The Republic of Ecuador straddles the equator on the northeast Pacific coast of South America. Its territory includes the Galapagos Islands about 1,500km due west of the mainland, a world-famous biological resource and a major ecotourism destination. Continental Ecuador, which has borders with Colombia to the north and Peru to the east and south, is divided into three physiographic regions, a coastal plain covering about a quarter of the country, a central sierra region between the Cordillera Occidental and the Cordillera Oriental -- two high Andean chains which cover about half the country -- and the forested Oriente in the east. The port of Guayaquil at the mouth of the Rio Guayas is Ecuador's largest city with a metropolitan population of about 3mn.

Until the discovery of substantial oil fields in the early 1970s, agriculture was the economic basis for Ecuador’s economy, although light manufacturing efforts were boosted by an industrial development law passed in 1965. The country is one of the world’s top five banana exporters and a major producer of shrimp and cut flowers. In 1991, economic reform efforts began after Ecuador joined the Andean Pact. Following International Monetary Fund (IMF) guidelines, the government instituted new taxes, reduced fuel subsidies, and began a modest privatization program. In 1995, the government created the Fondo de Solidaridad (Solidarity Fund) to administer the proceeds from the privatization of public sector companies. Income from Solidarity Fund investments and related operations was earmarked for public health, urban development, housing, rural electrification, and environmental protection measures.

By the late 1990s, Ecuador’s economy was in great difficulty thanks in part to a severe El Nino in 1997, a sharp drop in global oil prices, and generalized instability in emerging markets worldwide. Meanwhile, the government was incurring large fiscal deficits while pursuing an expansionary monetary policy. The sum total was an economic crisis in 1999 which saw a 7% drop in GDP, inflation in the 50% range, and a 65% devaluation of the national currency, all of which helped precipitate a default on external loans. In January 2000, the government said it would adopt the U.S. dollar as the official currency, a process completed in September of that year. The initial economic recovery saw GDP up 5.9% in 2001 and inflation reduced to about 40%.

Thanks to rising oil prices, Ecuador’s real GDP in 2006 was up an estimated 4.3% following a 4.7% increase in the previous year. Nonetheless, the country continued to be plagued by political instability with urban protests contributing to the mid-term ouster...
of Ecuador’s last three elected Presidents. In 2006, populist sentiment caused the government to reappraise its collection and use of oil revenues and, in January 2007, a new leftist government took office under President Rafael Vicente Correa Delgado and won a referendum asking whether people would back a constituent assembly that would rewrite the constitution. New laws were proposed to give a greater voice to the poor, indigenous groups, and women, overhaul the Congress and judiciary, and limit the influence of established political parties, all policies similar to those espoused by the late Hugo Chavez in Venezuela and Evo Morales in Bolivia.

In December 2008, the government of Ecuador (GOE) defaulted on about 30% of the country’s sovereign debt. To keep the public social spending levels high, Ecuador contracted with the Chinese government in December 2013 for $9.9bn of funds from forward oil sales and other financing mechanisms. In the following 18mos, Ecuador took other regulatory and trade actions generally considered as deleterious to free-market economic operations. Nonetheless, Ecuador’s economic growth was 4.5%/yr from 2012-2014 with official unemployment at around 5% and inflation at 4%.

The Ecuadorian oil sector is the most important component of the cash economy accounting for over half of export income and 25% of public sector revenues. According to BP statistics, the country has reserves of 2.4bn barrels (bbls) and produces about 550,000 bbls/day (bpd). State-owned EP Petroecuador and other government-controlled companies Petroamazonas, and Operaciones Rio Napo, a joint venture of Petroecuador and Venezuela’s PDVSA, account for most of the oil production in Ecuador. Other oil companies active in Ecuador include Spain’s Repsol, Italy’s Eni, Argentina’s Tecpetrol, and Andes Petroleum, a 55:45 JV of China National Petroleum Corp (CNPC) and China Petrochemical Corp (Sinopec). Domestic consumption is about 310,000 bpd while the USA accounts for just over 60% of exports.

All hydrocarbons in Ecuador are now 100% state-owned and international participation is via service contracts rather than via production-sharing contracts. Since 2009, Chevron has been involved in lengthy and extremely expensive litigation with the Ecuadorian government on various legal issues related to asset expropriation and alleged environmental degradation.

The 500km SOTE oil pipeline was built in 1972 from the oilfields in the Oriente to the port of Esmeraldas. In 2000, the government made the decision to go ahead with Oleoducto de Crudos Pesados (OCP) a new 506km oil pipeline from Lago Agrio to Balao on the Pacific coast. OCP was delayed for over 10yrs by opposition from indigenous peoples and environmental activists, but in July 2001 the construction contract was awarded to Techint and operations began in September 2003. The $1.1bn project is mostly built in parallel to the SOTE pipeline.

Ecuador has three refineries: the largest is at Esmeraldas, which processes about half of the country’s total, and there are smaller refineries at La Libertad and Amazonas. Despite its large-scale oil production, Ecuador is a net importer of refined oil products,
much of it from the U.S.

In addition to oil, Ecuador has an estimated 212bn cubic feet (bcf) of natural gas reserves, with 2013 production of 54 bcf according to the U.S. EIA. About 70% is used domestically with the remaining associated gas flared or vented. In 1999, a government agreement allowed U.S. independent Noble Energy to begin development of the Amistad field in the Gulf of Guayaquil. Full-scale gas production started in 2002 and is routed to an on-shore electric power plant. Noble Energy exited from Ecuador in May 2011 having received $97mn in compensation for its in-country assets.

Despite substantial copper-gold prospects, there has been virtually no mining and metals industry investment in Ecuador in modern times. Government regulatory and tax regimes make near-term mining prospects weak.

There are a variety of ministries with somewhat overlapping portfolios in Ecuador’s energy and natural resource sectors including Ministerio de Hidrocarburos, Ministerio de Recursos Naturales no Renovables, and Ministerio de Electricidad y Energia Renovable (MEER).

Electric Power Overview

In the late 1990s, the Ecuadorian electric sector was partially restructured and operated for a time under legal and regulatory frameworks defined in the October 1996 LRSE (Ley de Regimen del Sector Electrico, “Law of the Electric Sector.”) Up through mid-1999, Ecuador’s national utility was Instituto Ecuatoriano de Electrificacion (Inecel) which served two-thirds of Ecuador’s population through regional distribution companies and the national transmission system know as the Sistema Nacional Interconnectado (SNI), also known as the Sistema Nacional de Transmision (SNT). Inecel held a majority stake in all but one of those distributors, with minority interests held by municipalities and private shareholders.

