, and Dompe	30	-	-
Total	767	321	220

Estimation of Electricity Demand

Electricity demand estimation based on no. of train substations

			Number of Substations	
Feeding System	Voltage	Interval	Low: 248km	High: 767km
DC	1.5 kV	Approx. 5 km	51	157
AC	20 kV	Approx. 20 km	15	39

ELECTRIFICATION OF PUBLIC TRANSPORTATION SYSTEM

Approx. demand requirement : 2MW for DC and 10MW for AC

Total electricity demand for railway electrification:

Feeding System	Low: 248km	High: 767km
DC	Approx. 102 MW	Approx. 314 MW
AC	Approx. 150 MW	Approx. 390 MW

Predicted total demand 150MW for Low case and 390MW for High Case in railway electrification

ELECTRIFICATION OF PUBLIC TRANSPORTATION SYSTEM

Rapid Transit System (RTS) in Sri Lanka

- Considered vehicle types: Monorail System and Light Rail Transit (LRT)
- Development Plan

	Line	Length	Section
1	Green Line (RTS1)	15km	Fort–Kollupitiya-Bambalapitiya-Borella-Union Place- Maradana
2	Yellow Line (RTS2)	11.5km	Fort- Maradana- Mattakkuliya/Peliyagoda
3	Red Line (RTS3)	10km	Dematagoda-Borella-Narahenpita-Kirulapone-Havelock City- Bambalapitiya
4	Purple Line (RTS4)	10km	Borella–Rajagiriya–Battramulla-Malabe
5	Pink Line (RTS5)	9.6km	Malabe – Kottawa
6	Olive Line (RTS6)	6km	Malabe - Kaduwela
7	Ash Line (RTS7)	13km	Peliyagoda - Kadawatha
	Total	75.1km	

ELECTRIFICATION OF PUBLIC TRANSPORTATION SYSTEM

Total electricity demand for RTS:

Feeding System	Length	Number of Substations	Electricity Demand
DC	75.1 km	Approx. 17	Approx. 34 MW

Predicted total electricity demand approx. 34MW for RTS beyond 2040

THANK YOU

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