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INTRODUCTION

MARELCO'S PROFILE

MARELCO's Franchise MAP

The Marinduque Electric Cooperative, Inc. (MARELCO) is a non-stock, non-profit corporation duly organized on March 27, 1973. It is registered with the National Electrification Administration with Certificate of Franchise No. 048 dated December 18, 1979 and effective for a period of fifty (50) years. It is under the direct supervision of the National Electrification Administration (NEA) by virtue of PD 269 and RA 10531 and the Energy Regulatory Commission (ERC) in terms of regulatory requirements.

Its primary mandate is to provide electric service around a franchise area or the province of Marinduque that is composed of six (6) municipalities namely, Boac, Buenavista, Gasan, Mogpog, Sta Cruz and Torrijos.

The total length in kilometers of overhead distribution line per type of configuration for the entire distribution system of MARELCO is composed of the following:

	Kms of Line
Three Phase	453.5370 kms.
V-Phase	20.54 kms.
Single Phase	383.03 kms.
Open Secondary	431.965 kms.
Underbuilt	352.58 kms.
Total	1,641.6520 circuit kms

MARELCO was categorized by NEA as "AA" in 2015, 2016 and 2017 respectively from D in 2012 and B in 2013 and 2014. In 2016, it was classified as Extra Large cooperative. Just recently, the coop was categorized AAA for its 2017 performance.

Status of Electrification as of December 31, 2017

District	No of Bgys.	Bgys Energized	Potential Sitios	No of Sitios Energized	HOUSE CONNECTION		
					Potential	Actual	%
Boac	61	61	84	83	13,771	13,672	99%
Buenavista	15	15	42	39	5,312	4,798	90%
Gasan	25	25	77	72	8,197	7,627	93%
Mogpog	37	37	49	46	8,620	8,544	99%
Sta Cruz	55	55	111	109	14,013	14,089	100%
Torrijos	25	25	45	39	6,866	6,433	94%
Total	218	218	408	388	56,779	55,163	97%

The Sitio Electrification Program (SEP) which started in 2011 has provided a total subsidy amounting to **P125,619,156.85** as of 2017 and afforded energization of **223** Sitios. It also allowed construction of additional **201.9323** circuit kms of lines and additional **2,495** household connection including barangays Boi and Bayuti. Energization of Bgys. Boi and Bayuti thru SEP marked the 100% energization of the coverage area in December 2012.

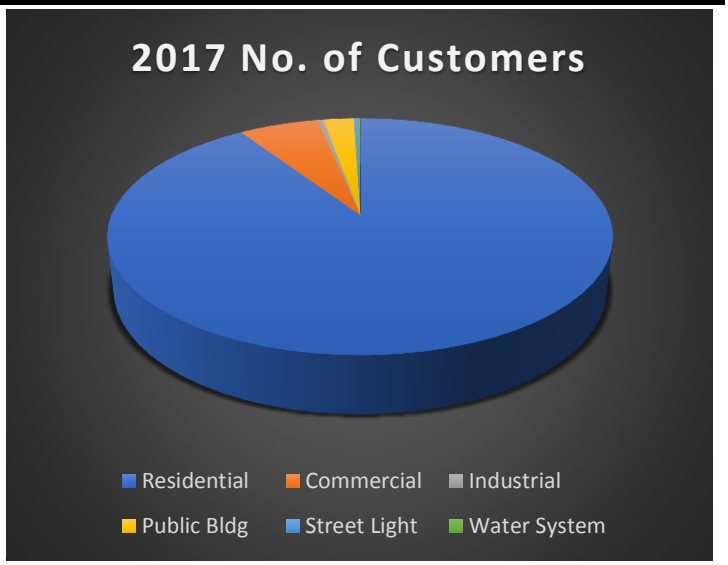
The electrification of the three Islets in Sta Cruz namely, Polo, Maniwaya and Mongpong took place in March 1999 through a Memorandum of Undertaking among the National Power Corporation (NPC), MARELCO and the Marinduque Provincial Government. The Memorandum of Undertaking was adopted by the Board of Directors through Resolution No. 99-012. NPC supplies power through generating units while MARELCO is in charge of operation and maintenance of distibution system. However, on February 9, 2018, the Polo islet was connected to the Marinduque Main Grid through a 2.2 kms submarine cable funded through Barangay Line Enhacement Program (BLEP).

TECHNICAL & FINANCIAL HIGHLIGHTS

From year 2000 to 2012, MARELCO's system loss had been consistently high as compared to the standard cap of 13%. The high system loss greatly affected the financial operations of the coop that resulted to huge financial losses. However, a great turnaround of events happened when a new management took over in December 2012. Various programs and activities on the reduction of system loss were extensively implemented which resulted to a dramatic decline of system loss starting year 2013. The coop's average system loss in 2013 was 11.19%, 9.27% in 2014, 11.11% in 2015, 12.79% in 2016 and 12.49% in 2017. Efficient financial strategy was employed by the present management, which included among others strict implementation of collection and disconnection policy, availment of additional loans from NEA to improve its working capital and judicious use of funds. Marelco was able to alleviate from financial burdens and is now gaining sound financial performance.

Number of Customer Connections in	ACTUAL	FORECAST									
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Residential	45212	47745	48799	49752	50621	51419	52157	52844	53486	54090	54659
Commercial	3027	3229	3435	3647	3861	4078	4296	4516	4738	4960	5184
Industrial	208	211	216	221	226	232	237	243	248	254	259
Public Bldg	1154	1180	1204	1227	1250	1272	1294	1316	1336	1356	1376
Street Light	160	139	142	145	147	150	152	155	158	161	163
Water System	96	175	190	205	221	236	251	266	282	297	313
Total (Captive	49857	52679	53986	55197	56326	57387	58387	59340	60248	61118	61954

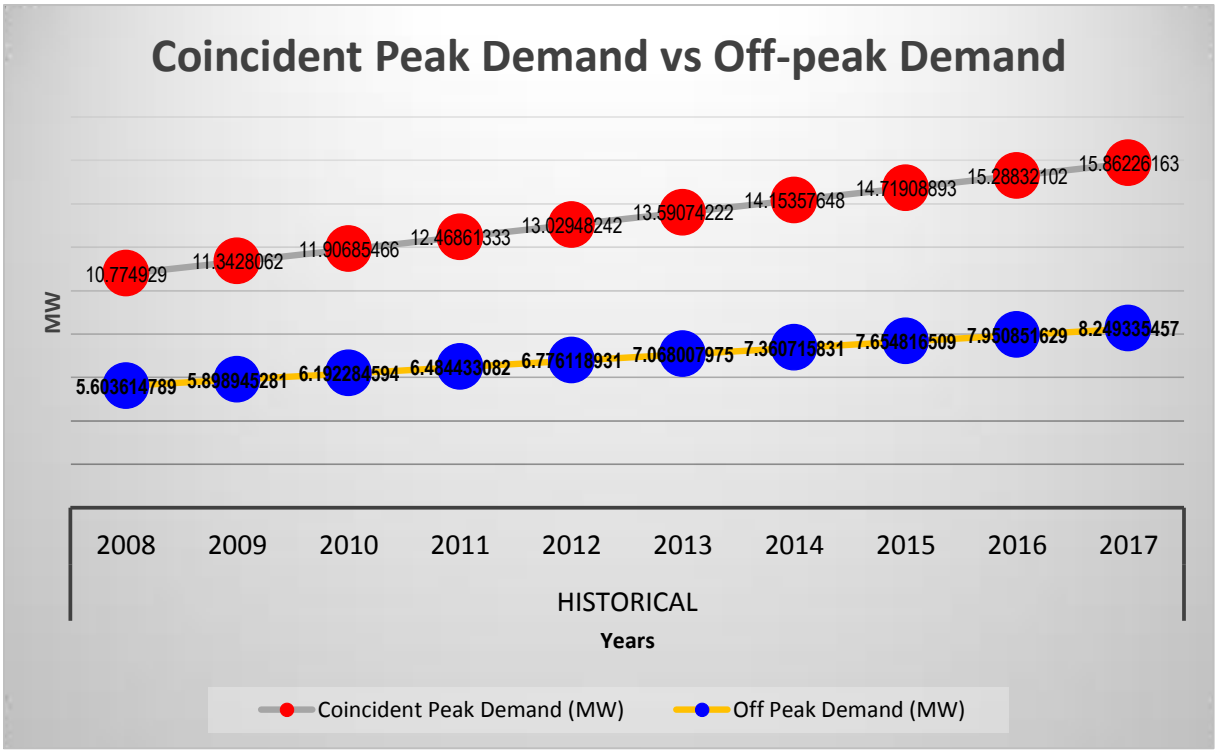
Residential customers composed the largest part of the consumer base with a total number of 45,212 representing 90.72% of the total consumer base. Commercial consumer class comprises the next largest group followed by Public Buildings, Industrial, Water System and Street Lights, respectively. The average growth rate of customers for residential, comercial and industrial in the last five years was 3.57%, 6.01%, and 3.69% respectively. Commercial customers has the highest growth rate because of the influx of commercial establishments in the province during the last five years such as supermarkets, resorts and restaurant, hotels, cellsites and gasoline station among others.



DEMAND

Demand	HISTORICAL									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Coincident Peak Demand (MW)	7.334	7.66	8.132	8.1	7.92	8.19	8.4	8.566	9.829	9.92
Off Peak Demand (MW)	3.814	3.984	4.229	4.212	4.119	4.259	4.369	4.455	5.1117	5.159

Demand	FORECASTED									
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Coincident Peak Demand (MW)	10.77	11.34	11.91	12.47	13.03	13.59	14.15	14.72	15.288	15.8623
Off Peak Demand (MW)	5.604	5.899	6.192	6.484	6.776	7.068	7.361	7.655	7.9509	8.24934

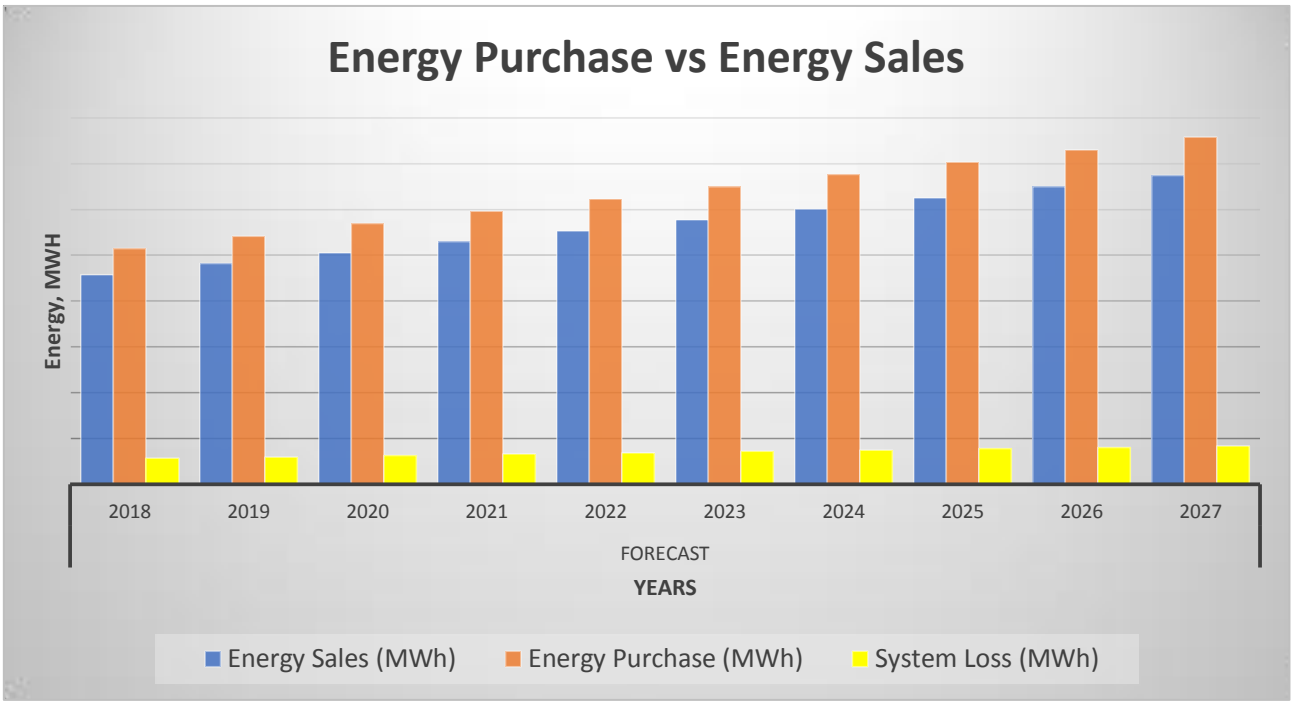


Brief highlight of historical demand and forecasting methodology and result. The Historical demand in the last five years has an average growth rate of 5.05%. In 2015 to 2016 the peak demand had a growth rate of 14.75% in view of the influx of several commercial establishments in the province. In forecasting the demand we used the forecasted energy sales and converted the energy purchased by using the 12.49% system loss. Based on the 2017 load factor we computed the 10 year forecasted energy demand with an annual increase of 4.39%.