In February 2009, President Correa proposed the nationalization of a series of power and telecomms companies that had been partially privatized in 1996. In May 2010, EP Corp Electrica del Ecuador (CELEC) went into operation taking over the major thermal and hydroelectric plants formerly operated by regional generating companies (gencos), namely Hidropaute, Hydroagoyon, Electroguayas, Termopichincha, and Termoesmeraldas. Also incorporated into CELEC was the national transmission company Transelectric. A final genco HidroPastaza remained in its former state for a time due to ongoing legal issues with the completion of the San Francisco hydroelectric power plant (HPP).

In October 2009, EP Corp Nacional de Electricidad (CNEL) took over as the national distribution company (disco). Thereafter, the following utilities ceased to exist: Empresa Electrica Esmeraldas SA, Empresa Electrica Regional Manabi SA (EMELMANABI), Empresa Electrica Santo Domingo SA, Empresa Electrica Regional Guayas-Los Rios SA (EMELGUR), Empresa Electrica Los Rios CA, Empresa Electrica Milagro
CA, Empresa Electrica Peninsula de Santa Elena SA, Empresa Electrica El Oro SA, Empresa Electrica Bolivar SA, and Empresa Electrica Regional Sucumbios SA. The associated offices and facilities then began to function as CNEL regional centers, that is CNEL Esmeraldas, CNEL Manabi, etc.

In addition to the 11 CNEL branches, Ecuador has nine other state-owned distribution companies, namely Empresa Electric (EE) Ambato, EE Azogues, EE Centro Sur Azuay, EE Cotopaxi, EE Galapagos, EE Norte Carchi, EE Quito, EE Riobamba, and EE Sur Azuay. CNEL Sucumbios and EE Ambato each have extra-large service territories of around 40,000 km² in the eastern part of the country.

CNEL and CELEC both operate as part of MEER. Also under the Ministry is Agencia de Regulacion y Control de Electricidad (Conelec), which functions as the power sector’s central regulatory and statistical agency.

At year-end 2014, Ecuador had 5,745 MW of installed capacity, 2,262 MW in hydroelectric plants, 1,085 MW in combustion and gas turbines, 458 MW in steam-electric plants, and 1,748 MW in diesel power plants (DPP). The total may be compared to the 3,998 MW value from 2006.

Total electricity supplied to the Ecuadorian grid in 2014 was 25,144 GWh, up 4.9% from the previous year. Of this 46% was from hydroelectric plant, 49% was from oil- and gas-fired thermal power plants (TPP), 2% was from biomass-fired TPP, 3% was from interconnections with Colombia and Peru, and the small remaining amount was from wind and solar plants. Ecuador’s installed power plant base is notably more balanced than that in many other Latin American companies.

The first electric company in Ecuador was formed in April 1897 in Loja and the new company’s first power station was completed in 1899. Two 14-kW hydraulic turbines were installed at El Pedestal in the western part of the city and used for public lighting and for power at a local sawmill. For the next hundred years, electricity supply expanded slowly and steadily and today, Ecuador’s urban areas are over 95% electrified, although rural electrification is only at about the 55% level.

From 1995 to 1997, Inecel struggled with the results of a drought followed by late and short wet seasons that caused widespread electricity shortages, power rationing, and -- ultimately -- contributed to the resignation of the Energy Minister and the firing of the heads of Inecel and Petroecuador. The 1,225-MW Paute hydroelectric plant, with 10 Pelton turbines from Italy’s Riva Hydroart, is the country’s largest plant by far and typically accounts for around 30% of the country’s domestic power production. Paute was reduced to 300 MW effective capacity by September 1995 and 200 MW by November. In 1997, an El Nino arrived and drought conditions worsened. In addition, Petroecuador was unable to secure adequate quantities of diesel and fuel oil for the thermal power plants during an upgrade of its Esmeraldas refinery and, by October 1997, nationwide electricity rationing of up to eight hours a day was reported. After a period of more or less normal operations, drought conditions reappeared in 2001.
leading to shortages in September and October.

In September 2005, the government again declared a power-sector emergency due to drought conditions, this time exacerbated by delayed distributor payments for thermal power, and hence delayed payments by generating companies for fuel oil. A new interconnection to Colombia plus government assistance on the payments front mitigated the worst effects of the drought.

During this period of essentially continuous power supply difficulties, the government was reorganizing its electricity holdings. On 1 April 1999, the government dissolved Inecel and created six main generating companies (gencos) and Transmision de Energia de Ecuador (Transelectric) to run the national grid. The new companies continued operations with existing staffing, although one major change occurred in 2003 when a government company known as Corporacion para la Administracion Temporal Electrica de Guayaquil (CATEG) had to take over the operations of Empresa Electrica del Ecuador (Emelec).

As noted, Ecuador’s old genco and disco structures have now been replaced with new centralized state entities.

Customers and Sales

At year-end 2014, Ecuador had 4.694mn electricity customers, of which 4.1mn were residential, 456,000 were commercial, 48,440 were industrial and the balance were public entities and others.

Ecuador’s total electricity sales in 2014 were 18,733 GWh. Residential sales were 35% of the total, commercial 21%, industrial 29%, and other/public 16%. The total may be compared to the 2006 sales value of 11,030 GWh.

CNEL Guayaquil and EE Quito are the two largest discos in Ecuador with 26% and 20% market shares, respectively

Transmission and Distribution

Ecuador’s national grid, the SNT, has a central ring about 660km long operating at 230kV with 138kV radial lines delivering energy to the main substations of the distribution companies. The ring was completed in the early 1990s with the closure of the gap between Paute and Riobamba. At year-end 2014, Ecuador’s high voltage transmission system included 1,445km of double-circuit 230kV line, 768km of single-circuit 230kV line, 817km of double-circuit 138kV line, and 1,150km of single-circuit 138kV line.

The SNT has 50 transmission substations with installed capacity of 8,046 MVA.

Ecuador’s national distribution system has smaller substations (69-, 46-, 34.5-, and
22kV) and distribution line and cable at 13.8-, 6-, 4-, and 2.2kV. The sub-transmission system consists of 5,051km of line and 6,258 MVA of transforming capacity while the medium-voltage system has 80,331km of line and cable and 9,428 MVA of capacity.

System electricity losses are high at nearly 23% and are essentially unchanged over the last decade.

**CELEC Transelectric** operates the SNT and was taken over by the **Solidarity Fund** after it was demerged from **Inecel**. The company built Ecuador’s first full-scale interconnection with Colombia’s **ISA**, a 260km, 230kV line from the Santa Rosa power plant south of Quito to Pasto in Colombia. The line has a nominal 300-MW capacity and will enable seasonal electricity exchanges, although Ecuador is expected to be a net importer for some time.

