



Energy subsidies in Galapagos

Carlos Jácome

Ministry of Energy and Mining - ERGAL Project, UNDP – Renewable Energy for Galapagos

In the last few years, the geographical isolation of Galapagos and the resulting policy of Ecuador's government to maintain subsidies to its energy sector have resulted in substantial contributions of government resources to this province. Moreover, the isolated location of the archipelago has given rise to many insular activities being managed as isolated systems, separate from mainland Ecuador. For instance, the electrical system is independent, not only in the archipelago but even on each island. The electrical system in Galapagos is Ecuador's second largest unconnected system, after that of Sucumbíos in northeast Ecuador. The electricity sector is not the only one operating in isolation in Galapagos. This is also the case for fuels used for terrestrial and maritime transport.

Fuel consumption

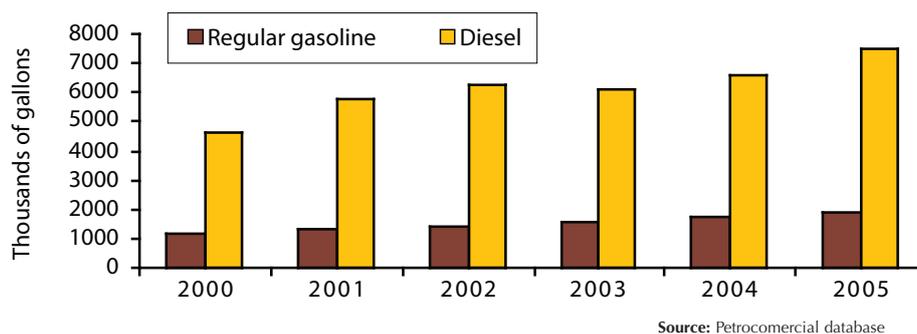
Liquid fuels used in the archipelago include regular gasoline and diesel fuel; premium gasoline is not sold in Galapagos.

The State contributes significantly to the operation of the electrical system and supply of fossil fuels in Galapagos.

Figure 1 shows fuel demand in Galapagos for 2000-05: gasoline consumption rose by 63% and diesel by 64%.

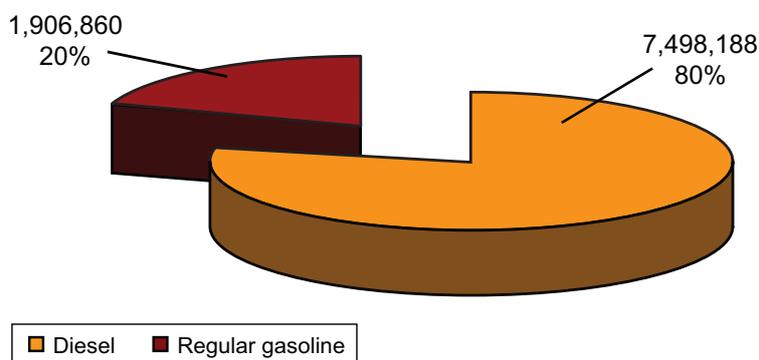
Figure 2 shows the breakdown of different types of fuel used in the archipelago in 2005, and Figure 3 shows diesel consumption by sector during that year. The greatest consumer of diesel is the maritime fleet, mainly tourism vessels, accounting for 61% of total demand. Generation of electricity is the second-greatest consumer, at 25% of total demand. A comparison of these data with those published in the last *Galapagos Report (2001-2002)* show that diesel consumption by sector has not changed from 2001 to 2005.

Figure 1. Fuel consumption in Galapagos, 2000-2005



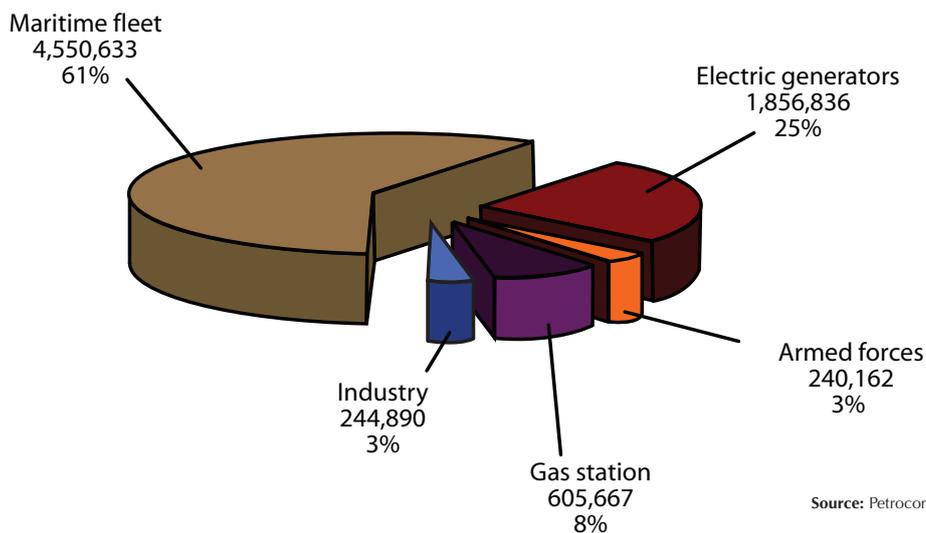
The greatest consumer of diesel is the maritime fleet, primarily tourist vessels, which account for 61% of total demand.