ENERGY SALES AND PURCHASE

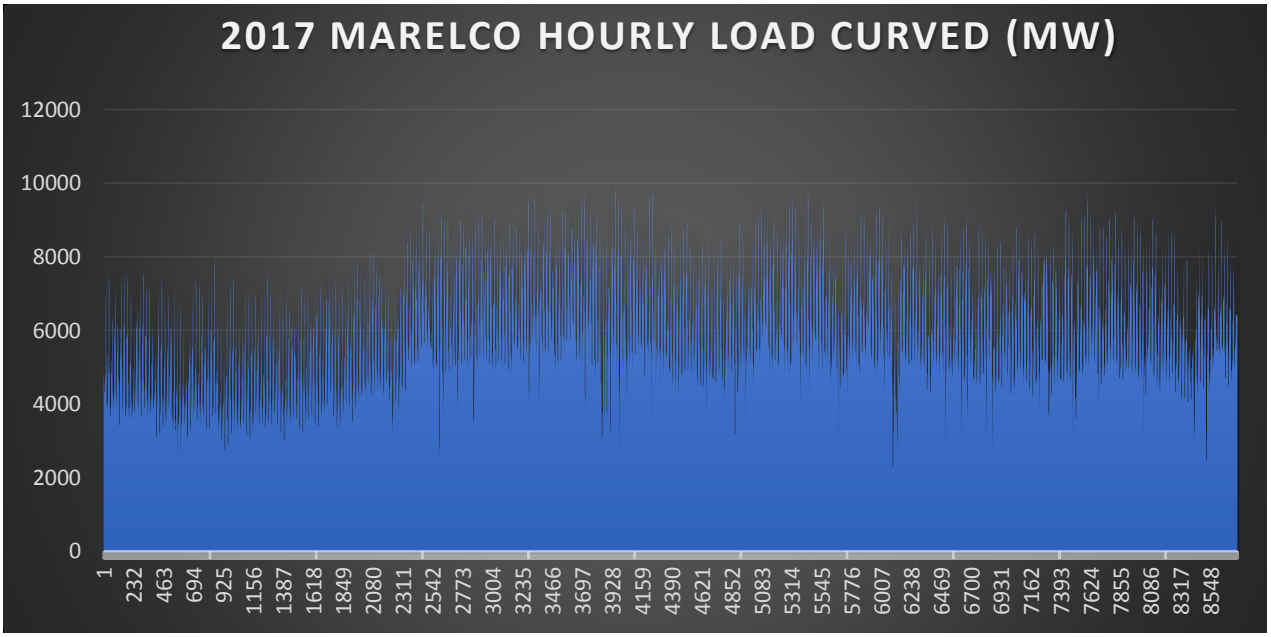
ENERGY SALES AND PURCHASE	HISTORICAL									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Energy Sales (MWh)	23,398.00	26,097.00	29,204.91	27,888.54	30,496.78	31,958.640	32,778.09	35,931.12	42,290.22	41,070.64
Energy Purchase (MWh)	28,977.30	31,160.99	35,728.46	33,929.00	36,767.72	37,926.00	38,820.01	42,850.17	48,377.32	46,934.68
System Loss (MWh)	5,859.30	5,062.99	6,536.32	6,039.91	6,270.93	5,968.20	6,041.92	6,919.05	6,087.10	5,863.62

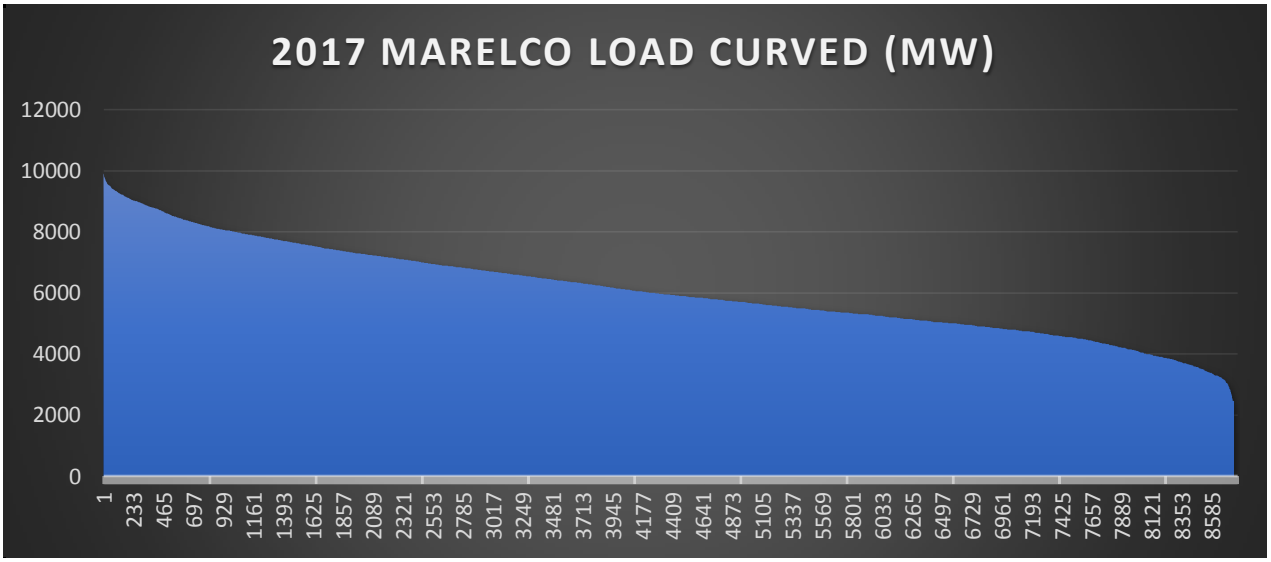
ENERGY SALES AND PURCHASE	FORECAST									
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Energy Sales (MWh)	45797.4624	48211.1521	50608.5682	52996.2518	55380.1544	57765.71765	60157.9729	62561.6115	64981.06	67420.5214
Energy Purchase (MWh)	51,517.57	54,232.72	56,929.58	59,615.48	62,297.14	64,980.66	67,671.70	70,375.56	73,097.19	75,841.34
System Loss (MWh)	5,720.10	6,021.57	6,321.01	6,619.23	6,916.98	7,214.94	7,513.73	7,813.95	8,116.13	8,420.82

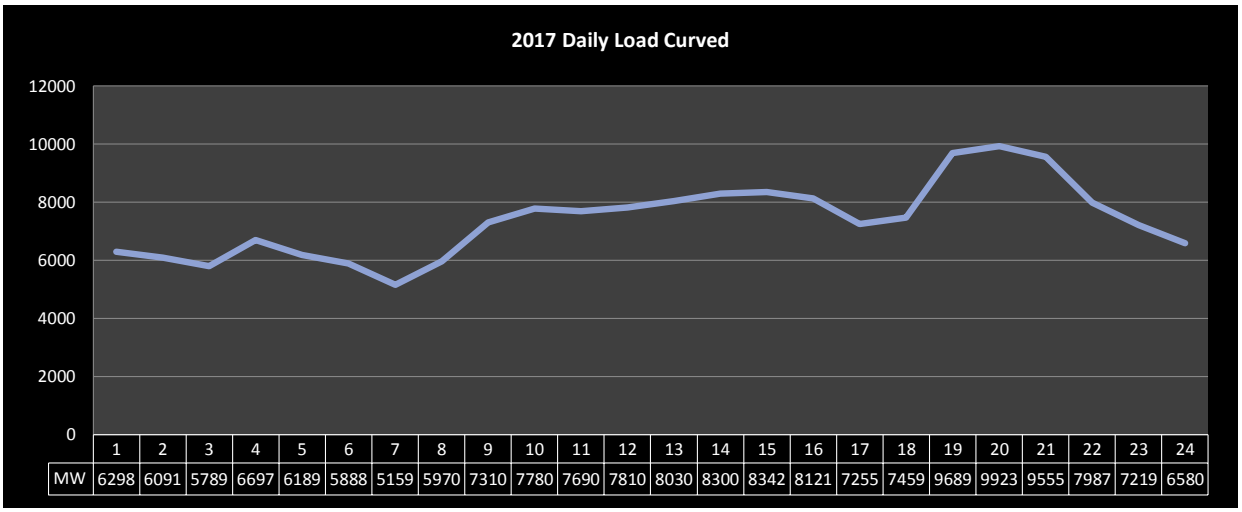


The Historical energy sales and purchased in the last five years has an average growth rate of 6.75%. In 2015 and 2016, the recorded growth rate of 17.7% can be attributed to the influx of several business establishments such as supermarkets, restaurants and hotels among others. In forecasting the energy sales and purchases, we used the 7 year- historical data covering 2011-2017. To determine the yearly average growth rate, spot load was excluded to the data, then we normalized the data of January and February 2017 that was affected due to Typhoon Nina on December 2016, and right after, we forecasted individualy the load growth per type of customer . After that we added the excluded spot load to the forecasted data. The 10 year Development Plan per municipality of Marinduque was considered including the proposed connection of the 2 remaining islets (Maniwaya & Mongpong) to the Marinduque Mainland which will result to 24 hours operation.

LOAD PROFILE AND LOAD DURATION CURVE







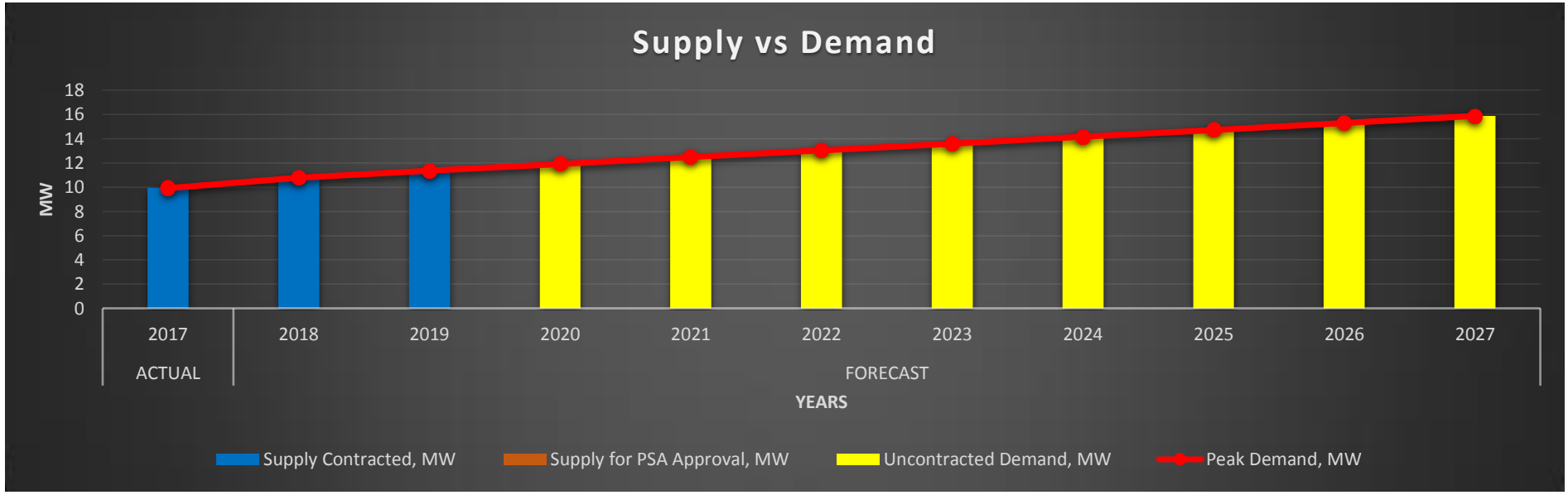
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
MW	6298	6091	5789	6697	6189	5888	5159	5970	7310	7780	7690	7810	8030	8300	8342	8121	7255	7459	9689	9923	9555	7987	7219	6580

Brief highlight:
MARELCO peak and average demand for the year 2017 is 9.92MW and 8.840MW . The connected loads of government agencies and other economic activities of business establishments dominate the shape of the daily load curve to bring its peak of 8.840 MW at about 2:00 o'clock in the afternoon. Night peak of 9.92 MW comes at around 7:00 o'clock in the evening. With the prevailing conditions in the area where the day peak is lower by 10.88% than the night peak level, a 62% load factor is constantly experienced in the coverage area .

MIX SUPPLY VS DEMAND AND THE OPTIMAL SUPPLY

Supply Demand	ACTUAL	FORECAST									
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Peak Demand, MW	**9.92**	**10.77493**	**11.34281**	**11.90685**	**12.46861**	**13.02948**	**13.59074**	**14.15358**	**14.71909**	**15.2883**	**15.86226**
Supply Contracted, MW	**9.92809**	**10.71935**	**11.27146**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
NPC BDPP	9.76767	10.58977	11.134								
NPC POLO DPP	0.041	*Connected to the Mainland in Feb 2018*									
NPC MANIWAYA DPP	0.06647	0.07034	0.07136	*to be connected to the Mainland in Feb 2019 as the Installation of Submarine Cable is on-going*							
NPC MONGPONG DPP	0.05295	0.05924	0.0661								
Supply for PSA Approval, MW	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Generation Plant Name 1											
Generation Plant Name 2											
Generation Plant Name 3											
Uncontracted Demand, MW	**0**	**0.055579**	**0.071346**	**11.90685**	**12.46861**	**13.02948**	**13.59074**	**14.15358**	**14.71909**	**15.2883**	**15.86226**

POWER SUPPLY PROCUREMENT PLAN



List of Existing Contracts and Details

Supply Contracted	Plant Owner/ Operator	Capacity Factor	PSA Effectivity (MM/YR)	PSA Expiration (MM/YR)	Contracted Capacity, MW	Contracted Energy, MWH	Base / Mid-merit / Peaking	Embedded/ Grid Connected	Utility-owned/ NPC/ IPP/ NPC-IPP	Status	Fuel Type	Installed Capacity (MW)	Net Dependable Capacity (MW)
NPC SPUG	BANTAD		9/1/2014	9/1/2019				Embedded	NPC		DIESEL	21.472	9.8
NPC SPUG	POLO		9/1/2014					Embedded	NPC		DIESEL	0.45	0.45
NPC SPUG	MANIWAYA		9/1/2014	9/1/2019				Embedded	NPC		DIESEL	0.8	0.8
NPC SPUG	MONGPONG		9/1/2014	9/1/2019				Embedded	NPC		DIESEL	0.45	0.45
NPC SPUG	TORRIJOS		9/1/2014	9/1/2019				Embedded	NPC		DIESEL	3.05	1.85

Performance of the existing Contracted Generation Companies:

MARELCO has an existing five-year Power Supply Agreement with the National Power Corporation covering the period from August 31, 2014 to August 31, 2019. NPC's current dependable capability is 12.8 MW composed of Boac DPP (4.7 MW), PB 120 (3.1 MW), Torrijos DDP (2.2 MW), Monark Rental Units (2.8 MW). **The SAGR is Php5.6404/kwh.**

NPC and Marelco has established good working rapport to ensure continuity of electric service. In cases of power outages, close coordination is maintained so that restoration is effectively and timely executed. However, it is a fact that NPC's generating units are already aging and frequent breakdown results to power failures. Although, there is a 5 MW newly installed generating units in Bantad Power Plant, its dependability is still sometimes uncertain. Hence, Marelco is fully determined to conduct a self-managed Competitive Selection Process to look for a power provider that will ensure reliable and efficient power supply for the whole coverage area.