**Transelectric** has also recently completed a 60km, 230kV line from Machala to Zorritos in Peru and a 140km, 138kV line to link the Amazon towns of Tena and Coca.

In September 2011, **GE Energy** announced that it had supplied 25,000 smart meters to **Electrica de Guayaquil (EDG)** as the second phase of a project to replace over 200,000 meters in Ecuador. In December 2011, **Itron** announced that **EDG** had completed the installation of Latin America’s first meter-to-cash smart metering system. The **Itron** system actively collects data from the new smart meters and supplies **Itron’s** meter data management (MDM) system through a two-way wireless communications network.

In July 2013, **CELEC** signed a contract with **Harbin Electric International Co Ltd** for construction and operation of a new, extra high-voltage transmission system to evacuate energy production from the Coca Coda Sinclair and Sopladora HPPs to the national grid. The $599mn project has a completion deadline of 1,185 days and will be financed with tax resources and a loan from **China Exim Bank**. There is an additional 2yr, $33mn operation and maintenance services contract. The main works include a 500kV line from Coca Codo Sinclair to El Inga Substation (S/S) in Quito and from there to Chorrillo S/S in Guayaquil via Tisaleo S/S in the center of the country. A 230kV system will connect Sopladora. And another 230kV line is planned to oil fields in the northeast.

Other current **Transelectric** projects include a subsea connection between Baltra and Santa Cruz islands in the Galapagos and a 70km, 230kV double-circuit line in Santo Domingo to evacuate power from the Manduriacu HPP.

**Tariffs and Pricing**

Ecuador’s average electricity price in 2014 was 8.8 U.S. cents/kWh. The average 2014 electricity price for residential users was 9.97 ¢/kWh, 8.92 ¢/kWh for commercial users, and 7.16 ¢/kWh, for industrial users.
These prices may be compared to the 2006 values of 9.77 ¢/kWh for residential users, 8.20 ¢/kWh for commercial users, and 7.32 ¢/kWh, for industrial users.

**Privatization and Restructuring**

Drought and other operational and financial problems led to various structural changes in Ecuador’s electric power sector, but the expected large-scale privatization of the generation and distribution assets was delayed and finally shelved. A modest number of private-power projects did advance, although these have now been reversed.

Restructuring got underway in 1993 when the government prepared the first version of a new electricity law. The LRSE was drafted two years later and this was passed by the Ecuadoran Congress in September 1996 and approved by the President late in the year, but implementation was delayed by objections raised by the powerful union Frente Unitario de los Trabajadores which had long been opposed to the privatization plan.

In 1991, Empresa Electrica de Guayaquil (Electroquil) was formed as an industrial cooperative to provide electricity to industrial and commercial customers in Guayaquil. Its 3,000 owners are the members of the Guayaquil Chamber of Industries, Commerce, Construction and Small Business including the country’s largest cement producer, financial institutions and many other businesses and industries. In February 1998, Duke Energy from the U.S. invested $45mn to acquire a 51.5% stake in Electroquil and eventually owned 68.6%.

In March 1996, Old Dominion Electric Cooperative (ODEC) spent $15mn for a 50% stake in a power supply project developed by SeaCoast Inc of Amarillo, Texas, which had built a 40-MW gas turbine at Santa Elena on the coast and a pair of 55-MW gas turbines at Santo Domingo in the Andes foothills west of Quito. Other owners were two U.S. companies MCI Power and Energy Services Inc, each with a 25% share. Despite a power purchase contract with Inecel, no payments were received after about three months of operation. This dispute centered around the fact that SeaCoast did not meet the original November 1995 start-up date in the original power purchase agreement. The partners shut down operations, filed a $25mn suit against Inecel, and, in January 1997, sold the gas turbines to oil-trading company Tripetrol Holdings Inc for about $17.1mn. ODEC thereby lost $10.5mn on its original $19mn investment (some additional costs were incurred after the initial purchase.)

In March 1997, Marathon Power Co, a unit of Marathon Oil Co of Houston, Texas, purchased a 50% stake in the two plants, by that time being operated by local company Ecuapower. In March 2001, the power purchase contract with Inecel was completed and the plants were shutdown for good. The Santo Domingo plant was dismantled shortly thereafter.

In April 1998, Inecel transferred its stakes in the 18 local distribution companies to the Solidarity Fund. The government also approved the formation of Transelectric and a
central dispatching authority known as Centro Nacional de Control de Energía (Cenace). Originally, Cenace was a private, non-profit organization with a board formed by a representative of the President and by representatives of the gencos, Transelectric, the distributors, the marketers, and large consumers. Its current institutional status is somewhat obscure, but it appears to operate as part of MEER. Finally, the new law created Consejo Nacional de Electrificacion (Conelec) to oversee technical aspects of electric operations and charged the government agency Consejo Nacional de Modernizacion (Conam) with oversight of the privatization process.

In June 1999, the Ecuadorian Congress rejected a framework privatization bill leaving the divestiture of utility assets in limbo. In December 1999, Conam's lead utility privatization advisor U.S. investment bank Solomon Smith Barney (SSB) presented a timetable for the sale of stakes in the 18 distributors.

In February 2001, Conam announced that it had grouped the 18 companies into four packages and that the Solidarity Fund was planning to sell 51% stakes in each package starting in June 2001. The companies were later re-grouped into two sets – Group A with the companies serving Quito and the northeastern provinces and Group B with the utilities serving the northwest – but the sale slipped to July and then to September. In that month, however, Conam announced that the sale of the distributors was being postponed and instead began preparations to sell Transelectric.

By March 2002, Conam was reported be again pressing on for a sale of the distributors in April. The entire process remained controversial as critics charged that the asking prices – a total of $752mn – were too low although, as it turned out, this value was substantially higher that the value assigned to the companies by SSB.

Meanwhile, in March 2000, Conam announced that it would sell Emelec via international public bidding. The utility had been owned by Fernando Aspiazu, owner of Banco del Progreso which essentially shutdown in March 1999 and was put in the charge of Agencia de Garantia de Depositos (AGD), the Ecuadorian agency in charge of bank clean-ups. Aspiazu was later jailed on charges of corruption and bank mismanagement and Emelec sale proceeds were to be provided to AGD to repay Progreso depositors. In February 2001, a team of PriceWaterhouseCoopers and Spain’s Banco de Bilbao was selected to undertake Emelec’s valuation and design the sale process.

In May 2002, the governments effort to sell Emelec collapsed when the three pre-qualified companies all withdrew. AES Corp from the U.S. had in the meantime temporarily halted acquisitions while the bid submitted by Argentina’s Pecom was below the floor price. Spain’s Union Fenosa, the remaining candidate and considered the strongest contender, also decided not to bid just before the process was to be completed. In August 2003, Emelec’s production and distribution functions were reorganized into CATEG-SG for generation and CATEGocana -D for distribution.
As noted above, the GOE later re-nationalized the electricity industry putting an end to all privatization initiatives. Conam was disbanded in 2007.

