

Energy Mix

STEPS IN DETERMINING AND ANALYZING ENERGY

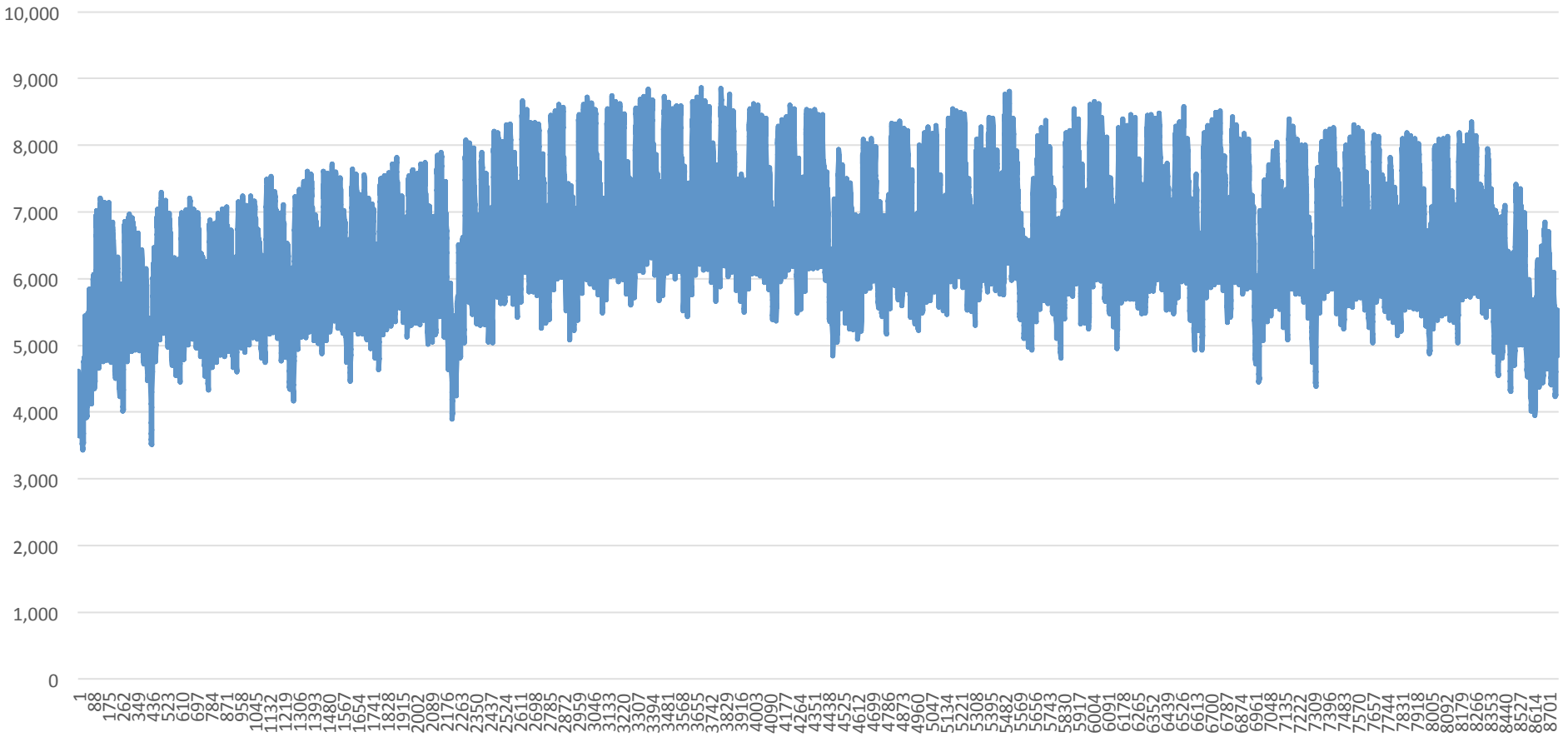
MIX ECONOMICS

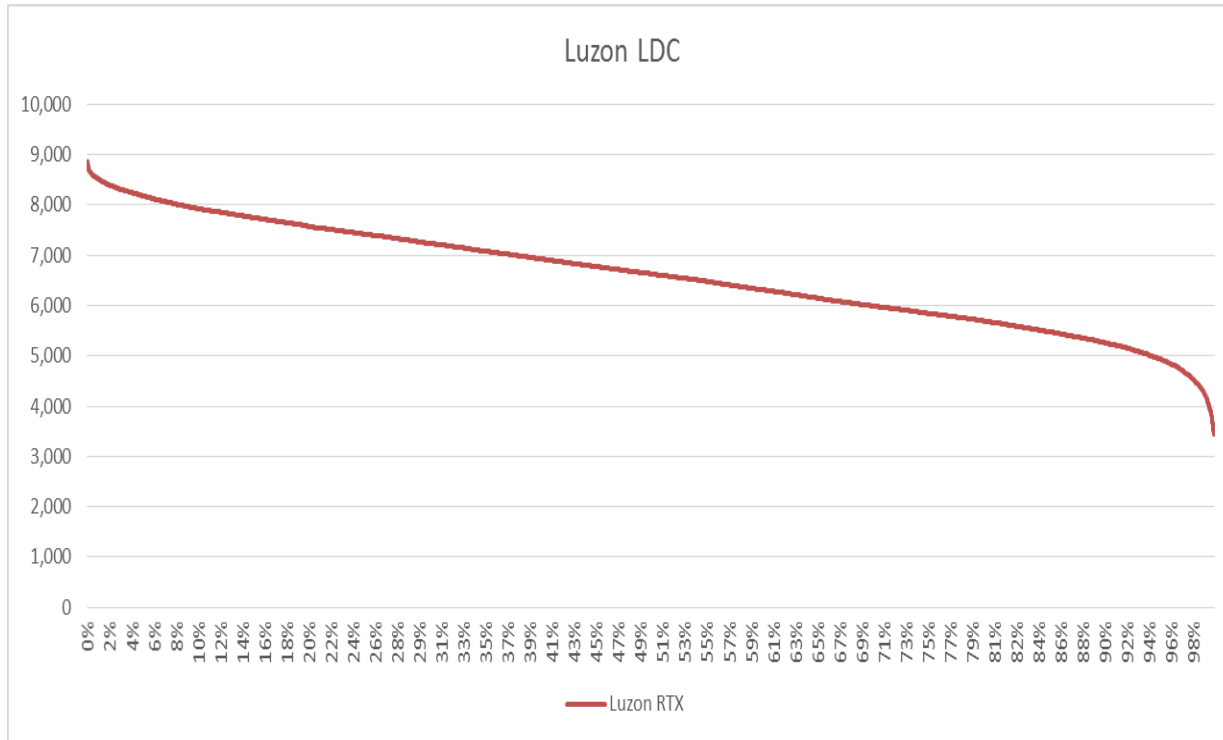
1. Using the load curve (or LDC), determine mix on the basis of the components of the load curve; namely, base-load, mid-to-peak load, and ancillary.