OPTIMAL MIX:

The energy demand requirement for the year 2022 is 13 MW however, MARELCO will need a 16 MW power plant to satisfy the n-2 contingency.
Based on the normalized load curved for the year 2017 the economic power supply mix for the year 2022 is 80.21% for base plant and 19.79% for peaking plant.
Considering the peaking plant will generate only 2.75% of annual requirements, this indicates that the base power plant, if equally capable of fast response to the changing demand like the light Diesel power plant, can also provide the peaking energy. With the possibility that all contracted bunker power plants will provide the reserve requirements in the future, it is best that they provide the full service requirement, i.e., both the baseload and peaking supply and avoid the more costly light diesel plants. Furthermore based on the study, the cheapest in terms of initial investment and total generation cost in Php per kilowatt-hour is by adding a power plant of two (2) generating units each rated at 1MW (2 x 1MW) and filling the 20 year demand requirement of MARELCO from 2022 to 2041 by 2 x 1MW expansion pattern.

Note:

The MARELCO's 2018 DDP was prepared before the finalization of 2017 data and submitted thereafter long before the preparation of our Power Supply Procurement Plan (PSPP). The data on the PSPP was revised to conform to the actual data or historical data of 2017.

DISTRIBUTION IMPACT STUDY

At present Marinduque Mainland/island generation and distribution system is composed of five (5) embedded generators, two (2) subtransmission line rated at 69kV line, two (2) substations. The generators' location are in the port of Brgy. Balancan Mogpog, in Brgy. Bantad Boac,, in Brgy. Cagpo Torrijos, Maniwaya islet and Mongpong Islet. The generator namely PB120 situated at Brgy. Balanacan is a power barge rated 7.2MW with a capability of 4MW and connected to a 69 kV line using only a 13.8kV rating to synchronize the generator at Brgy. Bantad. The generators at Brgy. Bantad is a diesel power plant with a rated capacity of 14.307MW and dependable capacity of 8.7 MW and connected to the two (2) Feeders of the distribution system at the mainland of Marinduque. The embedded generator in Brgy. Cagpo is rated 3.05 MW and has a dependable capability of 2.3MW, located at the Feeder 1 line section. The 10 MVA substation located at Brgy. Bantad is connected to another 69 kV line going to the 5MVA substation at Brgy. Cagpo Torrijos. This Substation and 69kV subtransmission is not operational due to damaged lines and poles. The 69 kV line is scheduled for total rehabilitation by this year. The Maniwaya and Mongpong islets have a separate distribution system and generator with eight (8) hour operation, while Polo islet was connected to the mainland of Marinduque using a submarine cable on February 9, 2018. Based on the assessment and forecast of the distribution system of Marinduque there will be no power quality problem in Feeder 1 line section. While in Feeder 2 line section the southern part of Buenavista located at the load end of the feeder, an under voltage is estimated to occur at peak load because of the long stretch of line and increasing demand of the feeder. On the other hand, in terms of power interruptions, the reliability indices are within the NEA standard. Based on the existing assessment, projects were formulated to solve the power quality problem in Feeder 2 that will also improve the reliability and efficiency of power that will be delivered to every customer. These projects are; Construction of 5MVA substation between Gasan and Buenavista, Construction of 69 kV line connecting Bantad substation and the proposed 5MVA Substation coupled with the Energization of existing 69kV line and existing substation. We also identified three (3) economic locations of the new power plant namely, Brgy of Bantad Boac, Municipality of Sta Cruz and in the boundary of Gasan and Buenavista. The said locations of the power plant are in the load centers of Marinduque and will be synchronized thru 69kV line substransmisison and will be converted to a 13.2kV by using the three substations. The existing two (2) feeders will be converted to six (6) feeders or one feeder per town. In this case the long stretch of line will be shortened, the load reach will be minimized and the power quality will be improved to allowable voltage set on the PDC. Improvement in reliability is also expected to happen.

SCHEDULE OF CSP

Base / mid-merit / peaking	For CSP		Proposed contract period (MM/YYYY)		Proposed schedule (MM/YYYY)						
	Demand (MW)	Energy (MWh)	Start Month and Year	End Month and Year	Publication of Invitation to Bid	Pre-bid Conference	Submission and Opening of Bids	Bid Evaluation	Awarding	PSA Signing	Joint Application to ERC
Base with the capability of peaking plant	14 (exclusive of reserve)	74,910.70	Jan 2022	Dec 2041	August 24 & 31, 2018	11-Sep-18	5-Feb-19	Feb 5 to Feb 19, 2019	12-Apr-19	19-Apr-19	20-Apr-19
Additional Contract	2	8,909.26	Jan 2024	Dec 2044							
Note:											
	To augment additional load there will be a Competitive Selection process every two years thereafter starting 2022.										

10 Year Monthly Data

Year	Forecast			Contracted and For PSA Approval Demand and Energy		Uncontracted Demand and Energy		Committed for CSP	
	Coincident Peak Demand (MW)	Off Peak Demand (MW)	Energy Requirement (MWh)	Demand (MW)	Energy (MWh)	Uncontracted Demand (MW)	Uncontracted Energy (MWh)	Demand (MW)	Energy (MWh)
2018									
Jan	10.05	5.23	3,664.80	9.18	4,021				
Feb	10.05	5.22	3,670.27	9.17	4,027				
Mar	10.04	5.22	3,511.29	9.17	3,853				
Apr	10.77	5.60	4,484.59	9.84	4,921				
May	10.61	5.52	4,668.38	9.69	5,122				
Jun	10.75	5.59	4,974.35	9.82	5,458				
Jul	10.75	5.59	4,464.78	9.81	4,899				
Aug	10.17	5.29	4,604.82	9.29	5,053				
Sep	10.06	5.23	4,645.18	9.19	5,097				
Oct	10.01	5.20	4,395.60	9.14	4,823				
Nov	10.01	5.20	4,709.48	9.14	5,167				
Dec	10.73	5.58	3,724.03	9.80	4,086				
2019									
Jan	10.58	5.50	3,857.96	9.52	4,389				
Feb	10.58	5.50	3,863.73	9.52	4,396				
Mar	10.57	5.50	3,696.37	9.52	4,206				
Apr	11.34	5.90	4,720.96	10.22	5,372				
May	11.17	5.81	4,914.45	10.06	5,592				
Jun	11.32	5.89	5,236.54	10.20	5,960				
Jul	11.32	5.88	4,700.12	10.19	5,346				
Aug	10.71	5.57	4,847.54	9.65	5,517				
Sep	10.60	5.51	4,890.02	9.55	5,566				
Oct	10.53	5.48	4,627.29			10.53	4,627.29		
Nov	10.53	5.48	4,957.71			10.53	4,957.71		
Dec	11.30	5.88	3,920.32			11.30	3,920.32		
2020									
Jan	11.10	5.78	4,049.82			11.10	4,049.82		
Feb	11.10	5.77	4,055.87			11.10	4,055.87		
Mar	11.10	5.77	3,880.19			11.10	3,880.19		
Apr	11.91	6.19	4,955.74			11.91	4,955.74		
May	11.72	6.10	5,158.84			11.72	5,158.84		
Jun	11.88	6.18	5,496.95			11.88	5,496.95		
Jul	11.88	6.18	4,933.85			11.88	4,933.85		
Aug	11.24	5.85	5,088.60			11.24	5,088.60		
Sep	11.12	5.78	5,133.20			11.12	5,133.20		
Oct	11.06	5.75	4,857.40			11.06	4,857.40		
Nov	11.06	5.75	5,204.25			11.06	5,204.25		
Dec	11.86	6.17	4,115.27			11.86	4,115.27		
2021									
Jan	11.63	6.05	4,240.82			11.63	4,240.82		

Feb	11.63	6.05	4,247.16			11.63	4,247.16		
Mar	11.62	6.04	4,063.19			11.62	4,063.19		
Apr	12.47	6.48	5,189.47			12.47	5,189.47		
May	12.28	6.38	5,402.15			12.28	5,402.15		
Jun	12.44	6.47	5,756.21			12.44	5,756.21		
Jul	12.44	6.47	5,166.55			12.44	5,166.55		
Aug	11.77	6.12	5,328.60			11.77	5,328.60		
Sep	11.65	6.06	5,375.30			11.65	5,375.30		
Oct	11.58	6.02	5,086.49			11.58	5,086.49		
Nov	11.58	6.02	5,449.70			11.58	5,449.70		
Dec	12.42	6.46	4,309.36			12.42	4,309.36		
2022									
Jan	12.15	6.32	4,431.61			12.15	4,431.61	12.15	5,328.93
Feb	12.15	6.32	4,438.24			12.15	4,438.24	12.15	5,336.90
Mar	12.14	6.31	4,245.99			12.14	4,245.99	12.14	5,105.72
Apr	13.03	6.78	5,422.93			13.03	5,422.93	13.03	6,520.98
May	12.83	6.67	5,645.19			12.83	5,645.19	12.85	6,788.23
Jun	13.00	6.76	6,015.17			13.00	6,015.17	13.03	7,233.13
Jul	13.00	6.76	5,398.99			13.00	5,398.99	13.03	6,492.18
Aug	12.30	6.40	5,568.33			12.30	5,568.33	12.35	6,695.81
Sep	12.17	6.33	5,617.13			12.17	5,617.13	12.22	6,754.49
Oct	12.10	6.29	5,315.33			12.10	5,315.33	12.15	6,391.59
Nov	12.10	6.29	5,694.88			12.10	5,694.88	12.14	6,847.98
Dec	12.98	6.75	4,503.24			12.98	4,503.24	13.03	5,415.06
2023									
Jan	12.68	6.59	4,622.54			12.68	4,622.54	12.68	5,645.77
Feb	12.67	6.59	4,629.45			12.67	4,629.45	12.67	5,654.21
Mar	12.66	6.59	4,428.92			12.66	4,428.92	12.66	5,409.29
Apr	13.59	7.07	5,656.57			13.59	5,656.57	13.59	6,908.70
May	13.38	6.96	5,888.40			13.38	5,888.40	13.38	7,191.84
Jun	13.56	7.05	6,274.33			13.56	6,274.33	13.56	7,663.20
Jul	13.56	7.05	5,631.60			13.56	5,631.60	13.56	6,878.19
Aug	12.83	6.67	5,808.23			12.83	5,808.23	12.83	7,093.92
Sep	12.69	6.60	5,859.13			12.69	5,859.13	12.69	7,156.09
Oct	12.62	6.56	5,544.33			12.62	5,544.33	12.62	6,771.61
Nov	12.62	6.56	5,940.23			12.62	5,940.23	12.62	7,255.15
Dec	13.54	7.04	4,697.25			13.54	4,697.25	13.54	5,737.02
2024									
Jan	13.20	6.86	4,813.97			13.20	4,813.97	13.20	5,962.69
Feb	13.20	6.86	4,821.17			13.20	4,821.17	13.20	5,971.60
Mar	13.19	6.86	4,612.33			13.19	4,612.33	13.19	5,712.93
Apr	14.15	7.36	5,890.83			14.15	5,890.83	14.15	7,296.50
May	13.94	7.25	6,132.25			13.94	6,132.25	13.94	7,595.54
Jun	14.13	7.35	6,534.16			14.13	6,534.16	14.13	8,093.35
Jul	14.12	7.34	5,864.81			14.12	5,864.81	14.12	7,264.28
Aug	13.37	6.95	6,048.76			13.37	6,048.76	13.37	7,492.12
Sep	13.22	6.88	6,101.77			13.22	6,101.77	13.22	7,557.78
Oct	13.15	6.84	5,773.94			13.15	5,773.94	13.15	7,151.72
Nov	13.14	6.84	6,186.23			13.14	6,186.23	13.14	7,662.40
Dec	14.10	7.33	4,891.78			14.10	4,891.78	14.10	6,059.06

POWER SUPPLY PROCUREMENT PLAN

2025		-							
Jan	13.73	7.14	5,006.32			13.73	5,006.32	13.73	6,279.57
Feb	13.72	7.14	5,013.81			13.72	5,013.81	13.72	6,288.96
Mar	13.72	7.13	4,796.63			13.72	4,796.63	13.72	6,016.55
Apr	14.72	7.65	6,126.21			14.72	6,126.21	14.72	7,684.27
May	14.49	7.54	6,377.28			14.49	6,377.28	14.49	7,999.20
Jun	14.69	7.64	6,795.25			14.69	6,795.25	14.69	8,523.47
Jul	14.68	7.64	6,099.15			14.68	6,099.15	14.68	7,650.34
Aug	13.90	7.23	6,290.45			13.90	6,290.45	13.90	7,890.29
Sep	13.75	7.15	6,345.58			13.75	6,345.58	13.75	7,959.44
Oct	13.67	7.11	6,004.65			13.67	6,004.65	13.67	7,531.80
Nov	13.67	7.11	6,433.42			13.67	6,433.42	13.67	8,069.62
Dec	14.66	7.63	5,087.24			14.66	5,087.24	14.66	6,381.07
2026									
Jan	14.26	7.42	5,199.89			14.26	5,199.89	14.26	6,596.45
Feb	14.25	7.41	5,207.66			14.25	5,207.66	14.25	6,606.31
Mar	14.25	7.41	4,982.08			14.25	4,982.08	14.25	6,320.15
Apr	15.29	7.95	6,363.07			15.29	6,363.07	15.29	8,072.03
May	15.05	7.83	6,623.85			15.05	6,623.85	15.05	8,402.85
Jun	15.26	7.93	7,057.98			15.26	7,057.98	15.26	8,953.57
Jul	15.25	7.93	6,334.97			15.25	6,334.97	15.25	8,036.38
Aug	14.44	7.51	6,533.67			14.44	6,533.67	14.44	8,288.44
Sep	14.28	7.43	6,590.93			14.28	6,590.93	14.28	8,361.08
Oct	14.20	7.38	6,236.81			14.20	6,236.81	14.20	7,911.86
Nov	14.20	7.38	6,682.16			14.20	6,682.16	14.20	8,476.82
Dec	15.23	7.92	5,283.93			15.23	5,283.93	15.23	6,703.06
2027									
Jan	14.79	7.69	5,395.09			14.79	5,395.09	14.79	6,913.36
Feb	14.79	7.69	5,403.15			14.79	5,403.15	14.79	6,923.70
Mar	14.78	7.69	5,169.11			14.78	5,169.11	14.78	6,623.79
Apr	15.86	8.25	6,601.93			15.86	6,601.93	15.86	8,459.84
May	15.62	8.12	6,872.51			15.62	6,872.51	15.62	8,806.55
Jun	15.83	8.23	7,322.93			15.83	7,322.93	15.83	9,383.73
Jul	15.82	8.23	6,572.78			15.82	6,572.78	15.82	8,422.48
Aug	14.98	7.79	6,778.94			14.98	6,778.94	14.98	8,686.65
Sep	14.82	7.71	6,838.35			14.82	6,838.35	14.82	8,762.78
Oct	14.73	7.66	6,470.94			14.73	6,470.94	14.73	8,291.97
Nov	14.73	7.66	6,933.00			14.73	6,933.00	14.73	8,884.07
Dec	15.80	8.22	5,482.28			15.80	5,482.28	15.80	7,025.10

FORECASTING METHODOLOGY

Various forecasting models were used to have an almost accurate forecast that passed all the parameters. However, to establish the most accurate forecast, Trend Models was developed using the last seven (7) years historical and progressive data. Since Trend analysis was used, data has to pass the criteria of at least 99% for Adjusted R2 statistic. The Mean Absolute Percentage Error (MAPE) was computed and should not exceed 5%. Independent variables were also tested for their validity using at least the p-value which should be lower than 0.1 and t-statistics which should be greater than 2 or less than -2 to be valid. All the chosen models passed these criteria and were used for the technical evaluation of the future system.