**New Power Plants**

In August 1996, Italy’s **Ansaldo** was awarded a contract for a third 70-MW Francis turbine at the 210-MW Daule Peripa hydroelectric plant built for the state-owned **Comision de Estudios para el Desarrollo de la Cuenca del Rio Guayas (Cedege)** and operated by **Hidronacion**. The $273mn project was funded by regional development bank **Corporacion Andina de Fomento (CAF)** and international aid donors. Italy’s **Impregilo** was responsible for the civil works, which started in 1995, and the plant was completed in 1999.

In May 1996, **Electroquil** completed two 45-MW **General Electric** LM6000 gas turbines packaged by **Stewart & Stevenson** after six weeks of site preparation and construction. Two similar diesel-fired gas turbines were installed in early 1997, giving a total capacity of 180 MW.

In December 1997, **Inecel** started-up a new 125-MW oil-fired steam-electric unit at Trinitaria in Guayaquil. This includes a boiler from **Babcock Wilcox Espanola** and a T/G set from **ABB**. In 1997, **Inecel** also completed the Enrique Garcia (Pascuales) plant near Guayaquil consisting of a single 102-MW **Westinghouse** W501D5 gas turbine. Turnkey construction of the oil-fired unit was by Colombia’s **Schrader Camargo**, which subcontracted to the local company **Nacymel** for site preparation and some civil works. Both these plants are now run by **CELEC Electroguayas**.

In August 1998, U.S. developer **Polar Energy** signed a controversial, two-year power supply contract under Ecuador’s emergency electricity program. In 1999, the 105-MW Victoria-II power barge was relocated from the Dominican Republic and its **Westinghouse** 501D5A gas turbine went into operation alongside the Trinitaria power plant in Guayaquil. The Victoria-I barge was first operated by **Energycorp SA**, a partnership of two local companies, **Empresa Tecnica Comercial CA (Eteco)** and **Tecnie Cie Ltda**, along with **Saship Holding**, the Malaysian owner of the barge plant. A fuel barge was built to hold naphtha from the nearby La Libertad refinery. The power barge was later taken out of service for a time and then reactivated. It remains in place and, in June 2003, was licensed to an obscure company called **Intervisa Trade SA**. The barge plant was in operation as recently as January 2010, but its current status is unknown.

In August 1998, **Inecel** selected **Consorcio San Francisco (CSF)** for the build-own-operate (BOO) development of the San Francisco hydroelectric project, part of the integral development of the Rio Pastaza basin. The group included **Electrowatt** from Switzerland, **Jose Cartellone Construcciones** from Argentina, and Mexico’s **Bufete**. After **CSF** was unable to secure financing, **Conelec** instead awarded the 30yr concession contract to **Hidropastaza** in early 1999. This consortium was controlled by **Hidroagoyan** (80%) and included Brazil’s **Construtora Norberto Odebrecht** (20%)
Hidropastaza secured a letter of credit from Brazil’s state bank BNDES and Odebrecht later received a $150mn guarantee from the World Bank’s Multilateral Investment Guarantee Agency (MIGA) for its loan guaranty to BNDES covering the risk of breach of contract. The total project cost $302mn.

The preliminary outlines of the San Francisco project were developed from 1976 to 1987, but construction did not get underway until 2003. The plant is situated on the left bank of the Rio Pastaza, and 11km downstream from the 156-MW Agoyan plant, on the border between Tungurahua and Pastaza provinces in the central part of the country. The location is 150km southeast of Quito. The scheme uses water discharged from Agoyan delivered along a 9km headrace plus flows diverted from the Rio Verde. Two 115-MW Aistom Francis turbines were installed in an underground powerhouse and the machines were commissioned in February and May 2007, respectively. Other partners in the San Francisco engineering, procurement, and construction (EPC) work were VA TECH Hydro, Ecuadorian engineering consultancy Caminos y Canales Cia Ltda (Caminosca), and Brazil’s PCE Engenharia Ltda. CELEC Hidroagoyan is now the plant operator.

In April 1999, Finnish engine builder Wartsila signed a concessionary contract to build a $240mn, 298-MW diesel power plant next to the Amazonas Refinery in Shushufindi, Sucumbios province. The design included a connection to the SNI via a 230kV line to the Santa Rosa S/S south of Quito plus a 69kV connection to the Jivini S/S of Empresa Electrica Regional Sucumbios. In December 2001, project company Termoriente Cia Ltda completed agreements to sell 200 MW to seven distributors at a cost of 4.3 U.S. cents/kWh for a 10yr period. The contracts were modified several times thereafter, but, in April 2005, project company TermOriente reported that financing had not yet been obtained. Following a variety of legal initiatives, the project was shelved in August 2006 and formally terminated in September 2007. However, from 2003 to 2009, Wartsila did install 70 MW of diesel engines in the area for Petroamazonas for onsite power generation. The 11 gensets fire associated gas and crude oil.

In September 2000, the GOE awarded a concession to Noble Energy subsidiary Energy Development Corporation (EDC) for a gas-by-wire TPP at Machala near Guayaquil. In October 2001, the concession was transferred to another Noble company Machala Power Ltd. In June 2000, a pair of 62-MW, GE 6FA gas turbines were ordered and these were installed by EPC contractor Washington Group International. WGI hired two local firms for construction, Santos-CMI for civil works and COINTEC for the switchyard, transmission line, and substation construction and, in April 2002, the Machala TPP was commissioned fueled by gas from the Amistad offshore gas field. In February 2010, the GOE initiated the process of reclaiming the concession. In May 2011, the project reverted to the GOE and the plant operator is now CELEC-Termogas Machala. The 14.5ha site is in Baja Alto, about 2km from the coast, and is connected to the gas production works by a 70km pipeline while a 14km transmission line connects to Transelectric’s existing 138kV Milagro-Machala line. In October 2013, CELEC signed a $195.2mn agreement with Russia’s Roseximbank to finance the addition of HRSGs and a steam set to convert Machala to combined-cycle operation.
After completion the plant is to be run by Russian power conglomerate OAO Inter RAO.

In December 2002, Emprelanga, a joint venture of Consorcio Nobis, a leading business group in Ecuador, and Union Fenosa, were preparing to move forward on two new HPP, Vacas Galindo on the Rio Intag in Zamora-Chinchipe province (42 MW) and Delisi on the Rio Santiago (50 MW). Neither project advanced.