Figure 2. Liquid fuel consumption (in gallons) in Galapagos, 2005



Source: Petrocomercial, 2006

Figure 3. Diesel consumption (in gallons) in Galapagos by sector, 2005



Source: Petrocomercial, 2006

Energy Prices

Fuel prices in the archipelago are the same as on the mainland. However, prior to Executive Decree 338 in 2005, ELECGALAPAGOS paid a reduced price for diesel used for thermoelectric generation, the same as the Sucumbíos Electric Company, as both were considered isolated systems. With the signing of Executive Decree 338, this incentive was extended to all other electric companies in Ecuador.

Generation of electricity using thermoelectric plants in Galapagos is more expensive than hydroelectric plants used in the national interconnected system. However, electricity prices on the islands, listed on the rate schedule of the National Electricity Council (CONELEC), do not differ substantially from electricity prices in mainland Ecuador.

Energy prices (fossil fuels and electricity) do not cover the real costs of generating and distributing them in the islands.

Subsidies in Galapagos

The real cost of petroleum derivatives in the islands

To quantify the subsidy for petroleum derivatives in Galapagos, it is first necessary to determine the cost of diesel and regular gasoline on each island. The *Opportunity Cost*, the price of the petroleum derivative as an imported product (price at the terminal), is indicated in Table 1. These costs are then added to maritime shipping costs from the mainland to the islands and land transportation costs from the dock to the fuel storage site, plus the value added tax (VAT) and marketing expenses. For example, fuel for Santa Cruz

is brought from the mainland to Baltra, where it is stored at the Clean Product Terminal. Fuels are subsequently dispatched from the terminal and transported by barge across Itabaca Canal to northern Santa Cruz, and then overland in tank trucks to the Petrocomercial Service Station or the power plant of ELECGALAPAGOS, both located in Puerto Ayora (southern Santa Cruz). Table 2 shows the average subsidy at the insular level. However, real costs vary among islands due to different transportation and storage costs.

Table 1. Real costs of regular gasoline and diesel in Galapagos (US\$/gallon), 2005.

Fuel	Price at the terminal (a)	Maritime transport (b)	Overland transport (c)	Subtotal	VAT	Marketing profit (d)	Real cost
Diesel	1.94	0.204	0.060	2.202	0.264	0.049	2.515
Gasoline	1.93	0.204	0.060	2.190	0.263	0.049	2.501

Notes:

Average prices in the Archipelago

(a) Ministry of Energy and Mining.

(b) Resolution No. 230/03 by the Directorate General of Merchant Marine and the Coast.

(c) Agreement 123 Published in the Official Register of December 4, 2004.

(d) 2% profit.

Source: PETROCOMERCIAL and author's calculations.

The subsidy for fossil fuels in Galapagos

The fuel subsidy is equivalent to the difference between the cost of derivatives on the islands and their sale price (US\$ 0.92/gallon for diesel used for electric

generation, US\$ 1.01/gallon for diesel used for transport, and US\$ 1.48/gallon for regular gasoline).

Table 2. Fuel subsidy estimates for gasoline and diesel, 2005.

Derivative	Subsidy/gal [US\$/year]	Demand [gal/year]	Total subsidy [US\$/year]
Regular gasoline	1.021	1,906,860	1,947,560
Diesel, electric sector ¹	1.595	1,856,836	2,962,358
Diesel, other sectors ²	1.505	5,641,352	8,492,375
		9,405,048	13,402,294

Source: PETROCOMERCIAL and author's calculations.

Notes:

¹ The category of "Diesel, other sectors" includes diesel for maritime and terrestrial transportation and industry.

² The subsidy for diesel used for the electricity sector is not the only component of the subsidy for energy consumed. Total electricity sector subsidy, taking into account all other components, is calculated separately.

In 2005, the subsidy for diesel and gasoline consumption by “other sectors” (maritime and terrestrial transportation and industry), based on opportunity cost, was US\$ 10.44 million (Table 2).

