Electricity in Honduras

April 8, 2008

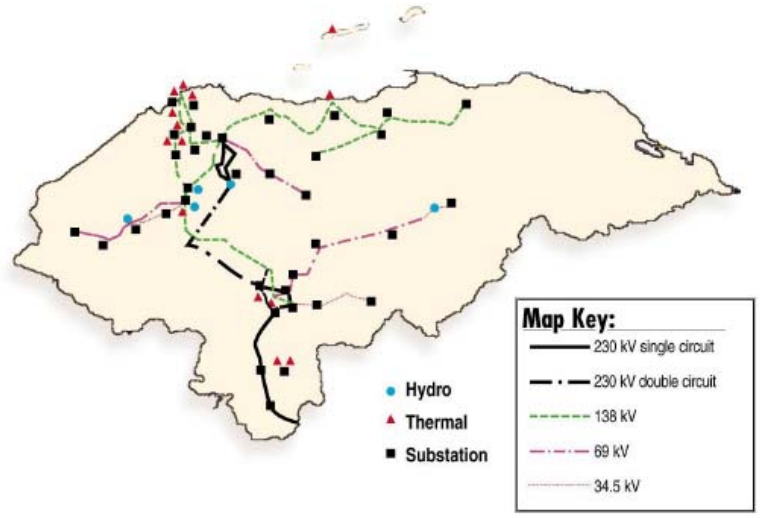
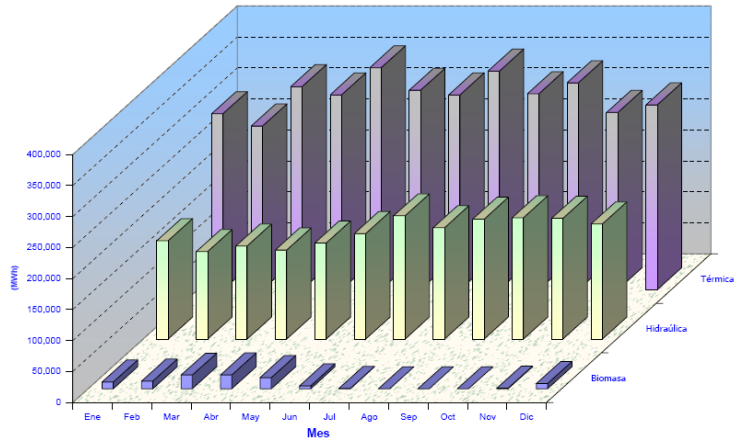


Figure 2.4 Sample Map of Power Plant Sites and Transmission Lines in Honduras (Source: ENEE)

Gráfica No.2

Energía Disponible en el Sistema de ENEE
Año 2006



GENERACION DE ENERGIA ELECTRICA

PERIODO 2005 - 2006

TIPO DE PLANTA	2005		2006		Variación	
	Energía GWh	Porcentaje %	Energía GWh	Porcentaje %	Energía GWh	Porcentaje %
TOTAL GENERAL						
Total	**5,551.1**	**100.0**	**5,947.7**	**100.0**	**396.6**	**7.1**
Generación ENEE	1,653.0	29.8	2,002.5	33.7	349.6	21.1
Energía Comprada	3,902.0	70.4	3,945.0	66.3	42.9	1.1
Energía Inadvertida	1.1	0.0	11.5	0.2	10.4	954.2
Venta Energía Internacional	-3.9	-0.2	-11.3	-0.2	-7.4	188.7
SISTEMA INTERCONECTADO NACIONAL						
Total	**5,551.1**	**100.0**	**5,947.7**	**100.0**	**396.6**	**7.1**
Hidráulica Estatal	1,646.5	29.7	1,938.3	32.6	291.7	17.7
Térmica Estatal	6.4	0.1	64.3	1.1	57.8	899.6
Energía Comprada	3,902.0	70.3	3,956.4	66.5	54.4	1.4
► *Renovable* [1]	147.5	0.0	231.6	3.9	84.0	57.0
► *Térmica*	3,754.5	1.0	3,724.9	62.6	-29.6	-0.8
Venta Energía Internacional	-3.9	0.0	-11.3	-0.2	-7.4	188.7