In March 2003, Delaware-based Ulysseas Inc, a multi-faceted partnership, installed the 30-MW Power Barge-I in Ecuador (formerly Cayman Power Barge- I, 2 X 15 MW). This vessel and Power Barge-II, installed in April 2005, were relocated from previous assignments in Latin America. Power Barge-II has a single 30-MW, oil-fired steam-electric set and was originally built in Canada in 1968. Both barges are out of service and believed removed from the country. Their operation was the subject of lengthy legal proceedings that terminated in September 2010.

In January 2004, CONELEC approved the EIA for the Hidroabanico SA project in Macas, Morona-Santiago province. The diversion HPP was built in two phases that commissioned on 19 Jan 2006 and 18 Jul 2007, respectively. Water is diverted from the Rio Abanico River through an overflow and conveyed to a small holding basin. From there, water flows through a 490m tunnel and a 2.3km trenched pipe to a powerhouse with five 7.5-MW WKV Pelton turbines equipped with AVK generators, all German equipment. The discharge water flows to the Rio Balapeque through a 200m trenched pipe. The total cost was $39.81mn and annual generation is about 315 GWh. The project has a 12km, 69kV transmission line to the Macas Substation.

In March 2004, Hidrelgen SA, then an affiliate of Caminosca, entered into a joint venture with Canadian metals company Corriente Resources Ltd to develop, build, and operate the 30-MW Sabanilla hydroelectric project to supply power to Corriente’s planned Mirador copper-gold mine. In October 2005, Hidrelgen released design documents for the power project, which is on the Rio Sabanilla in Zamora-Chinchipe province and reportedly had the necessary water usage and environmental clearances. Previously, Knight Piesold Consulting had been contracted to complete a due diligence review of the $40mn scheme, which included a run-of-river powerhouse with 6.5m diversion weir, intake structure, desanding chambers, tunnel, steel penstock, powerhouse, switchyard, and 90km of 138kV transmission line. In March 2006, Corriente Resources signed a Letter of Intent (LOI) with Hidroabanico (see below) to supply the power needs of the proposed mining operations and therefore postponed further development work at Sabanilla. Finally, in February 2014, Andritz was awarded a contract by Fondo de Cesantia del Magisterio Ecuatoriano (FCME) for a pair of 15.7-MW vertical Pelton sets for Sabanilla. FCME is essentially the pension fund of Ecuador’s teachers and took over the assets of Hidrelgen SA through a trust called Fideicomiso Magisterio Energia Renovable (FMER). Caminosca is the EPC contractor and the plant is due online in 2016.

In June 2004, it was reported that Chinese equipment contractor China National Machinery and Equipment Import and Export Corp (CMEC) had delivered a letter of
intent to the government for the investment of approximately $500mn in the El Reventador hydropower project. The Hidroriente consortium holds a preliminary 50yr concession for usage of the Quijos-Coca river systems in Sucumbios province for the 660-MW San Rafael and 520-MW Reventador projects, but the current status of the concession and the new power projects is obscure. Reventador is 150km east of Quito and 12km upstream from San Rafael. A 150km transmission line will be needed to tie the projects to the grid.

In December 2004, the first two Clean Development Mechanism (CDM) projects in Ecuador were agreed at the Kyoto Protocol COP10 meeting in Buenos Aires. The first project was developed by local developers Hidalgo & Hidalgo SA, who, that same month, received environmental clearances for the 15-MW Sibimbe run-of-river hydroelectric plant located at Echeandia in Bolivar province on the western slopes of the Andean Mountains. The project has a diversion dam on the Rio Sibimbe at an elevation of 247m and a 2.5km canal leading to a small day-storage reservoir. The powerhouse has two horizontal Francis turbines from WKV, who also acted as the EPC contractor and retained Ecuador’s Conapu SA for the civil works. Annual generation for the $22mn project is expected to be 95 GWh. The plant went online in May 2006 and is connected to the Emelrios system at 69kV.

In June 2005, Conelec awarded Singapore’s Keppel Energy Pte Ltd a concession to build and operate a diesel power barge project at Guayaquil in a project initiated by local industrial electricity consumers. In January 2006, Termoguayas Generation SA (TGSA), Keppel Energy’s wholly-owned subsidiary, signed a 15yr concession contract with Conelec including capacity payments plus revenue from selling the power into the national spot market. Five power barges with a mix of Caterpillar and Wartsila diesel gensets were redeployed from Aratu, Brazil, to Esclusas in the southern part of Guayaquil and went into operation in December 2006. Total capacity is 150 MW. MIGA provided $102.6mn in investment insurance to two other subsidiaries of Keppel Energy which made a five-year shareholder loan to and hold seven-year equipment leases with TGSA.

In November 2005, VA TECH Hydro (now Andritz) secured a turnkey order for the Enermax SA Calope project, a 16.8-MW run-of-river HPP on the Rio Calope in Cotopaxi province in the western Andes. The project was completed in 2007 and was the third Ecuadoran CDM project with CAF acting as an intermediary for the Dutch government to purchase emission reduction credits. The VA TECH scope of work included design, supply, erection supervision, and commissioning of two horizontal Francis turbines, valves, and Leroy Somer generators. Water is withdrawn from the Rio Calope at elevations of 250m and 434m and transferred into an hourly reservoir by a 6.5km system of canals and pipes. The project includes a 30km, 69kV tie-line to the Quevado Substation. Italy’s STE was project engineer and Conapu was the civil works contractor.

In December 2005, Inter-American Investment Corp approved loans for the $33mn Abanico hydroelectric project, the second of the CDM projects agreed in December.
2004. The developer is **Hidroabanico SA**. The project includes a 15-MW first phase and a 24-MW second phase near the town of Macas in the Amazon river basin. The first phase is a run-of-the-river plant on the Rio Abanico with two **WKW** Pelton turbines operating with a head of 350m. There is a 490m penstock, with the pipe running down a 2.8km channel along with discharge structures on the Rio Balaquepe. **AVK** supplied the generators and the first-phase went online in January 2006. The second phase with three similar units was approved in August 2006, and completed in 2007.

In January 2006, project company **Hidropaute** tendered for bids on the electro-mechanical equipment for the 160-MW Paute-Mazar hydroelectric plant. The site is at the confluence of the Paute and Mazar rivers and was initially designed about 25yrs ago to control water flows to the Paute plant. In January 2003, a consortium known as **ACS-Cobra-Omegaport**, and including **Union Fenosa**, withdrew from the project and, in June 2003, the scheme was instead awarded to **Hidropaute**. The design features a 183m rockfill dam and an underground powerhouse with two vertical Francis turbines. A double 138kV line links the plant to the grid. In March 2007, a consortium of **Alstom Hydro Energia Brasil**, **Voith Siemens**, and **Santos CMI**, won a €60mn equipment supply contract for the project. The lead engineering company was **SWECO** while **Impregilo** and the local firm **Herdoiza Crespo** were the civil contractors. Paute-Mazar went online in December 2010 at a cost of $500mn.