In the case that forecasting models formulated failed in terms of validity and accuracy, the historical data were normalized and ignored the years that were identified as abnormal due to erratic trend of the data.

Model No.	Substation / Customer Class	Forecasting Model	Validity Test				Acauracy Test	Annual Average Growth Rate	
			Adj. R^2	t-stat		p-value	MAPE (<5%)	Historical	Forecast
			(>0.99)	(|t|>2 or <-		(<0.1)			
MAINLAND SALES FORECAST									
7	Residential	a+bt+ct^3 (w/ horizon)	0.99463	*a*	4.5283	0.0062	2.59%	7.34%	7.50%
				b	11.298	9.5E-05			
				c	23.801	2.4E-06			
136	Commercial	a+bt^2+clogt^3+dt^-1 (w/ horizon)	0.99189	*a*	3.1585	0.03423	1.24%	6.11%	6.51%
				b	5.0552	0.0072			
				c	3.7007	0.0208			
				d	27.421	0.0000			
	Industrial	a+bt	0.99166	*a*	191.42	2.7E-05	0.32%	3.99%	3.83%
				b	18.913	0.0028			
190	Public Building	a+blogt+ct^-2+dt^-3 (w/ horizon)	0.99173	*a*	23.002	2.1E-05	2.08%	7.43%	7.61%
				b	4.3388	0.0123			
				c	4.7708	0.0088			
				d	3.8389	0.0185			
111	Street Light	a+bt+ct^-1+dt^-3 (w/ horizon)	0.99545	*a*	27.538	1.0E-05	2.57%	3.35%	3.25%
				b	2.9316	0.0427			
				c	2.2261	0.0900			
				d	8.0104	0.0013			
81	Water System	a+bt+ct^2+dt^-3 (w/ horizon)	0.99178	*a*	17.273	6.6E-05	1.52%	9.56%	9.49%
				b	15.441	0.0001			
				c	3.7801	0.0194			
				d	10.929	0.0004			
MANIWAYA SALES FORECAST									
113	Residential	a+bt+ct^-2+dt^-3 (w/ horizon)	0.99961	*a*	110.88	4.0E-08	2.90%	14.44%	15.33%
				b	4.4703	0.0111			
				c	3.6090	0.0226			
				d	7.8806	0.0014			
84	Commercial	a+bt+ct^3+dlogt^3 (w/o horizon)	0.99851	*a*	5.4117	0.0124	1.88%	42.26%	42.28%
				b	9.6266	0.0024			
				c	3.0697	0.0546			
				d	3.1071	0.0530			
12	Public Building	a+blog(t)+clog(t)^2+dlog(t)^3 (w/o horizon)	0.99676	*a*	6.3783	0.0078	1.95%	21.75%	21.63%
				b	3.5385	0.0384			
				c	3.1581	0.0509			
				d	14.423	0.0007			

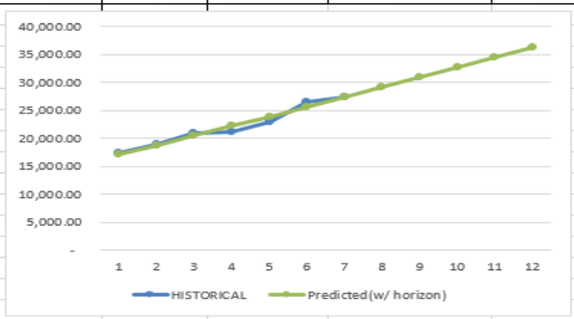
MONGPONG SALES FORECAST									
92	Residential	a+bt+clogt+dlogt^3 (w/ horizon)	0.99627	*a*	2.6707	0.0558	2.97%	14.40%	14.90%
				b	6.3890	0.0031			
				c	3.3910	0.0275			
				d	6.3222	0.0032			
12	Public Building	a+blog(t)+clog(t)^2+dlog(t)^3 (w/o horizon)	0.99964	*a*	11.967	0.0013	0.09%	4.89%	4.88%
				b	14.349	0.0007			
				c	31.826	6.8E-05			
				d	434.80	2.7E-08			
MAINLAND CUSTOMER FORECAST									
189	Residential	a+blogt+ct^-2+dt^-3 (w/o horizon)	0.99119	*a*	11.410	0.0014	0.37%	3.59%	3.63%
				b	3.6338	0.0359			
				c	3.9075	0.0298			
				d	19.447	0.0003			
6	Commercial	a+bt+ct^3 (w/o horizon)	0.99404	*a*	5.6488	0.0048	0.51%	5.04%	5.07%
				b	5.8225	0.0043			
				c	73.430	2.1E-07			
7	Industrial	a+bt+ct^3 (w/ horizon)	0.99120	*a*	2.6189	0.0472	1.03%	2.55%	2.61%
				b	9.6120	0.0002			
				c	75.290	7.8E-09			
7	Public Building	a+bt+ct^3 (w/ horizon)	0.98751	*a*	7.0671	0.0009	0.45%	2.07%	2.20%
				b	15.387	2.1E-05			
				c	142.08	3.3E-10			
46	Street Light	a+b(t)^3+clogt^2 (w/ horizon)	0.99390	*a*	5.6943	0.0023	2.14%	2.15%	2.50%
				b	4.8308	0.0048			
				c	50.660	5.7E-08			
112	Water System	a+bt+ct^-2+dt^-3 (w/o horizon)	0.99492	*a*	15.859	0.0005	0.61%	7.55%	7.68%
				b	3.6453	0.0356			
				c	3.1959	0.0495			
				d	7.6202	0.0047			
POLO CUSTOMER FORECAST									
143	Residential	a+bt^2+ct^-1+dt^-3 (w/ horizon)	0.99046	*a*	15.432	0.0001	1.46%	3.91%	3.72%
				b	3.9625	0.0166			
				c	2.1819	0.0945			
				d	35.421	3.8E-06			
MANIWAYA CUSTOMER FORECAST									
113	Residential	a+bt+ct^-2+dt^-3 (w/ horizon)	0.99191	*a*	15.422	0.0001	1.20%	8.08%	8.12%
				b	6.0490	0.0038			
				c	4.8498	0.0083			
				d	48.421	1.1E-06			
15	Commercial	a+blog(t)^2+clog(t)^3 (w/o horizon)	0.99684	*a*	16.484	7.9E-05	1.42%	22.94%	22.90%
				b	22.719	2.2E-05			
				c	8.9085	0.0009			

Megawatt Demand Forecast

Megawatt demand forecast for Mainland and 3 islets were developed by bottom to top approach. First the sales per customer type were forecasted and to compute the MWHr purchased, we used the average system loss of 12.49%. After computing the Mwhr purchased we assumed the load factor of 56% to get the megawatt demand.

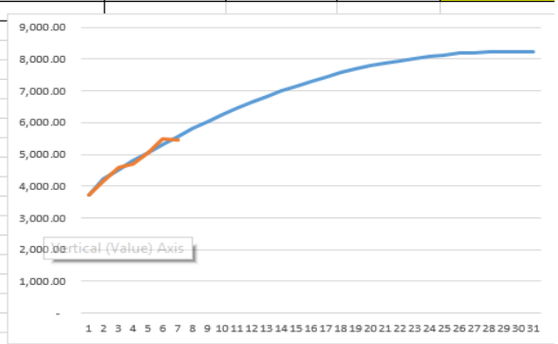
❖ MWH MAINLAND RESIDENTIAL SALES

YEAR	HISTORICAL	t^3	t	c	Predicted(w/ horizon)	HISTORICAL GR	GR(w/ horizon)	(w/ horizon)	horizon)	contrib. (w/ horizon)
2011	17,300.99	1	1	1	17,117.92			33,514.69	213,759,658.66	1.06%
2012	19,035.14	8	2	1	18,797.18	9.11%	8.93%	56,625.36	166,058,579.01	1.25%
2013	20,849.44	27	3	1	20,481.78	8.70%	8.22%	135,174.51	122,590,774.67	1.76%
2014	21,163.47	64	4	1	22,174.39	1.48%	7.63%	1,021,959.31	115,735,464.07	4.78%
2015	23,022.54	125	5	1	23,877.68	8.07%	7.13%	731,268.09	79,191,699.68	3.71%
2016	26,523.68	216	6	1	25,594.33	13.20%	6.71%	863,703.62	29,136,563.12	3.50%
2017	27,476.83	343	7	1	27,326.99	3.47%	6.34%	22,452.34	19,755,176.05	0.55%
2047	100,000.00	50653	37	1	100,001.83	*7.34%*	*7.50%*	**2864697.911**	**746227915.3**	*2.59%*
w/o horizon obs.	22,196.01	512	8	1	29,078.35					
w/ horizon obs.	31,921.51	729	9	1	30,851.07					
# of obs w/o Hori.(n)	7	1000	10	1	32,647.82					
# of variable(k)	2	1331	11	1	34,471.28					
# of obs w/ Hori.(n)	8	1728	12	1	36,324.11					
		2197	13	1	38,208.98					
t-stat(w/ horizon)	=[abc]/SE	2744	14	1	40,128.57					
t^3	4.528323232	3375	15	1	42,085.54					
t	11.29766031	4096	16	1	44,082.56					
c	23.80096608	4913	17	1	46,122.31					
		5832	18	1	48,207.46					
P-value(w/ horizon)	=tdist(abs(t-stat),(n-k-1),2)	6859	19	1	50,340.67					
		8000	20	1	52,524.62					
t^3	0.006235069	9261	21	1	54,761.97					
t	9.49684E-05	10648	22	1	57,055.40					
c	2.43866E-06	12167	23	1	59,407.58					
		13824	24	1	61,821.17					
Adjusted r^2 w/ horizon		15625	25	1	64,298.85					
	0.994625533	17576	26	1	66,843.29					



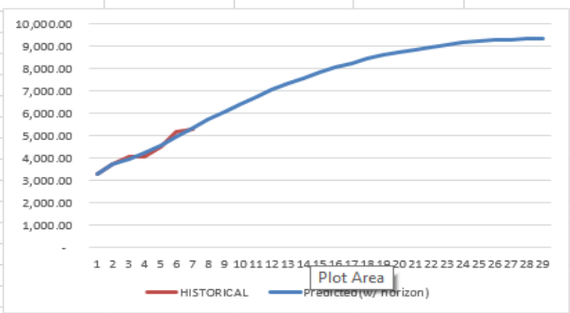
❖ MWH MAINLAND COMMERCIAL SALES

YEAR	HISTORICAL	t^2	logt^3	t^-1	c	Predicted(w/ horizon)	HISTORICAL GR	PREDICTED GR(w/ horizon)	ESS contrib. (w/ horizon)	TSS contrib. (w/ horizon)	MAPE contrib. (w/ horizon)
2011	3,722.63	1	0	1	1	3,711.26			129.2339233	2033552.477	0%
2012	4,165.18	4	0.027279	0.5	1	4,213.27	10.63%	11.91%	2312.627748	967224.0886	1%
2013	4,581.79	9	0.108614	0.333333	1	4,515.55	9.09%	6.69%	4387.257689	321340.0607	1%
2014	4,712.00	16	0.218232	0.25	1	4,793.24	2.76%	5.79%	6599.680614	190666.6677	2%
2015	5,052.73	25	0.341488	0.2	1	5,061.91	6.74%	5.31%	84.14469482	9201.255502	0%
2016	5,493.09	36	0.471186	0.166667	1	5,321.99	8.02%	4.89%	29274.50509	118635.1213	3%
2017	5,461.83	49	0.603561	0.142857	1	5,572.30	-0.57%	4.49%	12203.53595	98076.39781	2%
2047	8,000.00	1369	3.856611	0.027027	1	7,999.73			0.072058206	8130151.686	0%
w/o horizon obs.	4,741.32	64	0.736534	0.125	1	5,811.81	6.11%	6.51%	54991.05777	11868847.75	1.24%
w/ horizon obs.	5,148.66	81	0.868913	0.111111	1	6,039.90					
# of obs w/o Hori.(n)	7	100	1	0.1	1	6,256.22					
# of variable(k)	3	121	1.129389	0.090909	1	6,460.63					
# of obs w/ Hori.(n)	8	144	1.256849	0.083333	1	6,653.11					
		169	1.382259	0.076923	1	6,833.74					
t-stat(w/ horizon)	=[abcd]/SE	196	1.505565	0.071429	1	7,002.63					
t^2	3.158470805	225	1.626758	0.066667	1	7,159.94					
logt^3	5.055173227	256	1.74586	0.0625	1	7,305.82					
t^-1	3.700715617	289	1.862905	0.058824	1	7,440.45					
c	27.42097936	324	1.977944	0.055556	1	7,564.01					
		361	2.091032	0.052632	1	7,676.67					
P-value(w/ horizon)	=tdist(abs(t-stat),(n-k-1),2)	400	2.202226	0.05	1	7,778.59					
		441	2.311588	0.047619	1	7,869.94					
t^2	0.034234274	484	2.419178	0.045455	1	7,950.87					
logt^3	0.007204882	529	2.525056	0.043478	1	8,021.53					
t^-1	0.020822386	576	2.629279	0.041667	1	8,082.05					
c	1.05191E-05	625	2.731905	0.04	1	8,132.59					
		676	2.832988	0.038462	1	8,173.25					
Adjusted r^2 w/ horizon		729	2.932581	0.037037	1	8,204.17					
	0.991891854	784	3.030734	0.035714	1	8,225.46					