The cost of producing electricity in the Galapagos Islands

The production cost has been calculated for two scenarios, with and without the subsidy for diesel. Table 3 breaks down production costs for each kilowatt-hour

of energy per island. The cost of generating electricity incorporates the cost of diesel fuel used for thermo-electric generation. The first scenario (the current situation) uses the subsidized price of diesel, US\$ 0.92/gal. Table 4 breaks down costs per island, considering the real cost of diesel, which varies by island. The island with the lowest cost per kWh is Santa Cruz, whereas the highest cost is on Floreana, which confirms that electrical production is an activity based on economies of scale.

Table 3. Cost of producing electricity by island (US\$/ kWh), 2005.
(Reference scenario: Current Situation with *subsidized diesel*)

Sector	San Cristóbal	Santa Cruz	Isabela	Floreana
Generation	0.135	0.101	0.187	0.889
Distribution	0.025	0.010	0.029	0.102
Marketing	0.020	0.005	0.030	0.060
Administration	0.036	0.015	0.048	0.099
TOTAL	0.216	0.131	0.295	1.149

Source: Financial reports from ELECGALÁPAGOS, 2005.

Table 4. Cost of producing electricity by island (US\$/ kWh), 2005.
(Reference scenario: Current Situation with *Diesel at real cost*)

Sector	San Cristóbal	Santa Cruz	Isabela	Floreana
Generation	0.263	0.229	0.339	1.126
Distribution	0.025	0.010	0.029	0.102
Marketing	0.020	0.005	0.030	0.060
Administration	0.036	0.015	0.048	0.099
TOTAL	0.344	0.259	0.446	1.386

Source: Financial reports from ELECGALÁPAGOS, 2005.

The subsidy for electricity

The sale price of electricity for the province of Galapagos is set by CONELEC. For both scenarios, the cost of producing electricity is higher than the sale price set by CONELEC (Tables 3 and 4). The average sale price used to calculate the subsidy per island is 8.9 cents per kWh. At present, the Galapagos Provincial Electric Company covers the operating and maintenance deficits via an allocation from the Rural and Urban Marginal Electrification Fund (FERUM).

For 2005, the total subsidy for fossil fuels and generation of electricity in Galapagos is estimated at US\$ 15.3 million.

Table 5. Subsidy for electricity (US\$/year) for 2005.

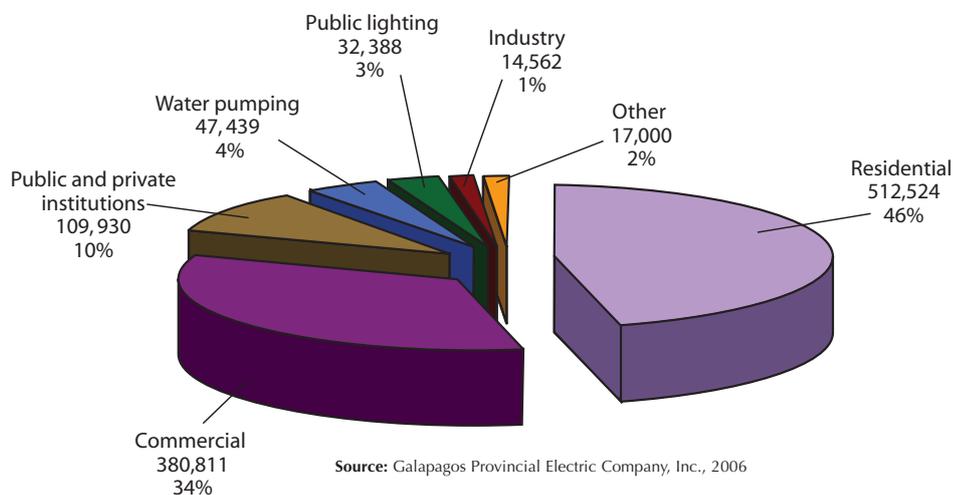
Island	US\$/kWh	Electricity	Subsidy
		kWh/year	US\$/year
San Cristóbal	25.539	6,546,056	1,671,776
Santa Cruz	16.963	14,603,200	2,477,191
Isabela	35.735	1,655,270	591,517
Floreana	129.707	53,917	69,934
TOTAL		22,858,443	4,810,418

Table 5 indicates the real subsidy for electricity, incorporating the real cost of diesel used to generate electricity. The annual subsidy for the electricity sector is US\$ 4.81 million.

Analysis of subsidy allocation in the electricity sector

The demand structure of the electricity sector is made up of residential, commercial, public and private institutions and organizations, public lighting, water pumping, industrial, and other sub-sectors that include social welfare, public benefit, and sports facilities.