In March 2006, **Consortium Hidroenergetico del Litoral SA (CHL)** was formed to build the 42-MW Baba multipurpose project in Buena Fe canton, Los Rios province. The company was led by **Odebrecht** and included **Papelera Nacional**, **Grupo Wong**, **Cartopel**, **Nirsa**, and **Ipac**. The project includes a low-head dam and an 8km diversion canal from its reservoir on the Baba and Toachi rivers to the 213-MW Marcel Laniado HPP and, later in 2006, **Voith** was contracted for two 21-MW Kaplan T/G sets and other electromechanical equipment. In July 2007, the development contract was terminated and the project was nationalized. In July 2010, EPC contractors **Caminosca** and Brazil’s **Constructora OAS Ltd** began work, in July 2011, the Rio Baba diversion was completed, and the Baba project went commercial in May 2013. These were the first Kaplan sets in the country.

In June 2006, **Suez Energy Peru SA** and Houston-based **BPZ Energy** announced a memorandum of understanding (MOU) for a 180-MW gas-fired plant near Arenillas about 13km from the Peruvian border. The MOU also covered a proposed 55km gas pipeline to deliver fuel for the power plant from BPZ’s Corvina offshore gas field development in Peru. This project did not advance.

In December 2006, **Generadora Rocafuerte SA (Generoca)** completed a new power plant in Guayaquil canton with eight, 4.3-MW **Wartsila** 18V26 diesel engines. At the time, Generoca was majority-owned by the large multinational cement company **Holcim Ltd**, but Holcim disposed of its shares in September 2013. The ownership of Generoca is obscure.

Also in December 2006, **Hidrotoapi SA** published a request for proposal (RFP) for the
selection of a strategic partner for the 190-MW Toachi-Pilaton hydroelectric scheme, another long-standing hydroelectric development project. The project is located in the provinces of Pichincha, Santo Domingo de los Tsachilas and Cotopaxi, and the cantons of Mejía Santo Domingo de los Tsachilas and Sigchos. This consists of three 68-MW units at Palo Quernado on the Rio Tochi connected by a 1.6km canal to a plant on the Rio Pilaton (3 X 16.5 MW). Site preparation began in January 2008 and, in 2010, CELEC awarded the turbine supply contract to Russia’s OAO Inter RAO Export and manufacturer Tyazhmash. Full construction by contractor China International Water & Electric Corp (CWE) began in May 2011 and is scheduled to finish in December 2015, although work was only 68% complete in May 2015. The capex budget is $508mn. Partial financing was by Russia’s Vnesheconombank, Roseximbank, Gazprombank, and Russian Commercial Bank (Cyprus) Ltd, who provided a loan agreement totaling up to $123.3mn for a period of 11yrs. The bank organizer and payment agent was Roseximbank.

In April 2007, Hidropaute and Conelec signed a concession contract for the Sopladoroa hydroelectric plant on the Rio Paute in Azuay and Morona Santiago provinces downstream from the Mazar and Molino plants. The first studies for the project were done in 1990-92 and the final design called for a flow-diversion downstream of Molino connecting to two tunnels and a discharge chamber before an underground powerhouse with three 165-MW Francis T/G sets. In June 2007, thirteen groups were reported to have purchased bid packages. In August 2010, China Gezhouba Group Corp and local construction company Fopeca SA were selected for a $672mn EPC contractor while Harbin won the T/G award. Construction began in April 2011 and work is expected to compete in December 2015 at a cost of $755mn. In October 2011, the GOE signed a $571mn credit agreement with China Eximbank for the Sopladoroa HPP.

In February 2008, Coca Codo Sinclair SA was established to build the 1,500-MW Coca Codo Sinclair HPP (CCS) as a 70:30 joint venture of Termopichincha and Energia Argentina (Enarsa) from Argentina. In September 2009, the GOE bought the entire stake of Enarsa for $5.5mn and established Cocasinclair EP in 2010 as a 100% state-owned company to take the project forward. The site is between Chaco and Lumbaqui in Napo province, 130km from Quito. The water intake complex is on the Rio Coca, 1km downstream of the confluence of the Quijos and Salado rivers. This has a concrete-face, rockfill dam with left-bank spillway and a 120m long sedimentation basin. From there, water passes through a 9.1m diameter, 24.8km-long concrete-lined headrace tunnel through two 1,900m penstocks to eight Pelton sets in an underground powerhouse. A tailrace tunnel will deliver water back to the Rio Coca.

In October 2009, Sinohydro-Andes JV won the EPC contract. This consists of Sinohydro (89%), Coandes (8%), and two consultants, China’s Yellow River Engineering Consulting Co Ltd and Geodato (3%). Mexico’s CFE and Ecuador’s Consultora Vera y Asociados and Ingenieros Consultores Asociados were hired for construction supervision. In June 2011, Harbin Electric Machinery awarded a contract to Andritz Hydro for the supply of core components for the HPP. The Andritz
scope includes engineering design and supply of 48 nozzles and eight Pelton runners plus one spare runner. In May 2013, **Nexans** was contracted to supply extra high-voltage power cables for the transmission tie-line. The $2.6bn project is being part-financed by China’s **Eximbank** and design production is 8.6 TWh/yr with operation expected in 2016. In January 2015, a construction accident in a pressure well at the CCS construction site killed 13 persons.

In February 2008, **CONELEC** approved a preliminary environmental impact assessment (EIA) for the 48-MW, San Bartolo run-of-river HPP proposed by **Hidrosanbartolo SA**. The project is on the Rio Negro in Santiago de Mendez canton, Morona-Santiago province. The final EIA was completed in March 2011 and, in March 2012, the project water usage was permitted by **Secretaria del Agua (SENAGUA)**. In November 2012, **Corporacion Interamericana de Inversiones (CII)** approved a total of up to $29.9mn in loans for the $54.9mn project with co-financing from **CAF** ($25mn), and **Banco Pichincha** ($10mn). The main components include a diversion weir and small reservoir, intake structure, 5.5km of channels, pipes, and tunnels, a surface powerhouse, plus a switchyard and 42km 230kV transmission tie-line. **WKV** is supplying three Francis turbines and generators for San Bartolo and annual production is expected to be about 350 GWh/yr. Local company **SIPETROL SA** is the EPC contractor. Heavy rains delayed operation but the project is expected online by the end of 2015.