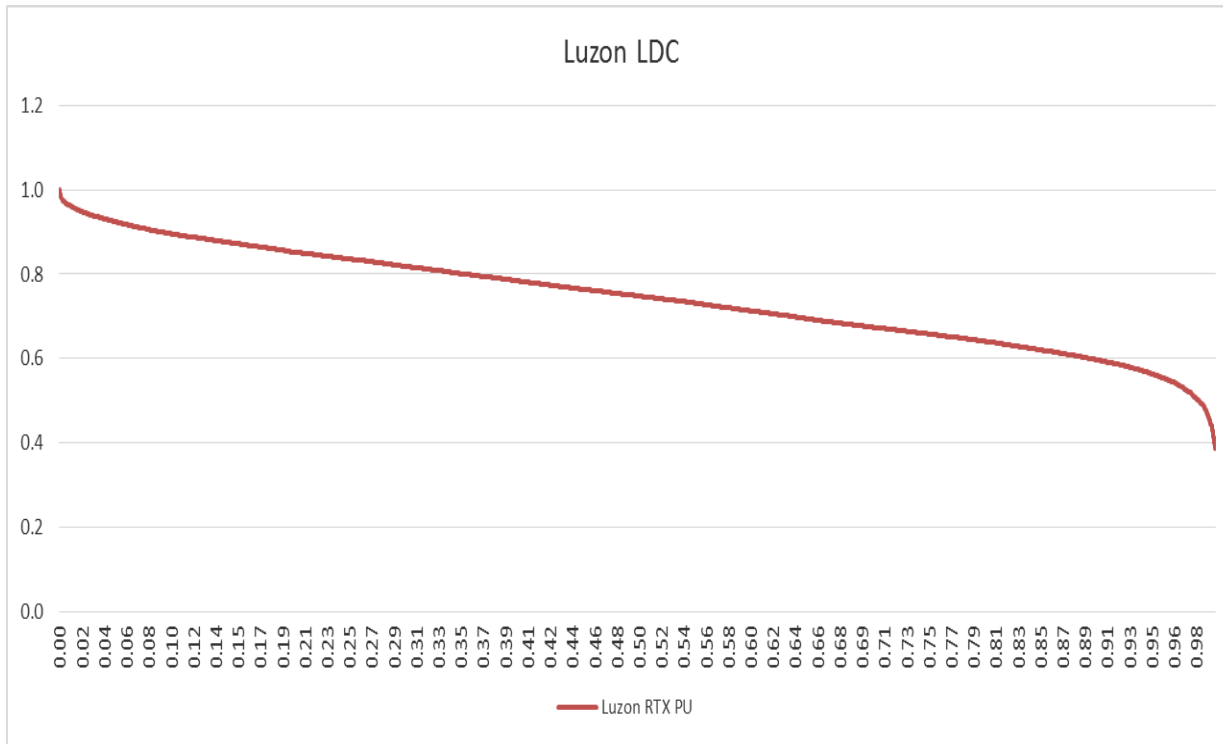
Load Curves and LDC

- Annual
- Monthly
- Daily

Luzon Demand







Energy Mix

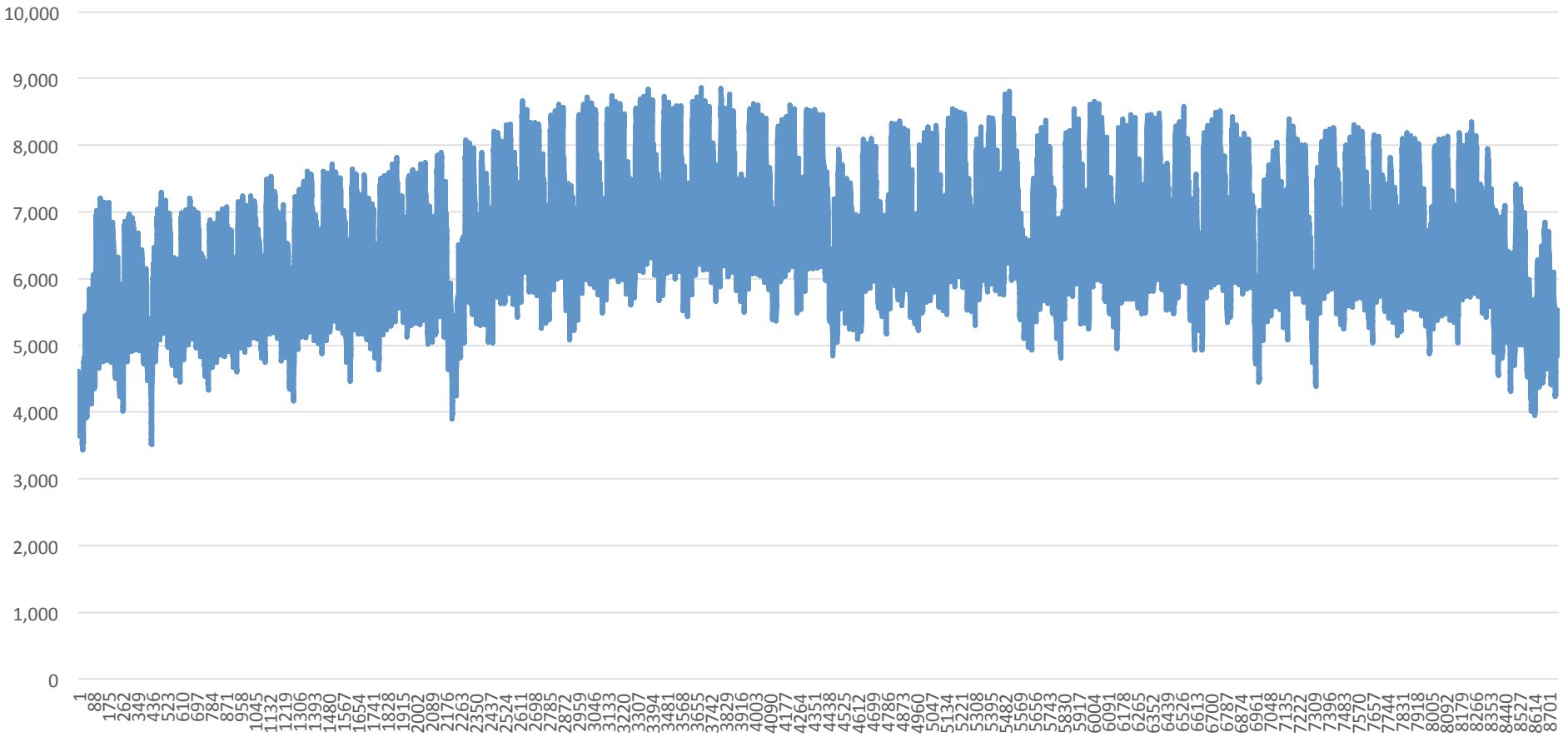
	From LDC	% of Peak Demand			% of Gwh Demand
2015 Luzon LF = 0.75	0.750		Per Unit Total Energy	0.750	100%
2015 Luzon Peak , MW	9,000	100%			
2015 Luzon Base, MW	5,000				
Ratio of Base to Peak = Per Unit Base	0.5556	56%	Per Unit Base Energy	0.556	74%
Per Unit mid- to peak	0.4444	44%	Per Unit Mid- Peak Energy	0.194	26%
Largest Unit, MW	647				