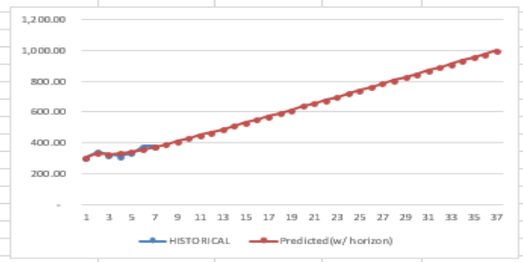
❖ MAINLAND PUBLIC BUILDING SALES

YEAR	HISTORICAL	t	logt^3	t^-1	c	Predicted(w/ horizon)	HISTORICAL GR	PREDICTED GR(w/ horizon)	ESS contrib. (w/ horizon)	TSS contrib. (w/ horizon)	MAPE contrib. (w/ horizon)
2011	3,282.06	1	0	1	1	3,292.85			116.3607538	2529854.72	0%
2012	3,714.64	2	0.027279	0.5	1	3,706.41	11.65%	11.16%	67.6540453	1340898.465	0%
2013	4,037.23	3	0.108614	0.333333	1	3,920.09	7.99%	5.45%	13722.52167	697862.5898	3%
2014	4,070.22	4	0.218232	0.25	1	4,217.83	0.81%	7.06%	21790.1632	643832.4452	4%
2015	4,491.00	5	0.341488	0.2	1	4,570.31	9.37%	7.71%	6289.66703	145627.4919	2%
2016	5,134.16	6	0.471186	0.166667	1	4,946.72	12.53%	7.61%	35131.87127	68405.72787	4%
2017	5,251.59	7	0.603561	0.142857	1	5,327.71	2.24%	7.15%	5795.118774	143622.3019	1%
2047	9,000.00	37	3.856611	0.027027	1	8,998.97			1.064454077	17035334.15	0%
w/o horizon obs.	4,282.98	8	0.736534	0.125	1	5,701.80	7.43%	7.69%	82914.4212	22605437.9	1.74%
w/ horizon obs.	4,872.61	9	0.868913	0.111111	1	6,062.27					
# of obs w/o Hori.(n)	7	10	1	0.1	1	6,405.26					
# of variable(k)	3	11	1.129389	0.090909	1	6,728.65					
# of obs w/ Hori.(n)	8	12	1.256849	0.083333	1	7,031.40					
		13	1.382259	0.076923	1	7,313.12					
t-stat(w/ horizon)	=[abcd]/SE	14	1.505565	0.071429	1	7,573.85					
t	3.509955158	15	1.626758	0.066667	1	7,813.90					
logt^3	4.04622033	16	1.74586	0.0625	1	8,033.71					
t^-1	6.703820643	17	1.862905	0.058824	1	8,233.86					
c	11.94887169	18	1.977944	0.055556	1	8,414.95					
		19	2.091032	0.052632	1	8,577.61					
P-value(w/ horizon)	=tdist(abs(t-stat),(n-k-1),2)	20	2.202226	0.05	1	8,722.48					
		21	2.311588	0.047619	1	8,850.21					
t	0.024672908	22	2.419178	0.045455	1	8,961.40					
logt^3	0.01552406	23	2.525056	0.043478	1	9,056.66					
t^-1	0.002576529	24	2.629279	0.041667	1	9,136.56					
c	0.000281082	25	2.731905	0.04	1	9,201.67					
		26	2.832988	0.038462	1	9,252.50					
Adjusted r^2 w/ horizon		27	2.932581	0.037037	1	9,289.58					
	0.99358118	28	3.030734	0.035714	1	9,313.37					



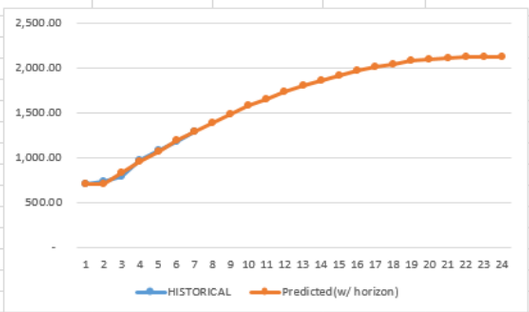
❖ MAINLAND STREET LIGHT SALES

YEAR	HISTORICAL	t	^-1	t^-3	c	Predicted(w/ horizon)	HISTORICAL GR	PREDICTED GR(w/	ESS contrib. (w/	TSS contrib.	MAPE contrib. (w/
2011	305.80	1	1	1	1	306.64			0.704956483	13616.5113	0%
2012	343.81	2	0.5	0.125	1	333.46	11.06%	8.04%	107.2201769	6190.51218	3%
2013	323.21	3	0.3333	0.037	1	328.13	-6.37%	-1.62%	24.17530878	9856.48027	2%
2014	313.59	4	0.25	0.0156	1	333.16	-3.07%	1.51%	383.0084613	11859.1682	6%
2015	335.01	5	0.2	0.008	1	344.15	6.39%	3.19%	83.58670956	7652.71681	3%
2016	377.78	6	0.1667	0.0046	1	358.50	11.32%	4.00%	371.7200024	1999.27365	5%
2017	380.72	7	0.1429	0.0029	1	374.87	0.77%	4.37%	34.29845934	1744.55865	2%
2047	1,000.00	37	0.027	2E-05	1	1,001.02			1.043692998	333518.022	0%
w/o horizon obs.	339.99	8	0.125	0.002	1	392.54	3.35%	3.25%	1005.757768	386437.243	2.57%
w/ horizon obs.	422.49	9	0.1111	0.0014	1	411.10					
# of obs w/o Hor	7	10	0.1	0.001	1	430.29					
# of variable(k)	3	11	0.0909	0.0008	1	449.95					
# of obs w/ Hori.	8	12	0.0833	0.0006	1	469.95					
		13	0.0769	0.0005	1	490.22					
t-stat(w/ horizon)	=[abcd]/SE	14	0.0714	0.0004	1	510.70					
t	27.5384828	15	0.0667	0.0003	1	531.36					
^-1	2.931613608	16	0.0625	0.0002	1	552.15					
t^-3	2.226136154	17	0.0588	0.0002	1	573.06					
c	8.010377876	18	0.0556	0.0002	1	594.06					
		19	0.0526	0.0001	1	615.14					
P-value(w/ horizo	=tdist(abs(t-stat),(n-k-1),2)	20	0.05	0.0001	1	636.30					
		21	0.0476	0.0001	1	657.51					
t	1.03415E-05	22	0.0455	9E-05	1	678.77					
^-1	0.042744952	23	0.0435	8E-05	1	700.08					
t^-3	0.089996341	24	0.0417	7E-05	1	721.42					
c	0.001317385	25	0.04	6E-05	1	742.80					
		26	0.0385	6E-05	1	764.21					
Adjusted r^2 w/ horizon		27	0.037	5E-05	1	785.65					
	0.995445377	28	0.0357	5E-05	1	807.11					
		29	0.0345	4E-05	1	828.59					
		30	0.0333	4E-05	1	850.10					
		31	0.0323	3E-05	1	871.62					
		32	0.0313	3E-05	1	893.15					
		33	0.0303	3E-05	1	914.70					



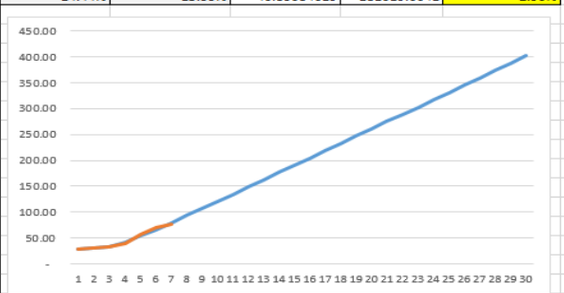
❖ MAINLAND WATER SYSTEM SALES

YEAR	HISTORICAL	t	t^2	t^-3	c	Predicted(w/ horizon)	HISTORICAL GR	PREDICTED GR(w/ horizon)	ESS contrib. (w/ horizon)	TSS contrib. (w/ horizon)	MAPE contrib. (w/ horizon)
2011	702.55	1	1	1	1	704.40			3.408815508	106838.7144	0%
2012	733.60	2	4	0.125	1	708.54	4.23%	0.58%	627.9554544	87504.69175	3%
2013	786.65	3	9	0.037037	1	827.93	6.74%	14.42%	1704.286461	58933.34958	5%
2014	962.40	4	16	0.015625	1	951.16	18.26%	12.96%	126.4264932	4490.597361	1%
2015	1,082.17	5	25	0.008	1	1,070.05	11.07%	11.11%	146.8786839	2783.415053	1%
2016	1,174.73	6	36	0.00463	1	1,183.14	7.88%	9.56%	70.79478319	21116.98121	1%
2017	1,293.20	7	49	0.002915	1	1,290.03	9.16%	8.29%	10.02474734	69582.361	0%
2047	1,500.00	37	1369	1.97E-05	1	1,500.05			0.002049093	221453.1415	0%
w/o horizon obs.	962.19	8	64	0.001953	1	1,390.57	9.56%	9.49%	2689.777487	572703.2519	1.52%
w/ horizon obs.	1,029.41	9	81	0.001372	1	1,484.72					
# of obs w/o Hori.(n)	7	10	100	0.001	1	1,572.43					
# of variable(k)	3	11	121	0.000751	1	1,653.70					
# of obs w/ Hori.(n)	8	12	144	0.000579	1	1,728.53					
		13	169	0.000455	1	1,796.90					
t-stat(w/ horizon)	=[abcd]/SE	14	196	0.000364	1	1,858.81					
t	17.2725411	15	225	0.000296	1	1,914.27					
t^2	15.44115425	16	256	0.000244	1	1,963.27					
t^-3	3.780068041	17	289	0.000204	1	2,005.81					
c	10.92904473	18	324	0.000171	1	2,041.90					
		19	361	0.000146	1	2,071.52					
P-value(w/ horizon)	=tdist(abs(t-stat),(n-k-1),2)	20	400	0.000125	1	2,094.68					
		21	441	0.000108	1	2,111.39					
t	6.59301E-05	22	484	9.39E-05	1	2,121.63					
t^2	0.000102656	23	529	8.22E-05	1	2,125.41					
t^-3	0.019434664	24	576	7.23E-05	1	2,122.74					
c	0.000398074	25	625	0.000064	1	2,113.60					
		26	676	5.69E-05	1	2,098.00					
Adjusted r^2 w/ horizon		27	729	5.08E-05	1	2,075.94					
	0.991780891	28	784	4.56E-05	1	2,047.43					



❖ MANIWAYA RESIDENTIAL SALES

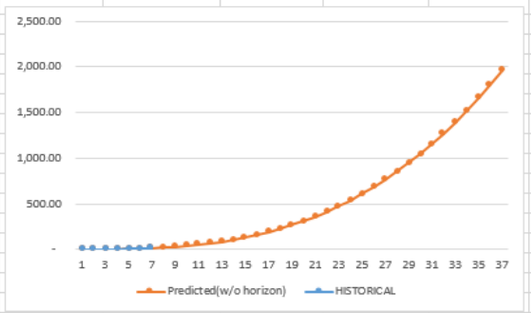
YEAR	HISTORICAL	t	t^-2	t^-3	c	Predicted(w/ horizon)	HISTORICAL GR	PREDICTED GR(w/ horizon)	ESS contrib. (w/ horizon)	TSS contrib. (w/ horizon)	MAPE contrib. (w/ horizon)
2011	28.93	1	1	1	1	28.92			1.26882E-05	5710.99774	0%
2012	30.76	2	0.25	0.125	1	30.79	5.97%	6.08%	0.000939212	5436.797662	0%
2013	34.00	3	0.111111	0.037037	1	33.56	9.52%	8.23%	0.197266454	4969.819052	1%
2014	39.72	4	0.0625	0.015625	1	42.54	14.41%	21.12%	7.933610437	4195.663765	7%
2015	57.15	5	0.04	0.008	1	53.99	30.49%	21.21%	9.96995816	2241.808821	6%
2016	69.48	6	0.027778	0.00463	1	66.56	17.75%	18.88%	8.555005555	1225.929326	4%
2017	75.93	7	0.020408	0.002915	1	79.70	8.49%	16.48%	14.16746745	815.9800796	5%
2047	500.00	37	0.00073	1.97E-05	1	499.92			0.00658624	156422.6676	0%
w/o horizon obs.	48.00	8	0.015625	0.001953	1	93.15	14.44%	15.33%	40.83084619	181019.6641	2.90%
w/ horizon obs.	104.50	9	0.012346	0.001372	1	106.80					
# of obs w/o Hori.(n)	7	10	0.01	0.001	1	120.57					
# of variable(k)	3	11	0.008264	0.000751	1	134.43					
# of obs w/ Hori.(n)	8	12	0.006944	0.000579	1	148.34					
		13	0.005917	0.000455	1	162.29					
t-stat(w/ horizon)	=[abcd]/SE	14	0.005102	0.000364	1	176.27					
t	110.878132	15	0.004444	0.000296	1	190.28					
t^-2	4.470258271	16	0.003906	0.000244	1	204.30					
t^-3	3.608986609	17	0.00346	0.000204	1	218.33					
c	7.880573908	18	0.003086	0.000171	1	232.37					
		19	0.00277	0.000146	1	246.43					
P-value(w/ horizon)	=tdist(abs(t-stat),(n-k-1),2)	20	0.0025	0.000125	1	260.49					
		21	0.002268	0.000108	1	274.55					
t	3.96764E-08	22	0.002066	9.39E-05	1	288.62					
t^-2	0.011072477	23	0.00189	8.22E-05	1	302.70					
t^-3	0.022576933	24	0.001736	7.23E-05	1	316.77					
c	0.001401781	25	0.0016	0.000064	1	330.85					



		26	0.001479	5.69E-05	1	344.93
Adjusted r^2 w/ horizon		27	0.001372	5.08E-05	1	359.02
	0.99960527	28	0.001276	4.56E-05	1	373.10