In August 2008, the provincial goverment of Pichincha formed state-owned **EP Hidroequinoccio** to bring forward several HPP from among a group of 11 HPP in the Rio Guayllabamba basin that had been under investigation for two decades. In August 2010, **Consoricipo Tractebel-Caminosca** presented its feasibility study for the Chirapi and Manduricau HPPs. Chirapi (169 MW) is planned to take the turbinate flow from the proposed Chontal project (194 MW) via a 18km, right-bank tunnel. Meanwhile the consultants proposed a 40m dam for the downstream 60-MW Manduricau project near Cielo Verde, Imbabura province. In the event, this scheme moved forward first. Ste preparation started in December 2011 and contractor **Construtora Norberto Odebrecht** began construction in February 2012 working with Brazilian engineers **Engevix Engenharia SA** with additional supervision by **Consorcio ITH**, comprising **Inclam SA** and **TYPSA** from Spain and **HOSPIPLAN** from Ecuador. In April 2012, **Alstom** secured the order for two 30-MW Kaplan T/G sets from its Brazilian works and Manduricau commissioned in March 2015, about 2mos past schedule. In November 2012, Brazil’s development bank **BNDES** agreed to provide $90.2mn in project financing, its first involvement in Ecuador since 2008 when the bank and the GOE were in an intense legal dispute over loans for the San Francisco HPP. Manduricau’s cost was about $227mn and production is expected to be about 340 GWh/yr.

In February 2009, **CNEL Sucumbios** opened the Jivino-2 power plant at San Pedro in Shushufindi canton. This has two 5.82-MW, heavy-fuel **MAN B&W**,12V32/40 diesel engines and was installed by Spanish firm **Isolux Corsan**. The plant cost $13mn and was built in 11mos.
In April 2009, Elecausto laid the foundation stone for the Ocana HPP on the Rio Canar in Javin canton, Canar province. In June 2009, Alstom was awarded a contract for the supply of a pair of 13.4-MW Pelton sets. The scheme has a dam at elevation 840m with a regulating reservoir and a 6.4km water tunnel to a 1km penstock to the surface powerhouse, which is located at elevation 455m. Caminosca, Soc Colombiana de Construcciones, and Semaica were the EPC contractors and the 41km, 69kV transmission tie-line was built by COINTEC. Ocana cost $65mn and was opened by President Correa in April 2012.

In October 2009, the GOE signed Executive Decree No 89 authorizing the installation of 151 MW of new thermoelectric plant with Cuban assistance. In 2012, CELEC began construction on the 50-MW Guangopolo-II diesel power station in Quito canton, Pichincha. This has six, 8.73-MW MAN Diesel 18V32/40 gensets with ABB generators and is expected to supply about 390 GWh/yr. The units were designed to allow for isolated operation and are connected to the distribution system of EE Quito. The plant commissioned in November 2014 at a cost of $69.85mn. Fuels are diesel and heavy oils and the EPC contractor was Cuban national power company Union Electrica.

In September 2010, Hyundai Heavy Industries - Engine & Machinery Division (HHI-EMD) received a $110mn order from its local business partner Equitatis SA for large-scale DPP for CELEC at Santa Elena S/S in Guayas and at Quevedo S/S in Los Rios. In total, 113 HHI-EMD 9H31/32 engines were installed, totaling 90 MW at Santa Elena and 102 MW at Quevedo. The installation, test, and commissioning process for the 40ft containerized gensets took two months and completed in August 2011.

In November 2011, CELEC hired Harbin Electric Power International to build the 96-MW Esmeraldas-II diesel power station in Esmeraldas province for $101.4mn. This plant is adjacent to the existing Termoesmeraldas TPP and has 12, medium-speed 8.35-MW gensets using No 6 fuel oil from the Esmeraldas Refinery. Site works began in April 2012 and the plant commissioned in August 2014. Heat recover boilers are included to steam-heat the fuel oil and an existing 138kV tieline was upgraded.

In April 2011, HHI-EMD received an order from Equitatis for a new 140-MW diesel power plant at Jaramijo in Manabi, 300km southeast of Quito. Eighteen, 8-MW HiMSEN 18H32/40V engines were installed. The project took 240 days and connects via a new 7km, 138kv tieline to a new substation at Manta. The project had previously been worked up using six 16.7-MW MAN B&W gensets for a company called Elecpacifico.

In October 2011, a consortium of Energeticos Ecuagesa SA (Ecuagesa), Hidrotopo SA, and PEMAFCia Ltda began construction on the 29.5-MW Hidrotopo HPP near the confluence of the Topo and Zunac rivers. The project has a 50yr concession from the GOE. The site is 250km south of Quito, in southeastern Tungurahua province. A catchment is being built on the Rio Topo at 1,500m elevation, along with a 567m water channel, a 485m water tunnel, and a 330m low-pressure pipeline to the turbine hall. The project also includes a switchyard and a 7km, 138kV tieline to the Banos-Puyo
transmission line. **Harbin** is building two Francis T/G sets and **Siemens** is building the substation. The EPC contractors are Peru’s **CESEL SA** and Ecuador’s **Constructora de los Andes Cia Ltda (COANDES)**. Project completion has been slowed by labor disputes and a January 2015 landslide that killed two workers.

In October 2011, the GOE signed a $215mn EPC contract with **Hydrochina** for the 180-MW Delsitanisagua HPP in Zamora canton, Zamora Chinchipe province. The scheme includes a 35m tall concrete gravity dam, a 4.1m diameter, 8km pressure tunnel, a 66.5m tall vertical pressure well, 516m of other shafts and tunnels, and a 484m pressure pipe leading to a final 255m pipeline to a left-bank powerhouse with three 60-MW Pelton T/G sets. The $266mn project began construction in December 2011 and is expected online in March 2016. Annual production is projected at 1,400 GW h delivered via a 36km, double-circuit 138kV tie-line to Yanacocha S/S in Loja city.

In December 2011, **CELEC Enerjubones** started construction on the Minas San Francisco HPP in Azuay and El Oro provinces, in Pasaje, Pucara, and Zaruma cantons. The final environmental approval was obtained in March 2012. **Harbin** is the turkey EPC contractor and is also supplying three 90-MW Pelton T/G sets. The project has a 54m tall, RCC dam on the Rio Jubones, and a 13.9km long headrace tunnel to an underground powerhouse. The design head is 474m. Production from the $556mn project is expected to be about 1,290 GWh/yr with operation from mid-2016 on the present schedule.

Also in December 2011, **CELEC** issued an EPC contract to **China National Electric Engineering Co (CNNEC)** for the 50-MW Quijos HPP in Quijos canton, Napo province, 80km southeast of Quito. In September 2013, Quijos was registered as a CDM project. The scheme features intakes on the Papallacta and Quijos rivers at elevation of about 2,300m, two conduction tunnels(78m from the former and 2,373m from the latter), a 3.4km main power tunnel and surge tank, and a powerhouse with three 17-MW Francis sets. A 53km, 138kV tie line will connect to the grid and deliver about 350 GWh/yr. Construction began in January 2012 with operation scheduled by mid-2016. The cost estimate is $138mn.