[1] Incluye Biomasa

CAPACIDAD INSTALADA EN EL SISTEMA
PERIODO 2005-2006

TIPO DE PLANTA	2005		2006		Variación	
	Potencia kW	Porcentaje %	Potencia kW	Porcentaje %	Potencia kW	Porcentaje %
Total	***1,526,799***	***100.0***	***1,548,009***	***100.0***	**21,210**	***1.4***
Hidraúlica Estatal	**464,400**	**30.4**	**464,400**	30.0	0	0.0
Térmica Estatal	**124,600**	**8.2**	**124,600**	8.0	0	0.0
Motores Diesel	91,600	6.0	91,600	5.9	0	0.0
Turbina de Gas	33,000	2.2	33,000	2.1	0	0.0
Plantas Privadas	**937,799**	**61.4**	**959,009**	62.0	21,210	2.3
Hidraúlica	**14,699**	**1.0**	**38,471**	2.5	23,772	161.7
Térmica	**923,100**	**60.5**	**920,538**	59.5	-2,562	-0.3
Motores Diesel	823,800	54.0	821,238	53.1	-2,562	-0.3
Turbina de Gas	39,500	2.6	39,500	2.6	0	0.0
Biomasa	59,800	3.9	59,800	3.9	0	0.0

PLAN DE EXPANSIÓN DE GENERACIÓN

2008 - 2022

ADICIÓN DE PLANTAS AL SISTEMA (MW)

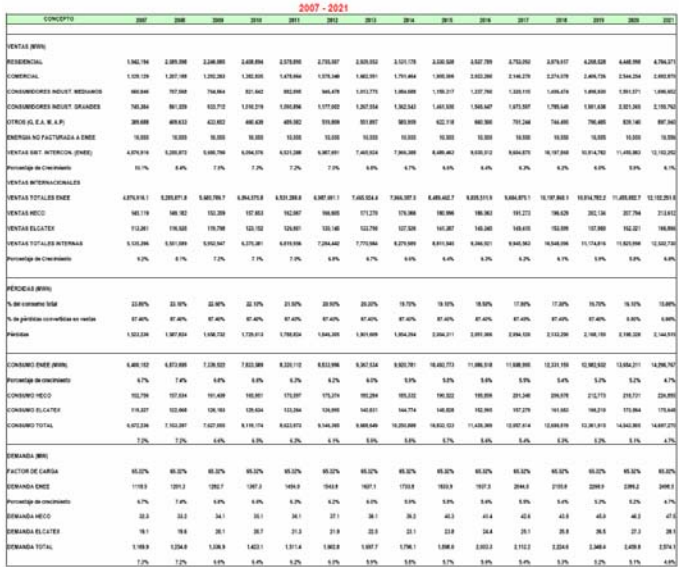
PROYECTOS	tecnología	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Ampliación de Enersa	Motores diesel	28.0														
Alsthom	Motores diesel	30.0														
Duizer	Motores diesel	30.0														
Cotronáo	Hidro	6.0														
Peña Blanca	Hidro	0.9														
Ecopalma biomasa	Biomasa	3.2														
Enersa	Carbón		100													
Cecsa	Carbón[1]		150													
Manguruge I	Hidro		1.2													
Matarrás I	Hidro		1.0													
Río Frío	Hidro		1.2													
Mezapa	Hidro		1.1													
Ecoenergy	Biomasa		10.8													
San Juan	Hidro			6.1												
Texiguat	Hidro			3.4												
Bloque 80 (Renovable)	Renovable				80											
Motores diesel media vel.	Motores diesel				230							500				
Planta carbón (PEPC)*	Carbón						300				100		300		200	
Tatoloa	Hidro							20								
Fasica 3	Hidro								100							
Tornillo	Hidro								160							
Llanitos	Hidro								98							
Jicatuyo	Hidro									173						
Patuca 2	Hidro													270		
TOTAL		70.1	265.3	9.5	310	0	300	20	358	173	100	500	300	270	200	0