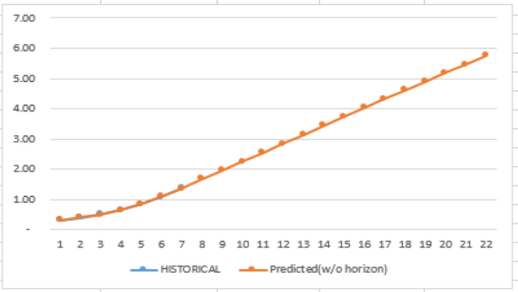
❖ MANIWAYA COMMERCIAL SALES

YEAR	HISTORICAL	t	t^3	logt^3	c	Predicted(w/o horizon)	HISTORICAL GR	PREDICTED GR(w/o horizon)	ESS contrib. (w/o horizon)	TSS contrib. (w/o horizon)	MAPE contrib. (w/o horizon)
2011	0.29	1	1	0	1	0.29			2.95988E-05	34.0672601	2%
2012	1.88	2	8	0.02728	1	1.92	84.44%	85.06%	0.00167625	18.02950577	2%
2013	3.30	3	27	0.10861	1	3.22	42.92%	40.27%	0.006047606	8.007295762	2%
2014	4.83	4	64	0.21823	1	4.79	31.66%	32.79%	0.001215409	1.691863547	1%
2015	6.85	5	125	0.34149	1	7.09	29.53%	32.37%	0.055611196	0.5229943	3%
2016	10.67	6	216	0.47119	1	10.44	35.79%	32.13%	0.052008729	20.63233893	2%
2017	15.08	7	343	0.60356	1	15.15	29.22%	31.05%	0.004811016	80.06311247	0%
w/o horizon obs.	6.13	8	512	0.73653	1	21.46	42.26%	42.28%	0.121399806	163.0143709	1.88%
w/ horizon obs.	192.86	9	729	0.86891	1	29.63					
# of obs w/o Hori.(n)	7	10	1000	1	1	39.90					
# of variable(k)	3	11	1331	1.12939	1	52.51					
# of obs w/ Hori.(n)	8	12	1728	1.25685	1	67.69					
		13	2197	1.38226	1	85.68					
t-stat(w/o horizon)	=[abcd]/SE	14	2744	1.50556	1	106.70					
t	5.411737591	15	3375	1.62676	1	131.00					
t^3	9.626572517	16	4096	1.74586	1	158.79					
logt^3	3.069740065	17	4913	1.86291	1	190.31					
c	3.10709147	18	5832	1.97794	1	225.80					
		19	6859	2.09103	1	265.47					
P-value(w/o horizon)	=tdist(abs(t-stat),(n-k-1),2)	20	8000	2.20223	1	309.57					
		21	9261	2.31159	1	358.31					
t	0.012373573	22	10648	2.41918	1	411.95					
t^3	0.002379232	23	12167	2.52506	1	470.69					
logt^3	0.054573508	24	13824	2.62928	1	534.77					
c	0.053001519	25	15625	2.73191	1	604.43					
		26	17576	2.83299	1	679.90					
Adjusted r^2 w/ horizon		27	19683	2.93258	1	761.40					
	0.999999689	28	21952	3.03073	1	849.16					
		29	24389	3.1275	1	943.42					
		30	27000	3.22291	1	1,044.40					
		31	29791	3.31703	1	1,152.34					



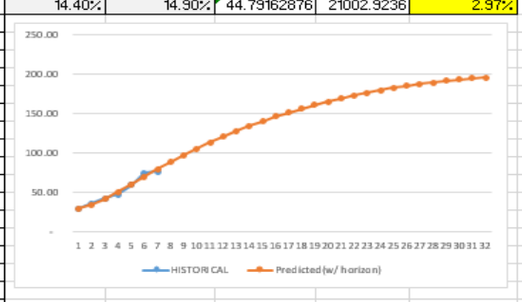
❖ MANIWAYA PUBLIC BUILDING SALES

YEAR	HISTORICAL	log(t)^3	log(t)^2	log(t)	c	Predicted(w/o horizon)	HISTORICAL GR	PREDICTED GR(w/o horizon)	ESS contrib. (w/o horizon)	TSS contrib. (w/o horizon)	MAPE contrib. (w/o horizon)
2011	0.32	0	0	0	1	0.31			4.55419E-06	0.180171125	1%
2012	0.40	0.02728	0.09062	0.30103	1	0.42	21.75%	24.94%	0.000202434	0.113498105	4%
2013	0.51	0.10861	0.22764	0.47712	1	0.50	21.75%	16.01%	0.000333656	0.050615526	4%
2014	0.66	0.21823	0.36248	0.60206	1	0.65	21.75%	23.41%	9.27051E-05	0.00671583	1%
2015	0.84	0.34149	0.48856	0.69897	1	0.85	21.75%	24.04%	0.000158043	0.010168911	1%
2016	1.07	0.47119	0.60552	0.77815	1	1.09	21.75%	21.98%	0.000369621	0.111855913	2%
2017	1.37	0.60356	0.71419	0.8451	1	1.36	21.75%	19.41%	0.000255881	0.400688894	1%
w/o horizon obs.	0.74	0.73653	0.81557	0.95424	1	1.68			0.001416894	0.873714303	1.95%
w/ horizon obs.	625.65	0.86891	0.91058	1	1	1.96					
# of obs w/o Hori.(n)	7	1	1	1.04139	1	2.25					
# of variable(k)	3	1.12939	1.0845	1.07918	1	2.55					
# of obs w/ Hori.(n)	8	1.25685	1.16463	1.11394	1	2.84					
		1.38226	1.24087	1.14613	1	3.14					
t-stat(w/o horizon)	=[abcd]/SE	1.50556	1.31361	1.17609	1	3.44					
log(t)^3	6.378289747	1.62676	1.38319	1.20412	1	3.73					
log(t)^2	3.538507707	1.74586	1.4499	1.23045	1	4.03					
log(t)	3.158134918	1.86291	1.514	1.25527	1	4.32					
c	14.42306506	1.97794	1.57571	1.27875	1	4.61					
		2.09103	1.63521	1.30103	1	4.90					
P-value(w/o horizon)	=tdist(abs(t-stat),(n-k-1),2)	2.20223	1.69268	1.32222	1	5.19					
		2.31159	1.74826	1.34242	1	5.47					
log(t)^3	0.007801943	2.41918	1.8021	1.36173	1	5.75					
log(t)^2	0.038404664	2.52506	1.8543	1.38021	1	6.03					
log(t)	0.050944372	2.62928	1.90498	1.39794	1	6.30					
c	0.000722492	2.73191	1.95424	1.41497	1	6.57					
		2.83299	2.00215	1.43136	1	6.84					
Adjusted r^2 w/o horizon		2.93258	2.0488	1.44716	1	7.11					
	0.996756619	3.03073	2.09427	1.4624	1	7.37					
		3.1275	2.13861	1.47712	1	7.63					
		3.22291	2.18189	1.49136	1	7.89					
		3.31703	2.22416	1.50515	1	8.15					



❖ MOMPONG RESIDENTIAL SALES

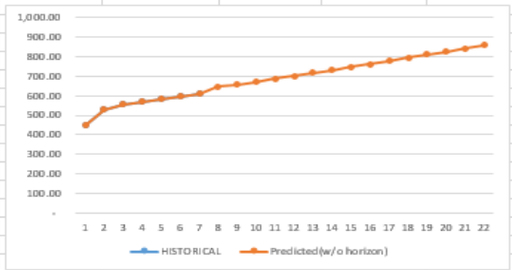
YEAR	HISTORICAL	t	logt	logt^3	c	Predicted(w/ horizon)	HISTORICAL GR	PREDICTED GR(w/	ESS contrib. (w/	TSS contrib.	MAPE contrib. (w/
2011	29.91	1	0	0	1	30.32			0.161064875	1712.7612	1%
2012	36.48	2	0.301	0.0273	1	35.32	18.00%	14.16%	1.357195609	1212.33624	3%
2013	43.05	3	0.4771	0.1086	1	42.41	15.25%	16.72%	0.409837308	798.139188	1%
2014	48.08	4	0.6021	0.2182	1	51.25	10.47%	17.25%	10.0243368	538.974259	7%
2015	60.15	5	0.699	0.3415	1	60.78	20.07%	15.68%	0.394147508	124.224826	1%
2016	75.47	6	0.7782	0.4712	1	70.43	20.29%	13.70%	25.38521737	17.3898245	7%
2017	77.25	7	0.8451	0.6036	1	79.91	2.30%	11.86%	7.059752966	35.3787527	3%
2047	200.00	37	1.5682	3.8566	1	199.99			7.63214E-05	16563.6593	0%
w/o horizon obs.	52.91	8	0.9031	0.7365	1	89.05	14.40%	14.90%	44.79162876	21002.9236	2.97%
w/ horizon obs.	71.30	9	0.9542	0.8689	1	97.79					
# of obs w/o Hor	7	10	1	1	1	106.10					
# of variable(k)	3	11	1.0414	1.1294	1	113.95					
# of obs w/ Hori.	8	12	1.0792	1.2568	1	121.36					
		13	1.1139	1.3823	1	128.33					
t-stat(w/ horizon	=[abcd]/SE	14	1.1461	1.5056	1	134.87					
t	2.670692057	15	1.1761	1.6268	1	141.01					
logt	6.38898264	16	1.2041	1.7459	1	146.74					
logt^3	3.391000988	17	1.2304	1.8629	1	152.10					
c	6.322242277	18	1.2553	1.9779	1	157.10					
		19	1.2788	2.091	1	161.75					
-value(w/ horizo	=tdist(abs(t-stat),(n-k-1),2)	20	1.301	2.2022	1	166.07					
		21	1.3222	2.3116	1	170.08					
t	0.055765805	22	1.3424	2.4192	1	173.78					
logt	0.003080533	23	1.3617	2.5251	1	177.18					
logt^3	0.027504584	24	1.3802	2.6293	1	180.31					
c	0.003202529	25	1.3979	2.7319	1	183.18					
		26	1.4150	2.8331	1	185.78					



		28	1.415	2.833	1	185.78
Adjusted r^2 w/ horizon		27	1.4314	2.9326	1	188.14
	0.996267884	28	1.4472	3.0307	1	190.26
		29	1.4624	3.1275	1	192.15

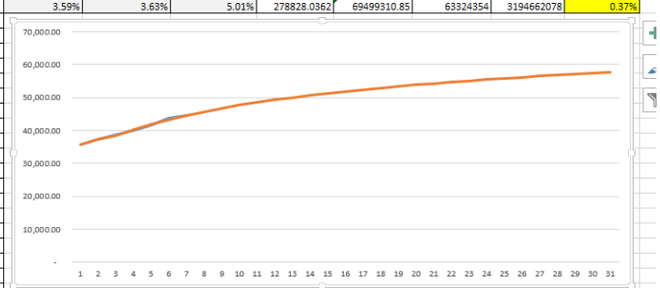
❖ MOMPONG RESIDENTIAL SALES

YEAR	HISTORICAL	log(t)^3	log(t)^2	log(t)	c	Predicted(w/	STORICAL G	PREDICTED GR(w/o	ESS contrib.	TSS contrib.	MAPE contrib.
2011	449.00	0	0	0	1	448.91			0.00874124	11525.19114	0.021%
2012	529.00	0.0273	0.0906	0.301	1	529.73	15.12%	15.26%	0.53923958	748.3202606	0.139%
2013	556.00	0.1086	0.2276	0.4771	1	554.57	4.86%	4.48%	2.0589071	0.126339712	0.258%
2014	569.33	0.2182	0.3625	0.6021	1	569.90	2.34%	2.69%	0.32952936	168.2247539	0.101%
2015	582.97	0.3415	0.4886	0.699	1	583.42	2.34%	2.32%	0.20506684	708.3642464	0.078%
2016	596.94	0.4712	0.6055	0.7782	1	596.97	2.34%	2.27%	0.00072669	1647.313097	0.005%
2017	611.25	0.6036	0.7142	0.8451	1	610.99	2.34%	2.29%	0.06749205	3013.347086	0.043%
2047	1,000.00	3.8566	2.4593	0.9031	1		4.89%	4.88%			
w/o horizon obs.	556.36	0.7365	0.8156	0.9542	1	645.91			3.20970286	17810.88692	0.092%
w/ horizon obs.	611.81	0.8689	0.9106	1	1	658.79					
# of obs w/o Hor	7	1	1	1.0414	1	672.48					
# of variable(k)	3	1.1294	1.0845	1.0792	1	686.77					
# of obs w/ Hori.	8	1.2568	1.1646	1.1139	1	701.53					
		1.3823	1.2409	1.1461	1	716.65					
t-stat(w/o horizon	=[abcd]/SE	1.5056	1.3136	1.1761	1	732.02					
log(t)^3	11.9665689	1.6268	1.3832	1.2041	1	747.59					
log(t)^2	14.34932283	1.7459	1.4499	1.2304	1	763.29					
log(t)	31.82583424	1.8629	1.514	1.2553	1	779.08					
c	434.801948	1.9779	1.5757	1.2788	1	794.93					
		2.091	1.6352	1.301	1	810.81					
P-value(w/o horizo	=tdist(abs(t-stat),(n-k-1),2)	2.2022	1.6927	1.3222	1	826.70					
		2.3116	1.7483	1.3424	1	842.56					
log(t)^3	0.001255307	2.4192	1.8021	1.3617	1	858.40					
log(t)^2	0.000733559	2.5251	1.8543	1.3802	1	874.19					
log(t)	6.81695E-05	2.6293	1.905	1.3979	1	889.93					
c	2.6828E-08	2.7319	1.9542	1.415	1	905.61					
		2.833	2.0021	1.4314	1	921.22					
Adjusted r^2 w/o horizon		2.9326	2.0488	1.4472	1	936.75					
	0.99963958	3.0307	2.0943	1.4624	1	952.20					
		3.1275	2.1386	1.4771	1	967.57					