In October 2013, **CONELEC** approved a license for Sigchos, an 18-MW HPP in Cotopaxi Province. This $20mn project was originally a joint-venture project of Ecuador’s **Minicen SA** and **Construcmedgar**, but was taken forward by Italy’s **Triolo srl**. The site is 6km from Sigchos and is expected to connect to the SNT via an existing 69kV line. The project has received most of the needed permits and licenses and awaits only additional financing. **Alstom** apparently agreed to finance the necessary equipment purchases, but the project remains unscheduled.

In October 2013, the GOE, **Roseximbank**, and **Inter RAO** signed letters of intent for financing and developing the Chontal HPP in Pichincha province and the 400-MW Cardenillo HPP in Morona-Santiago province bordering Peru. The estimated investments are $368mn and $933mn, respectively.
In January 2014, Hidroequinoccio signed a $236mn EPC contract with China’s Hydrochina Xibei Engineering Corp, part of PowerChina, for the El Tigre HPP in Pedro Vicente Maldonado canton, Pichincha province. The scheme is sited at the confluence of the Guayllabamba and San Dimas rivers. Components include a 52m RCC dam and a powerhouse with two 40-MW Kaplan T/G sets. The contract is to run 54mo. Also included is a 16km, 230kV transmission tie-line to the Manduriacu HPP. This will deliver about 400 GWh/yr to the grid.

Renewable Energy Sources and Distributed Generation

The GOE makes financing for renewable energy projects available through its Fondo de Electrificacion Rural y Marginal (FERUM) administered by the Solidarity Fund.

So far, Ecuador’s hydropower development workd has been largely concentrated on medium- to large-size projects, but there is certainly scope for more small hydroelectric plants (SHP).

In 2007, Manageneracion SA, for example, completed the 6-MW La Esperanza and 3-MW Poza Honda projects.

In July 2014, Elecaustro started testing on the Saymirin-V SHP in Chiquintad, Cuenca canton, Azuay province. This has two 3.76-MW Francis T/G sets from Alstom.

The Galapagos Islands have been a focus for deployment of renewable energy since the use of diesel power plants has deleterious environmental impacts and detracts from the area’s substantial ecotourism potential. FERUM has sponsored a small wind-solar demonstration on Isla Floreana in the Galapagos.

In January 2007, the first major wind turbine components for installation in Ecuador were delivered to Guayaquil port by Spain’s MADE. Three 800-kW machines were installed for a new wind plant on El Tropezon Hill on the Galapagos island of San Cristobal. The project was implemented by Elecgalapagos SA with funding from the E8 group of large global power companies. The U.S. company Walsh Environmental Scientists and Engineers LLC completed the Definitive Environmental Impact Assessment (DEIA) for the E8, and this was approved by the Ministerio del Ambiente and Conelec in 2004. In September 2005, a project document was signed between the United Nations Development Program (UNDP), the government of Ecuador, and San Cristobal Wind Project Commercial Trust. U.S. consultancy Industry and Energy Associates provided management services for the project and Santos-CMI was the civil contractor. The project cost about $10mn.

In 2013, CELEC commissioned the Villonaco windpark. China’s Goldwind supplied and installed eleven 1.5-MW wind turbines for the plant, which is situated at an altitude of 2,700m. The plant cost about $40mn and links to the Loja S/S of Empresa Electrica Regional Sur, the utility that provides power to the provinces of Loja, Zamora, and sections of Morona-Santiago.
Ecuador has a substantial solar energy resource, but a 1.5-MW photovoltaic plant in the Galapagos at Pampas Coloradas, Puerto Ayora Island, is the largest single plant built so far. This was installed in 2014 per a December 2010, $10mn agreement between the GOE and Korean International Cooperation Agency (KOICA).

The GOE has also sponsored the construction of several dozen +/- 1-MW solar projects for isolated and semi-isolated systems on the mainland.

A series of 20- to 50-MW solar projects have been proposed by Canadian, European, and Ecuadorian developers, but none are known to be in active implementation.

Biomass already makes a useful contribution to Ecuador’s power supply from several bagasse-fueled power plants. In August 2006, CAF approved an $8mn loan to Ecoelectric SA for a 25-MW unit at the Ingenio Valdez sugar mill in San Francisco de Milagro in Guayas. The location already hosts a 3-MW unit built by Compania Azucarera Valdez SA and a 6-MW unit operated by Ecoelectric, which is owned by Consorcio Nobis. Corporacion Interamericana para el Financiamiento de Infraestructura SA (CIFI) was hired by Ecoelectric as lead arranger for the larger cogeneration project. CIFI completed technical and environmental due diligence, structured the financing, and led the $21mn syndication for the renewable energy project. Lenders include CAF, CIFI, and DEG of Germany. The project was completed in July 2007 at a cost of about $31mn. The Brazilian companies Caldema Equipamentos Industriais Ltda and NG Metalurgica Ltda supplied the boiler and turbine, respectively.

In 2007, landfill gas (LFG) flaring began at the Zambiza landfill in a suburban area northeast of Quito. The landfill was closed in 2002 and is owned by Emaseo, the local municipal refuse company. Green Gas International (GGI) obtained CDM status for the flaring project and a small LFG power project has been mooted at Zambiza.

In the longer term, Ecuador may be able to take advantage of its estimated 500 MW of geothermal generating potential. Working with the United Nations and Germany’s GTZ, the government is continuing studies initiated by Inecel in several locations including Tufino-Chiles-Cerro Negro (in cooperation with Colombia), Chachimbio, and Chalupas with hopes of eventually obtaining private investment for power plant construction.

Future Prospects

In the 1990s, Ecuador was a regional case study of the political problems that can be encountered in the re-ordering of sensitive or “strategic” government-owned assets. Initially, workers reacted to the Inecel restructuring plan with a variety of job actions, including the occupation of several power plants. The government responded to popular discontent by shelving plans for the actual sale of assets and instead concentrated on getting private-sector involvement in building new generating capacity.
As it turned out, the institutional issues with the electricity power sector were to some extent symptomatic of generalized issues elsewhere in the energy sector and more generally with Ecuador’s other productive and infrastructure assets. In the event, President Correa finally reversed the entire market-orientation for the country’s power sector and, since then, the GOE and its state-owned power companies and other entities have been making heavy investments in new infrastructure on their own account. Much of this has been with the active involvement of Chinese equipment, service, and financial providers.

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