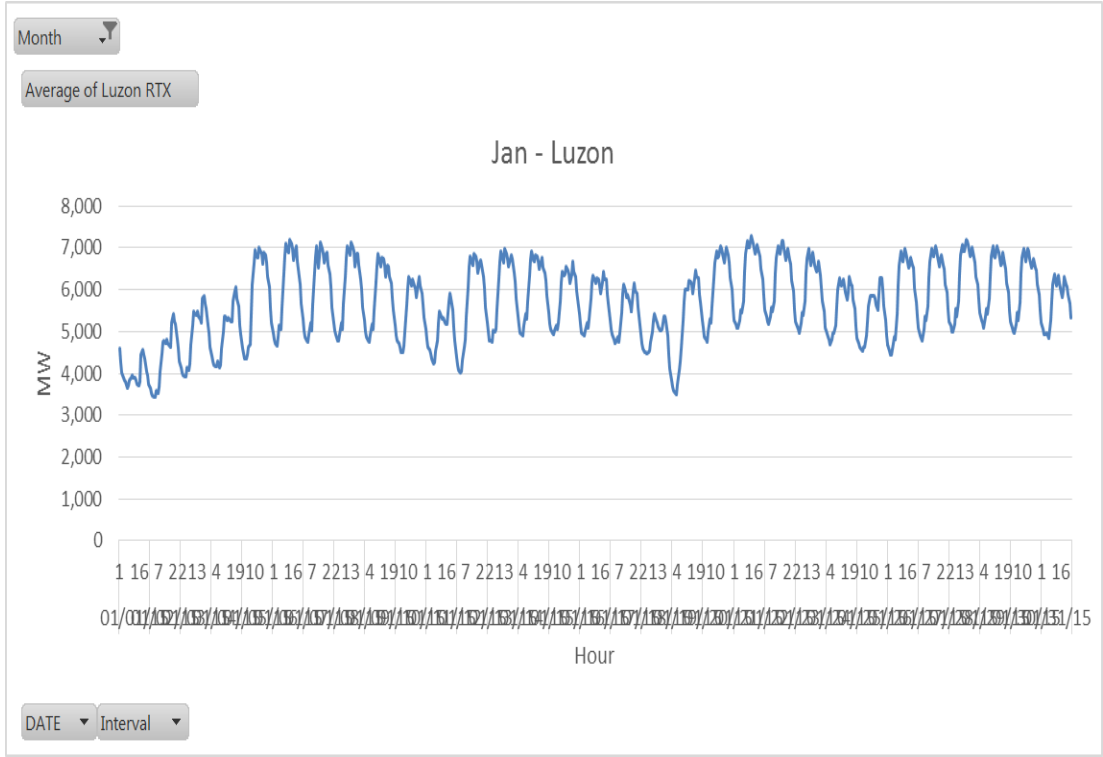
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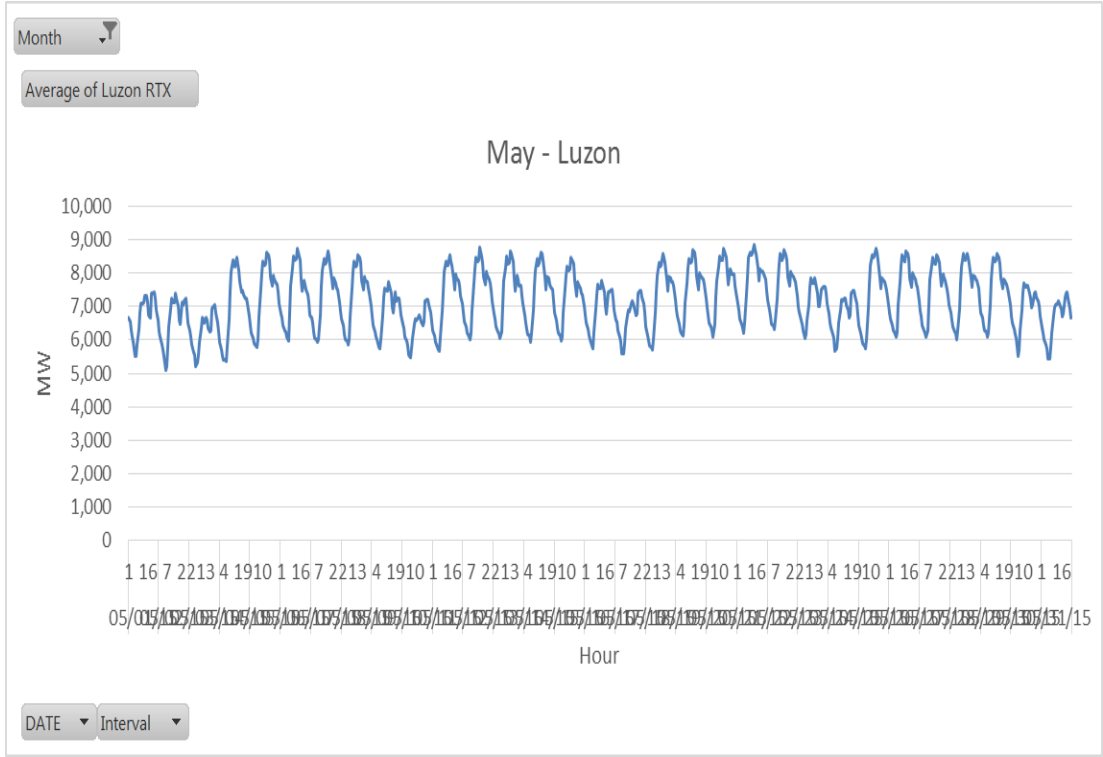
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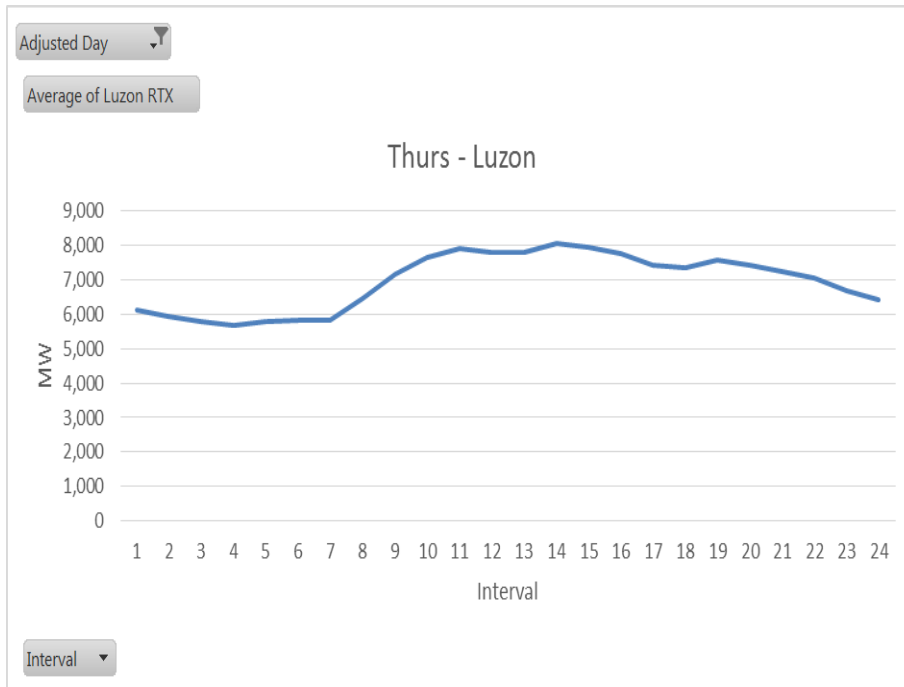
1. Using the load curve (or LDC), determine mix on the basis of the components of the load curve; namely, base-load, mid-to-peak load, and ancillary.
2. Determine technologies for each component of the load curve using basic rule of power system economics of a vertically integrated utility; namely, a) the base-load component are supplied by technologies with high capex and low variable/fuel costs; and, b) mid- to peak load are supplied by technologies with low capex and high variable/fuel costs. Moreover, they lend themselves to cycling and on/off operation and control of capacity output