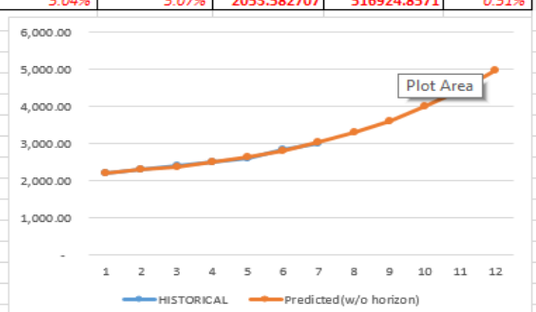
❖ MAINLAND RESIDENTIAL CUSTOMER

YEAR	DATA	logt	t^-2	t^-3	c	Predicted(w/o horizon)	HISTORICAL GR	PREDICTED GR(w/o horizon)	PREDICTED GR(w/ horizon)	ESS contrib. (w/o horizon)	ESS contrib. (w/ horizon)	TSS contrib. (w/o horizon)	TSS contrib. (w/ horizon)	MAPE contrib. (w/o horizon)
2011	35,707.00	0	1	1	1	35,706.27				0.533482556	3927.363048	19989841	142772626.6	0%
2012	37,308.00	0.30103	0.0625	0.125	1	37,341.55	4.29%	4.38%	9.39%	1125.471388	4114272.7	8236900	107075930.1	0%
2013	38,538.00	0.477121	0.012345679	0.037037037	1	38,377.60	3.19%	2.70%	-15.65%	25726.68726	20481646.29	2689600	83133365.06	0%
2014	40,036.00	0.60206	0.00390625	0.015625	1	40,137.47	3.74%	4.38%	8.07%	10296.66929	9240108.464	20164	58060590.06	0%
2015	41,521.00	0.69897	0.0016	0.008	1	41,809.63	3.58%	4.00%	10.64%	83304.8565	14691.88045	1803649	37635157.56	1%
2016	43,668.00	0.778151	0.000771605	0.00462963	1	43,287.83	4.92%	3.41%	9.54%	144531.6698	4406731.516	12180100	15902150.06	1%
2017	44,468.00	0.845098	0.000416493	0.002915452	1	44,585.65	1.80%	2.91%	8.08%	13842.14844	28341312.77	18404100	10161750.06	0%
2047	100,000.00	1.568202	5.33572E-07	1.97422E-05	1						2896619.863		2739920508	
w/o horizon obs.	40,178.00	0.90309	0.000244141	0.001953125	1	45,733.13	3.59%	3.63%	5.01%	278828.0362	69499310.85	63324354	3194662078	0.37%
w/ horizon obs.	47,655.75	0.954243	0.000152416	0.001371742	1	46,757.60								
# of obs w/o Hori.(n)	7	1	0.0001	0.001	1	47,681.04								
# of variable(k)	3	1.041393	6.83013E-05	0.000751315	1	48,520.63								
# of obs w/ Hori.(n)	8	1.079181	4.82253E-05	0.000578704	1	49,289.79								
		1.113943	3.50128E-05	0.000455166	1	49,999.10								
t-stat(w/o horizon)	=[abcd]/SE	1.146128	2.60308E-05	0.000364431	1	50,657.01								
logt	11.41034908	1.176091	1.97531E-05	0.000296296	1	51,270.34								
t^-2	3.633849497	1.20412	1.52588E-05	0.000244141	1	51,844.66								
t^-3	3.907462749	1.230449	1.1973E-05	0.000203542	1	52,384.59								
c	19.44745398	1.255273	9.52599E-06	0.000171468	1	52,893.97								
		1.278754	7.67336E-06	0.000145794	1	53,376.05								
P-value(w/o horizon)	=tdist(abs(t-stat),(n-k-1),2)	1.30103	0.00000625	0.000125	1	53,833.58								
		1.322219	5.14189E-06	0.00010798	1	54,268.92								
logt	0.001444422	1.342423	4.26883E-06	9.39144E-05	1	54,684.13								
t^-2	0.035896291	1.361728	3.57346E-06	8.21895E-05	1	55,080.97								
t^-3	0.02977256	1.380211	3.01408E-06	7.2338E-05	1	55,460.99								
c	0.000297005	1.39794	0.00000256	0.000064	1	55,825.55								
		1.414973	2.1883E-06	5.68958E-05	1	56,175.86								
Adjusted r^2 w/o horizon		1.431364	1.88168E-06	5.08053E-05	1	56,512.99								
	0.991193656	1.447158	1.62693E-06	4.55539E-05	1	56,837.89								



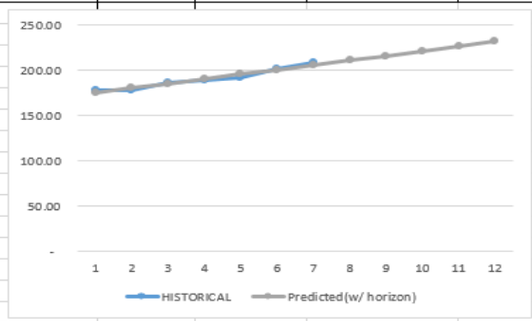
❖ MAINLAND COMMERCIAL CUSTOMER

YEAR	HISTORICAL	t^3	t	c	Predicted(w/o horizon)	HISTORICAL GR	PREDICTED GR(w/o horizon)	ESS contrib. (w/o horizon)	TSS contrib. (w/o horizon)	MAPE contrib. (w/o horizon)
2011	2,212.00	1	1	1	2,215.86			14.91	116,866.31	0.17%
2012	2,299.00	8	2	1	2,293.92	3.78%	3.40%	25.80	64,952.16	0.22%
2013	2,392.00	27	3	1	2,385.82	3.89%	3.85%	38.15	26,197.73	0.26%
2014	2,498.00	64	4	1	2,498.49	4.24%	4.51%	0.24	3,120.02	0.02%
2015	2,610.00	125	5	1	2,638.84	4.29%	5.32%	831.65	3,152.02	1.10%
2016	2,846.00	216	6	1	2,813.79	8.29%	6.22%	1,037.28	85,347.45	1.13%
2017	3,020.00	343	7	1	3,030.27	5.76%	7.14%	105.56	217,289.16	0.34%
2047	100,000.00	50653	37	1	63,162.87	5.04%	5.07%	2053.582707	516924.8571	0.51%
w/o horizon obs.	2,553.86	512	8	1	3,295.20					
w/ horizon obs.	14,734.63	729	9	1	3,615.50					
# of obs w/o Hori.(n)	7	1000	10	1	3,998.09					
# of variable(k)	2	1331	11	1	4,449.88					
# of obs w/ Hori.(n)	8	1728	12	1	4,977.81					
		2197	13	1	5,588.79					
t-stat(w/o horizon)	=[abc]/SE	2744	14	1	6,289.75					
t^3	5.648837757	3375	15	1	7,087.60					
t	5.822548413	4096	16	1	7,989.26					
c	73.43017228	4913	17	1	9,001.67					
		5832	18	1	10,131.73					
P-value(w/o horizon)	=tdist(abs(t-stat),(n-k-1),2)	6859	19	1	11,386.36					
		8000	20	1	12,772.50					
t^3	0.004837499	9261	21	1	14,297.06					
t	0.004332938	10648	22	1	15,966.97					
c	2.06118E-07	12167	23	1	17,789.13					
		13824	24	1	19,770.48					
Adjusted r^2 w/o horizon		15625	25	1	21,917.94					
	0.994040964	17576	26	1	24,238.42					



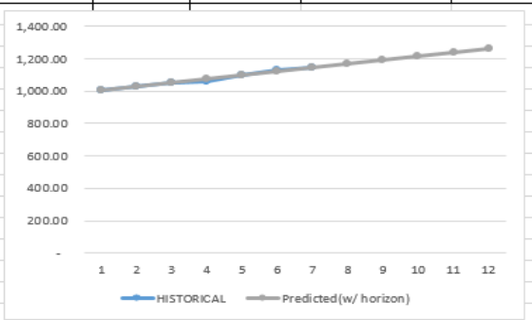
❖ MAINLAND INDUSTRIAL CUSTOMER

	YEAR	HISTORICAL	t^3	t	c	Predicted(w/ horizon)	HISTORICAL GR	PREDICTED GR(w/ horizon)	ESS contrib. (w/ horizon)	TSS contrib. (w/ horizon)	MAPE contrib. (w/ horizon)
2	2011	178.00	1	1	1	175.40			6.76	1,491.89	1.46%
3	2012	178.00	8	2	1	180.38	0.00%	2.76%	5.68	1,491.89	1.34%
4	2013	187.00	27	3	1	185.38	4.81%	2.69%	2.64	877.64	0.87%
5	2014	189.00	64	4	1	190.38	1.06%	2.63%	1.92	763.14	0.73%
6	2015	192.00	125	5	1	195.41	1.56%	2.57%	11.66	606.39	1.78%
7	2016	201.00	216	6	1	200.47	4.48%	2.52%	0.28	244.14	0.26%
8	2017	208.00	343	7	1	205.56	3.37%	2.48%	5.95	74.39	1.17%
9	2047	400.00	50653	37	1	400.01	*2.55%*	*2.61%*	**34.87273327**	**5549.484375**	*1.03%*
10	w/o horizon obs.	190.43	512	8	1	210.69					
11	w/ horizon obs.	216.63	729	9	1	215.86					
12	**# of obs w/o Hori.(n)**	7	1000	10	1	221.08					
13	**# of variable(k)**	2	1331	11	1	226.35					
14	**# of obs w/ Hori.(n)**	8	1728	12	1	231.68					
15			2197	13	1	237.08					
16	**t-stat(w/ horizon)**	=[abc]/SE	2744	14	1	242.55					
17	t^3	2.618937733	3375	15	1	248.09					
18	t	9.612038771	4096	16	1	253.71					
19	c	75.29015256	4913	17	1	259.42					
20			5832	18	1	265.22					
21	**P-value(w/ horizon)**	=tdist(abs(t-	6859	19	1	271.12					
22		stat),(n-k-1),2)	8000	20	1	277.12					
23	t^3	0.047158168	9261	21	1	283.23					
24	t	0.000206603	10648	22	1	289.45					
25	c	7.83055E-09	12167	23	1	295.79					
26			13824	24	1	302.25					
27	**Adjusted r^2 w/ horizon**		15625	25	1	308.85					
28		0.991202457	17576	26	1	315.57					



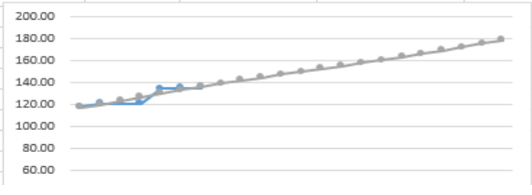
❖ MAINLAND PUBLIC BUILDING CUSTOMER

	YEAR	HISTORICAL	t^3	t	c	Predicted(w/ horizon)	HISTORICAL GR	PREDICTED GR(w/ horizon)	ESS contrib. (w/ horizon)	TSS contrib. (w/ horizon)	MAPE contrib. (w/ horizon)
2	2011	1,008.00	1	1	1	1,001.71			39.51	16,705.56	0.62%
3	2012	1,025.00	8	2	1	1,025.79	1.66%	2.35%	0.62	12,600.06	0.08%
4	2013	1,048.00	27	3	1	1,049.79	2.19%	2.29%	3.22	7,965.56	0.17%
5	2014	1,060.00	64	4	1	1,073.70	1.13%	2.23%	187.61	5,967.56	1.29%
6	2015	1,100.00	125	5	1	1,097.47	3.64%	2.17%	6.42	1,387.56	0.23%
7	2016	1,130.00	216	6	1	1,121.06	2.65%	2.11%	79.84	52.56	0.79%
8	2017	1,143.00	343	7	1	1,144.46	1.14%	2.04%	2.13	33.06	0.13%
9	2047	1,584.00	50653	37	1	1,584.02	*2.07%*	*2.20%*	**319.347262**	**44711.9375**	*0.45%*
10	w/o horizon obs.	1,073.43	512	8	1	1,167.62					
11	w/ horizon obs.	1,137.25	729	9	1	1,190.51					
12	**# of obs w/o Hori.(n)**	7	1000	10	1	1,213.09					
13	**# of variable(k)**	2	1331	11	1	1,235.34					
14	**# of obs w/ Hori.(n)**	8	1728	12	1	1,257.21					
15			2197	13	1	1,278.68					
16	**t-stat(w/ horizon)**	=[abc]/SE	2744	14	1	1,299.70					
17	t^3	5.436620037	3375	15	1	1,320.26					
18	t	15.39321434	4096	16	1	1,340.30					
19	c	142.7191547	4913	17	1	1,359.81					
20			5832	18	1	1,378.73					
21	**P-value(w/ horizon)**	=tdist(abs(t-	6859	19	1	1,397.05					
22		stat),(n-k-1),2)	8000	20	1	1,414.73					
23	t^3	0.002856577	9261	21	1	1,431.73					
24	t	2.09999E-05	10648	22	1	1,448.01					
25	c	3.20379E-10	12167	23	1	1,463.56					
26			13824	24	1	1,478.32					
27	**Adjusted r^2 w/ horizon**		15625	25	1	1,492.27					
28		0.990000743	17576	26	1	1,505.38					

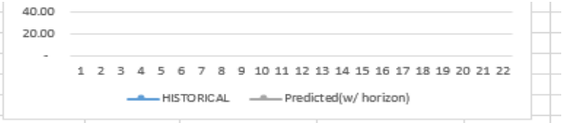


❖ MAINLAND STREET LIGHT CUSTOMER

YEAR	HISTORICAL	t^3	logt^2	c	Predicted(w/ horizon)	HISTORICAL GR	PREDICTED GR(w/ horizon)	ESS contrib. (w/ horizon)	TSS contrib. (w/ horizon)	MAPE contrib. (w/ horizon)
2011	118.00	1	-	1	116.96			1.08	570.02	0.88%
2012	121.00	8	0.09	1	119.34	2.48%	2.00%	2.75	435.77	1.37%
2013	121.00	27	0.23	1	122.96	0.00%	2.94%	3.84	435.77	1.62%
2014	121.00	64	0.36	1	126.54	0.00%	2.83%	30.74	435.77	4.58%
2015	134.00	125	0.49	1	129.93	9.70%	2.61%	16.55	62.02	3.04%
2016	135.00	216	0.61	1	133.12	0.74%	2.40%	3.53	47.27	1.39%
2017	135.00	343	0.71	1	136.14	0.00%	2.22%	1.30	47.27	0.84%
2047	250.00	50653	2.46	1	250.00			0.00	11,691.02	
w/o horizon obs.	126.43	512	0.82	1	139.03	*2.15%*	*2.50%*	**59.80**	**13,724.88**	*2.14%*
w/ horizon obs.	141.88	729	0.91	1	141.81					
# of obs w/o Hori.(n)	7	1000	1.00	1	144.52					
# of variable(k)	2	1331	1.08	1	147.18					
# of obs w/ Hori.(n)	8	1728	1.16	1	149.82					
		2197	1.24	1	152.45					
t-stat(w/ horizon)	=[abc]/SE	2744	1.31	1	155.10					
t^3	5.694338874	3375	1.38	1	157.78					
logt^2	4.830771032	4096	1.45	1	160.50					
c	50.66046505	4913	1.51	1	163.29					
		5832	1.58	1	166.15					