RETIRO DE PLANTAS (MW)

PROYECTOS	tecnología	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Green Valley	Motores diesel		10													
Santa Fe	Motores diesel		5													
Celba	Motores diesel			26.6												
Elcosa	Motores diesel			80.0												
Lufussa 1	Turbina de gas			40.0												
Nacional de Ingenieros	Motores diesel						20									
La Puerta Hitachi	Turbina de gas								19							
La Puerta General	Turbina de gas								15							
Alsthom	Motores diesel											30				
Duizer	Motores diesel											30				
Lufussa 3	Motores diesel											210.0				
Enersa	Motores diesel											200.0				
Smce 2	Motores diesel												60.0			
Lufussa 2	Motores diesel												80.0			
TOTAL		0	15	146.6	0	0	20	0	33	0	0	470	140	0	0	0

Tecnología	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Motores diesel	28.0													
Motores diesel	30.0													
Motores diesel	30.0													
Hidro	6.0													
Hidro	0.9													
Biomasa	3.2													
Carbón		100												
Carbón[1]		150												
Hidro		1.2												
Hidro		1.0												
Hidro		1.2												
Hidro		1.1												
Biomasa		10.8												
Hidro			6.1											
Hidro			3.4											
Renovable				80										
Motores diesel				230							500			
Carbón						300				100		300		200
Hidro							20							
Hidro								100						
Hidro								160						
Hidro								98						
Hidro									173					
Hidro													270	
	70.1	**265.3**	**9.5**	**310**	**0**	**300**	**20**	**358**	**173**	**100**	**500**	**300**	**270**	**200**

PROYECCIÓN DE DEMANDA DE ENERGÍA ELÉCTRICA
SISTEMA CENTRAL INTERCONECTADO - ENEE
2007 - 2021



Projected Demand Growth

- Percent increase from 2007 to 2021
  - Between 5.8 and 9.2 percent, per year
- Total demand
  - 1,170 MW to 2,575 MW

Phase 1: Research Biogas

- Gasifier technology
  - Capacity – input requirements and output capability
  - Costs
  - Crop / feedstock used
    - Land and water use
  - Examples / case studies
- Microturbines that use biogas
  - Cost, capacity (kW, MW?), emissions
- Larger and/or traditional turbines that use biogas?

Phase 1: Research Biodiesel

- Research biodiesel
  - → See previous slide
- Also, “gensets” typically burn diesel
  - Diesel genset – generator set
- For both (biogas and biodiesel)
  - preliminary findings for Friday April 11
  - “final” findings for next Tuesday, April 15

Phase 2: Modeling Needs

- Develop alternative expansion plans using PowerPlan
  - Start with existing ENEE expansion plan
    - Model replacing some generators in the current expansion plan with biomass technology
    - Model *more* demand growth, to be met with biomass
  - Vary amounts of biomass technology, along with existing technologies and PPAs
  - Model with different price assumptions for buying oil on the international market

Phase 2: Modeling Needs

- Output of alternative expansion plans
  - Cost, Reliability, Emissions…
  - Oil/petroleum used
  - Required new transmission lines?
  - …

Phase 1 & 2: Modeling Needs

- Develop a Power Flow model
  - Able to meet Friday?

Analysis Iteration

- Use the expansion plan to recommend amounts of biogas and biodiesel
- Use knowledge of these technologies to determine the crop requirements for the recommended amount of biomass use
- Iterate….
  - Acreage required to grow crops for desired biomass generation
  - …

Sign-up

- Phase 1 – biogas and biodiesel
  - Biogas → 4 volunteers to organize selves
  - Biodiesel → 4 volunteers to organize selves

- Phase 2 – PowerPlan expansion plans
  - Organize next Tuesday