Figure 4 shows energy demand by sector. The residential sector generates the greatest demand and has the largest number of users. The commercial sector is second in energy demand, which is expected given that Galapagos' main activities involve tourism and commerce. Public and private institutions and organizations, including those that supervise and oversee science and natural resource management in Galapagos, also account for a significant portion of demand for electricity. Energy demand by the industrial sector, which is restricted to artisan industries, is quite low compared to mainland Ecuador.

Figure 4. Energy demand in Santa Cruz by sector (kWh/month)

To categorize distribution of subsidies in Galapagos according to different economic strata, the average monthly energy consumption (in kWh) was classified by sector. A total of five different energy consumption ranges (kWh/month) were defined (Table 6). Consumption rates less than 100 kWh per month corresponded to families with low energy demands compared to the national average of 117 kWh/month.

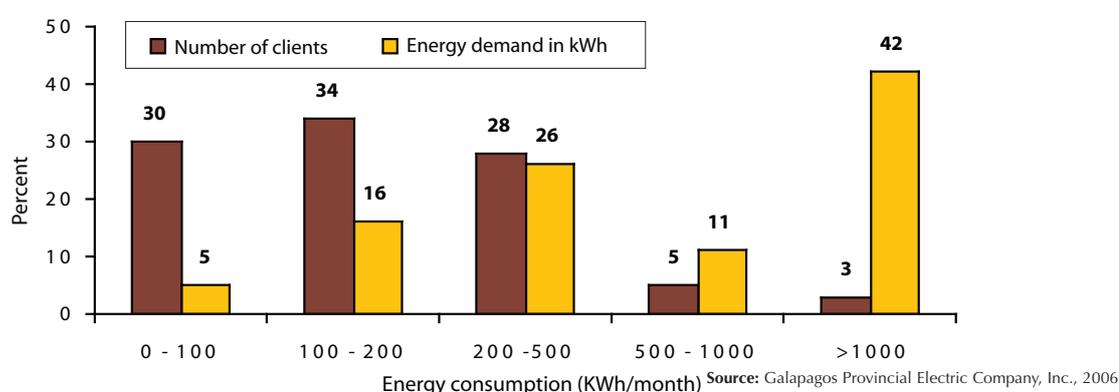
Customers from different sectors consuming 0–200 kWh/month represent 64% of all clients (Table 6 and Fig. 5). However, they account for only 20.5% of energy demand. A more detailed analysis by sector shows that the residential and commercial sectors with consumption over 500 kWh/month represent only 7% of all clients, but 36% of energy demand.

Table 6. Distribution of clients and total energy demand in kWh by range of consumption in Santa Cruz.

Sector	0 - 100	100 - 200	200 -500	500 - 1000	>1000	Total
Residential	873	1,079	786	82	18	2,838
Commercial	110	86	143	84	73	496
Public and private institutions	8	6	8	9	16	47
Water pumping	0	0	1	0	5	6
Public lighting	0	0	0	0	1	1
Industry	28	21	16	2	3	70
Other	21	10	14	2	2	49
Total (no. of clients)	1,040	1,202	968	179	118	3,507
Total (demand in kWh)	52,716	176,283	290,178	123,833	471,644	1,114,654

Source: Galapagos Provincial Electric Company, Inc., 2006

Figure 5. Distribution of clients and total energy demand in kWh by range of consumption in Santa Cruz



Source: Galapagos Provincial Electric Company, Inc., 2006

The future: renewable energy as an economical and environmental solution

Substantial resources are allocated to cover the subsidy in different energy sectors in Galapagos. In 2005, subsidies in Galapagos for liquid fuels used for transportation equaled approximately US\$10.48 million and those for electricity approximately US\$4.8 million.

Renewable energy projects will help reduce fossil fuel consumption and, therefore, associated environmental risks.

Given the importance of preserving this World Heritage Site and balancing energy and production activities in the islands, it is essential to promote renewable energy projects in the archipelago.

The project, *Renewable Energies for Galapagos* (ERGAL), is designed to reduce diesel consumption by using alternative sources to generate electricity (e.g., wind, photovoltaic, and biofuels), and thus reduce environmental problems resulting from use of fossil fuels. Once renewable energy projects are implemented, it is expected that the Government of Ecuador will experience substantial savings in fuel consumption, which are estimated in Table 7.

Table 7. Expected savings compared to 2005 costs when renewable energy projects are implemented.

Item	San Cristóbal	Santa Cruz	Isabela	Floreana	Total
Extent of renewable energy system	50%	40%	70%	40%	45.4%
Reduction in diesel consumption (gal/year)	270,944	463,201	110,116	3,517	844,260
Real cost of diesel in the electric sector (US\$)	2.478	2.532	2.518	2.525	2.50
Total savings (US\$/year)	671,447	1,173,028	277,226	8,878	2,121,701

Source: ERGAL Project, UNDP and MEM