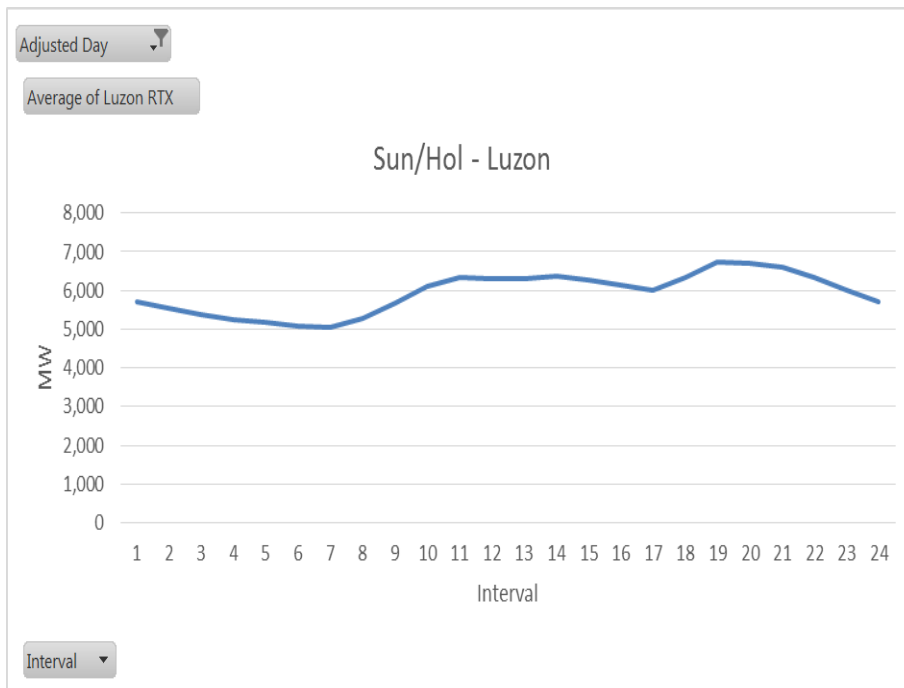
Luzon Demand











Technology vs. Load Curve Component

Base Capacity	Coal, Geothermal, Base Hydro, Must-dispatched REs						
Mid-merit Capacity	Hydro, Gas, Diesel Engines						
Peaking Capacity	Hydro, Gas, Diesel Engines						
Ancillary Capacity	Hydro, Gas, Diesel Engines						

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3. Distribute mix among the technologies using (1) & (2). Optimize mix on the basis of the following criteria/constraints:
 - 1) Cost-of electricity generation
 - 2) Environmental impact
 - 3) Security of supply
 - a) Indigenous vs. imported
 - b) Weather dependency
 - c) Geopolitics

Must-dispatched REs

MW installed % Peak Demand	% of Total Energy at 0.25 CF ave	% of Total Energy at 0.40 CF ave	MW Installed % Base Demand	% of Base Energy at 0.25 CF	% of Base Energy at 0.40 CF
5.56%	1.85%	2.96%	10.00%	2.50%	4.00%
10.00%	3.33%	5.33%	18.00%	4.50%	7.20%
18.75%	6.25%	10.00%	33.75%	8.44%	13.50%
30.00%	10.00%	16.00%	54.00%	13.50%	21.60%