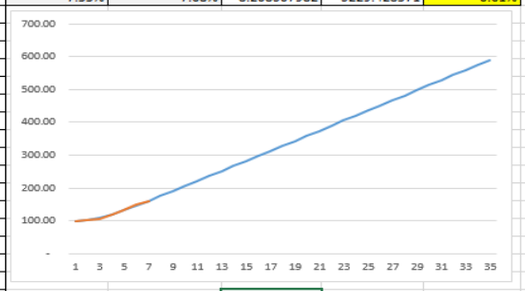


P-value(w/ horizon)	=tdist(abs(t-stat),(n-k-	6859	1.64	1	169.10
		8000	1.69	1	172.15
t^3	0.002329816	9261	1.75	1	175.32
logt^2	0.004753262	10648	1.80	1	178.61
c	5.66431E-08	12167	1.85	1	182.03
		13824	1.90	1	185.60
Adjusted r^2 w/ horizon		15625	1.95	1	189.33
	0.993900273	17576	2.00	1	193.23
		19683	2.05	1	197.31
		21952	2.09	1	201.57



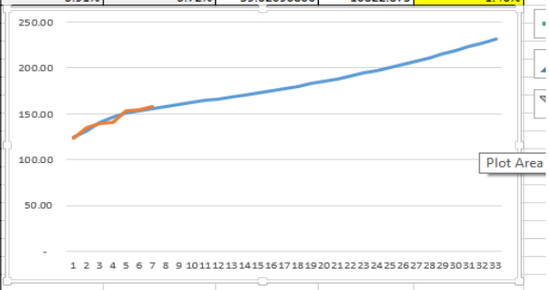
❖ MAINLAND WATER SYSTEM CUSTOMER

	YEAR	HISTORICAL	t	t^-2	t^-3	c	Predicted(w/o horizon)	HISTORICAL GR	PREDICTED GR(w/o horizon)	ESS contrib. (w/o horizon)	TSS contrib. (w/o horizon)	MAPE contrib. (w/o horizon)
2	2011	99.00	1	1	1	1	99.02			0.000246042	610.7959184	0%
3	2012	103.00	2	0.25	0.125	1	102.67	3.88%	3.56%	0.106607149	429.0816327	0%
4	2013	107.00	3	0.11111	0.03704	1	107.84	3.74%	4.79%	0.709898161	279.3673469	1%
5	2014	119.00	4	0.0625	0.01563	1	118.66	10.08%	9.12%	0.114780195	22.2244898	0%
6	2015	131.00	5	0.04	0.008	1	131.71	9.16%	9.91%	0.504109287	53.08163265	1%
7	2016	148.00	6	0.02778	0.00463	1	145.76	11.49%	9.64%	4.997152937	589.7959184	2%
8	2017	159.00	7	0.02041	0.00292	1	160.33	6.92%	9.09%	1.775514211	1245.081633	1%
9	2047	150.00	37	0.00073	2E-05	1						
10	w/o horizon obs.	123.71	8	0.01563	0.00195	1	175.19	7.55%	7.68%	8.208307982	3229.428571	0.61%
11	w/ horizon obs.	127.00	9	0.01235	0.00137	1	190.22					
12	# of obs w/o Hori.(n)	7	10	0.01	0.001	1	205.36					
13	# of variable(k)	3	11	0.00826	0.00075	1	220.57					
14	# of obs w/ Hori.(n)	8	12	0.00694	0.00058	1	235.84					
15			13	0.00592	0.00046	1	251.14					
16	t-stat(w/o horizon)	=[abcd]/SE	14	0.0051	0.00036	1	266.47					
17	t	15.85885986	15	0.00444	0.0003	1	281.81					
18	t^-2	3.645335908	16	0.00391	0.00024	1	297.18					
19	t^-3	3.195866194	17	0.00346	0.0002	1	312.55					
20	c	7.620208407	18	0.00309	0.00017	1	327.94					
21			19	0.00277	0.00015	1	343.33					
22	P-value(w/o horizon)	=tdist(abs(t-stat),(n-k-1),2)	20	0.0025	0.00013	1	358.73					
23			21	0.00227	0.00011	1	374.13					
24	t	0.000545096	22	0.00207	9.4E-05	1	389.54					
25	t^-2	0.035608384	23	0.00189	8.2E-05	1	404.95					
26	t^-3	0.04948817	24	0.00174	7.2E-05	1	420.37					
27	c	0.004691157	25	0.0016	6.4E-05	1	435.78					
28			26	0.00148	5.7E-05	1	451.20					
29	Adjusted r^2 w/o horizon		27	0.00137	5.1E-05	1	466.62					
30		0.994916557	28	0.00128	4.6E-05	1	482.04					
31			29	0.00119	4.1E-05	1	497.47					
32			30	0.00111	3.7E-05	1	512.89					



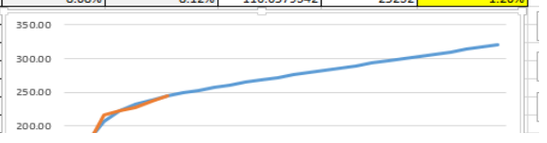
POLO RESIDENTIAL CUSTOMER

YEAR	HISTORICAL	t^2	t^-1	t^-3	c	Predicted(w/ horizon)	HISTORICAL GR	PREDICTED GR(w/ horizon)	ESS contrib. (w/ horizon)	TSS contrib. (w/ horizon)	MAPE contrib. (w/ horizon)
2011	124.00	1	1	1	1	124.24			0.056020098	1080.765625	0%
2012	135.00	4	0.5	0.125	1	131.94	8.15%	5.84%	9.337512343	478.515625	2%
2013	139.00	9	0.333333	0.037037037	1	141.23	2.88%	6.58%	4.978248511	319.515625	2%
2014	141.00	16	0.25	0.015625	1	146.88	1.42%	3.85%	34.60605069	252.015625	4%
2015	153.00	25	0.2	0.008	1	150.75	7.84%	2.57%	5.057183565	15.015625	1%
2016	155.00	36	0.166667	0.00462963	1	153.71	1.29%	1.92%	1.665326306	3.515625	1%
2017	158.00	49	0.142857	0.002915452	1	156.18	1.90%	1.58%	3.316274133	1.265625	1%
2047	250.00	1369	0.027027	1.97422E-05	1	250.07			0.004292414	8672.265625	0%
w/o horizon obs.	143.57	64	0.125	0.001953125	1	158.38	3.91%	3.72%	59.02090806	10822.875	1.46%
w/ horizon obs.	156.88	81	0.111111	0.001371742	1	160.45					
# of obs w/o Hori.(n)	7	100	0.1	0.001	1	162.46					
# of variable(k)	3	121	0.090909	0.000751315	1	164.45					
# of obs w/ Hori.(n)	8	144	0.083333	0.000578704	1	166.48					
		169	0.076923	0.000455166	1	168.55					
t-stat(w/ horizon)	=[abcd]/SE	196	0.071429	0.000364431	1	170.69					
t^2	15.43213967	225	0.066667	0.000296296	1	172.91					
t^-1	3.962486853	256	0.0625	0.000244141	1	175.22					
t^-3	2.181890541	289	0.058824	0.000203542	1	177.62					
c	35.42061033	324	0.055556	0.000171468	1	180.12					
		361	0.052632	0.000145794	1	182.74					
P-value(w/ horizon)	=tdist(abs(t-stat),(n-k-1),2)	400	0.05	0.000125	1	185.46					
		441	0.047619	0.00010798	1	188.29					
t^2	0.000102893	484	0.045455	9.39144E-05	1	191.24					
t^-1	0.016642959	529	0.043478	8.21895E-05	1	194.30					
t^-3	0.094544534	576	0.041667	7.2338E-05	1	197.48					
c	3.7916E-06	625	0.04	0.000064	1	200.79					
		676	0.038462	5.68958E-05	1	204.21					
Adjusted r^2 w/ horizon		729	0.037037	5.08053E-05	1	207.75					
	0.99045664	784	0.035714	4.55539E-05	1	211.42					



❖ MANIWAYA RESIDENTIAL CUSTOMER

	YEAR	HISTORICAL	t	t^-2	t^-3	c	Predicted(w/ horizon)	HISTORICAL GR	PREDICTED GR(w/ horizon)	ESS contrib. (w/ horizon)	TSS contrib. (w/ horizon)	MAPE contrib. (w/ horizon)
2	2011	145.00	1	1	1	1	144.81			0.03732629	6724	0%
3	2012	174.00	2	0.25	0.125	1	177.79	16.67%	18.55%	14.35903602	2809	2%
4	2013	216.00	3	0.111111	0.037037	1	207.21	19.44%	14.20%	77.34168335	121	4%
5	2014	222.00	4	0.0625	0.015625	1	222.26	2.70%	6.78%	0.069737902	25	0%
6	2015	227.00	5	0.04	0.008	1	231.65	2.20%	4.05%	21.62684836	0	2%
7	2016	237.00	6	0.027778	0.00463	1	238.48	4.22%	2.86%	2.184835746	100	1%
8	2017	245.00	7	0.020408	0.002915	1	244.00	3.27%	2.26%	1.000844811	324	0%
9	2047	350.00	37	0.00073	1.97E-05	1	349.81			0.037621743	15129	0%
10	w/o horizon obs.	209.43	8	0.015625	0.001953	1	248.79	8.08%	8.12%	116.6579342	25232	1.20%
11	w/ horizon obs.	227.00	9	0.012346	0.001372	1	253.14					
12	# of obs w/o Hori.(n)	7	10	0.01	0.001	1	257.20					
13	# of variable(k)	3	11	0.008264	0.000751	1	261.08					
14	# of obs w/ Hori.(n)	8	12	0.006944	0.000579	1	264.83					
15			13	0.005917	0.000455	1	268.48					
16	t-stat(w/ horizon)	=[abcd]/SE	14	0.005102	0.000364	1	272.07					
17	t	15.42171733	15	0.004444	0.000296	1	275.60					



18	t^-2	6.048992952	16	0.003906	0.000244	1	279.10
19	t^-3	4.849759452	17	0.00346	0.000204	1	282.57
20	c	48.42149972	18	0.003086	0.000171	1	286.01
21			19	0.00277	0.000146	1	289.43
22	P-value(w/ horizon)	=tdist(abs(t-stat),(n-k-1),2)	20	0.0025	0.000125	1	292.84
23			21	0.002268	0.000108	1	296.23
24	t	0.000103168	22	0.002066	9.39E-05	1	299.62
25	t^-2	0.003768444	23	0.00189	8.22E-05	1	302.99
26	t^-3	0.008340874	24	0.001736	7.23E-05	1	306.36
27	c	1.08834E-06	25	0.0016	0.000064	1	309.72
28			26	0.001479	5.69E-05	1	313.08
29	Adjusted r^2 w/ horizon		27	0.001372	5.08E-05	1	316.43
30		0.991909029	28	0.001276	4.56E-05	1	319.78

❖ MANIWAYA COMMERCIAL CUSTOMER

YEAR	DATA	logt^3	t^-2	t^-3	c	Predicted(w/ horizon)	HISTORICAL GR	PREDICTED GR(w/ horizon)	ESS contrib. (w/ horizon)	TSS contrib. (w/ horizon)	MAPE contrib. (w/ horizon)
2011	1.00	0	1	1	1	1.00			1.41319E-07	28.890625	0%
2012	3.00	0.02728	0.0625	0.125	1	2.98	66.67%	66.38%	0.000615696	11.390625	1%
2013	5.00	0.10861	0.01234568	0.03703704	1	5.14	40.00%	42.06%	0.018302993	1.890625	3%
2014	6.00	0.21823	0.00390625	0.015625	1	6.02	16.67%	14.71%	0.000435814	0.140625	0%
2015	7.00	0.34149	0.0016	0.008	1	6.56	14.29%	8.21%	0.194361197	0.390625	6%
2016	7.00	0.47119	0.0007716	0.00462963	1	6.98	0.00%	6.01%	0.000456755	0.390625	0%
2017	7.00	0.60356	0.00041649	0.00291545	1	7.35	0.00%	5.03%	0.12121846	0.390625	5%
2047	15.00	3.85661	5.3357E-07	1.9742E-05	1	14.98			0.000311729	74.390625	0%
w/o horizon obs.	5.14	0.73653	0.00024414	0.00195313	1	7.69	22.94%	23.73%	0.335702787	117.875	1.95%
w/ horizon obs.	6.38	0.86891	0.00015242	0.00137174	1	8.02					
# of obs w/o Hori.(n)	7	1	0.0001	0.001	1	8.34					
# of variable(k)	3	1.12939	6.8301E-05	0.00075131	1	8.65					
# of obs w/ Hori.(n)	8	1.25685	4.8225E-05	0.0005787	1	8.95					
		1.38226	3.5013E-05	0.00045517	1	9.24					
t-stat(w/ horizon)	=[abcd]/SE	1.50556	2.6031E-05	0.00036443	1	9.53					
logt^3	24.09840188	1.62676	1.9753E-05	0.0002963	1	9.82					
t^-2	7.089780786	1.74586	1.5259E-05	0.00024414	1	10.09					
t^-3	7.843520544	1.86291	1.1973E-05	0.00020354	1	10.37					
c	33.57365671	1.97794	9.526E-06	0.00017147	1	10.63					
		2.09103	7.6734E-06	0.00014579	1	10.90					
P-value(w/ horizon)	=tdist(abs(t-stat),(n-k-1),2)	2.20223	0.00000625	0.000125	1	11.15					
		2.31159	5.1419E-06	0.00010798	1	11.41					
logt^3	1.75885E-05	2.41918	4.2688E-06	9.3914E-05	1	11.66					
t^-2	0.002089815	2.52506	3.5735E-06	8.219E-05	1	11.90					
t^-3	0.001427091	2.62928	3.0141E-06	7.2338E-05	1	12.14					
c	4.69453E-06	2.73191	0.00000256	0.000064	1	12.38					
		2.83299	2.1883E-06	5.6896E-05	1	12.61					
Adjusted r^2 w/ horizon		2.93258	1.8817E-06	5.0805E-05	1	12.85					
	0.995016077	3.03073	1.6269E-06	4.5554E-05	1	13.07					
		3.1275	1.4139E-06	4.1002E-05	1	13.30					
		3.22291	1.2346E-06	3.7037E-05	1	13.52