Costa rica energy storage for renewable energy

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The 1948 elimination of the military of Costa Rica freed up millions of dollars from the government defense budget which are now invested in social programs and renewable energy generation.[1] As president of Costa Rica in 1948, Jos? Figueres announced that the nation"s former military budget would be refocused specifically in healthcare, education, and environmental protection.[7]

The commercial consumption of energy in Costa Rica has tripled from 1980 to 2009. The electricity consumption has increased by 4.2 times due to a high level of electrification.[9] According to the World Bank, 99.5%[10] of the country"s population has access to electricity. Meanwhile, fossil fuel"s consumption has increased by 2.4 times, caused by a significant growth of the number of motor vehicles.

Geothermal power is a natural energy source that provides subterranean heat and power as a byproduct of volcanic energy. Costa Rica has six currently active volcanoes and dozens of inactive volcanoes.[21] Unlike many other forms of renewable energy, geothermal can be continuously generated and is not dependent on weather. Geothermal energy contributes to about 15% of the energy in the country.[22]

The North Volcanic Mountain Ridge in Guanacaste is the region of Costa Rica with the most potential for geothermal power generation. Volcanoes in the region include Miravalles, Rinc?n de la Vieja, and Tenorio.

Wind Power is primarily used in Costa Rica during the months of December to March, or the dry season. During this period, there is a general decreased rainfall in the nation and hydropower output decreases.

Costa Rica finished 2015 with an additional 59 MW of power generation in wind energy, after the inauguration of the Orosi plant (50 MW) in October and "Vientos del Oeste" project (9 MW). As such, the wind power total capacity in the country is planned to grow from 194 MW in 2015 to 393 MW by 2017, an increase that would represent approximately 10.5% of total electricity production.[29]

Between 1996 and 1999 the first three private wind power plants began operation and in 2002 Tejona plant, built by the Instituto Costarricense de Electricidad. Later, the following plants were opened: Guanacaste (private 2009), Los Santos Wind Farm (built by the public cooperative Coopesantos in 2011 in the heart of Los Santos region, in San Jos?), the "Valle Central" (built by the Compa??a Nacional de Fuerza y Luz, or CNFL, a Grupo ICE subsidiary in 2011) and "Chiripa" (private, 2015).

In addition, the construction of five private plants during 2016 (Altamira, Campos Azules, Mogote, Vientos de la Perla y Vientos de Miramar) is planned, as well as another by the Compa??a Nacional de Fuerza y Luz in

2017 (Ventus Project).

Currently, there are nine large wind farms operating in Costa Rica. The Tejona Wind Power Project (TWPP) is a 19.8 MW project, fully operational since 2003, that consists of thirty wind turbines. Most recently, Tila Wind, an even larger 20-MW farm, opened in 2015. Three of the remaining eight are owned by ICE and Compania Nacional de Fuerza y Luz SA (CNFL) and CoopeSantos RL. The remaining five are privately owned, and nearly all of the wind power plants are in the province of Guanacaste.[27]

Like wind power, solar power is another newer energy source in the country. The first solar power projects in the country were established in 1978 by just a few researchers from public universities at the Solar Power Laboratory at the National University. Though still on a smaller scale and mostly privately owned, plans for larger more commercial projects are beginning to break through.[30]

In 2012, Costa Rica inaugurated the Miravalles Solar Park on the hillside of the Miravalles Volcano. At that time, it was the first of its kind in Costa Rica and the largest solar project in Central America.[33] It was built with the help of the Japanese International Cooperation Agency (JICA). The project"s totaling was $11.5 million ($10 million from JICA and $1.5 million from ICE[34]). This plant of 1MW only represents 0.03% of all the capacity installed in the country of 2872 MW.

As of 2011, only 0.25% of energy produced in Costa Rica came from biomass. The Jorge Manuel Dengo Obregon National Development Plan proposes the development of sustainable biomass for energy. Currently, biomass is primarily used for cooking and heating kitchen appliances to reduce the reliance on petroleum in the household.[28]