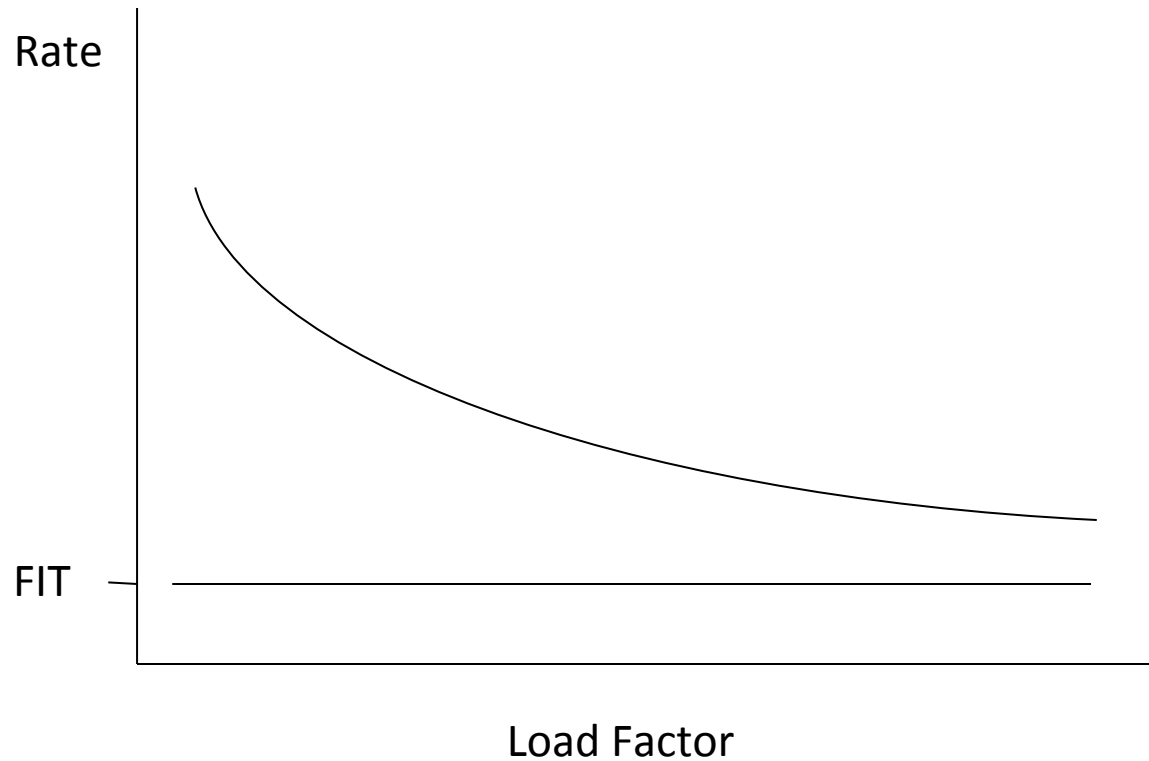
Energy Mix

	Peak Load, MW	9,000	2015	Year				
	Largest Unit, MW	647						
	MW (from Load Curve and LDC)	% of peak	Approx. Capacity Factor	Required Net Capacity	Required Gross Capacity +Maintenance Capacity	% of Peak Demand	% of Required Installed Capacity	% of Gwh Demand
Base Capacity	5,000	56%	1.00	5,000	6,173	69%	48%	74%
Mid-merit Capacity	3,000	33%		3,000	3,508	73%	52%	26%
Peaking Capacity	1,000	11%		1,000	1,169			
Ancillary Capacity		18%		1,654	1,935			
Total Demand Check		100%		9,000				
Total with ancillary check		118%		10,654				
Total with ancillary +maintenance capacity (Required Installed Capacity)					12,786			

Costs to Consumers of Mix

- For a utility, generation costs component will be the same for all if flat rate. But a Time-of-Use (TOU) enables those with high Load Factor (LF) to get lower rates. The deregulated generation sector mirrors a TOU-based rate determination for end-users.

Costs to Consumers of Mix



Energy Mix

	% of Peak Demand	% of Required Installed Capacity	% of Gwh Demand	Technologies							Total Check
				Coal	Geothermal	Must-dispatched REs	Base Hydro	Peaking Hydro	Gas	Oil	
Base Capacity	69%	48%	74%	30%	18%						48%
Mid-merit Capacity	73%	52%	26%					12%	30%	10%	52%
Peaking Capacity											
Ancillary Capacity											
TOTAL		100%		30%	30%				30%	10%	100%
				Based on DOE's Installed Capacity Mix							
2016				39%	5%	5%	17%		21%	9%	96%
					27%						

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				Based on DOE's Installed Capacity Mix									
2016				39%	5%	5%		17%	21%	9%		96%	
				27%									
				Based on Share of Gwh Demand (Energy-based)									
				47%		27%			26%			100%	
2016				61%	8%	2%			29%			100%	
				71%									