The California International Law Journal

Official Publication of The State Bar of California International Law Section www.calbar.ca.gov/ILS

Vol. 17, No. 2, 2009

Contents

Letter From the Chair 2

THE LEGAL IMPLICATIONS OF NEARSHORE OUTSOURCING TO MEXICO 3
BY RENEE DOPPLICK

GOING VERDE – RENEWABLE ENERGY IN MEXICO 15
BY J. ANTHONY GIROLAMI

MCLE Exam 21

IMPORTANCE OF UNDERSTANDING THE MEXICAN CULTURE WHEN DOING BUSINESS IN MEXICO 22
BY LIZBETH H. FLORES

STRATEGIES FOR COMPANIES PROTECTING IP IN THE EU – PART II 24
BY ROBERT CAIN AND MARK FINN

Going Verde - Renewable Energy in Mexico

*J. Anthony Girolami**

I. INTRODUCTION

As many nations focus their efforts on discovering and exploiting renewable sources of energy, Mexico has been provided an opportunity to rediscover its past. Aztec mythology is filled with references to *Huitzilopochtli*, the god of the sun,[1] *Ehecatl*, the god of the winds,[2] and *Chantico*, the goddess of volcanos,[3] who, along with other deities, were responsible for creating and maintaining the life force of the Aztec universe. Modern day Mexico may once again look to these resources to produce energy with the assistance of modern technology.

In order to meet its sustainable development goals and its international obligations with respect to the reduction of greenhouse gas emissions, Mexico plans to add renewable power sources to its energy portfolio. As part of this intiative, Mexico has recently enacted a Renewable Energy Law[4] (the "Law") which introduces welcome changes in the existing legal framework to promote economically viable renewable power. This article provides an overview of the types of renewable resources currently existing in México, the difficulties in implementing renewable energy projects, the Law and its potential impact on the Mexican renewable power industry and how California may benefit from renewable power generated in Mexico.

II. MEXICO'S RENEWABLE RESOURCES

It comes as no surprise as why the elements of the natural world played such a significant role in the mythology and religious practices of ancient Mexico: natural resources are abundant. México possesses many renewable energy resources that remain largely untapped. Studies have determined that México has national wind resources sufficient to generate in excess of 40,000 MW. The wind conditions in the State of Oaxaca are among the best in the world with the potential to generate 8,800 MW. Yucatan and Quintana Roo benefit from wind conditions which could potentially generate 352 MW and 157 MW, respectively. Outside of Oaxaca, the mountain ranges of Baja California Norte have the potential to produce in excess of 5,000 MW.[5]

With respect to solar resources, the desert regions of the states of Baja California, Sonora and Chihuahua in northern Mexico have one of the highest potentials in the world for the generation of solar power since the solar insolation[6] in this region averages of 5.5 kWh/m^2.

As a region with considerable volcanic activity (specifically within the so-called "Volcanic Belt"),[7] México is the world's third largest producer of electricity from geothermal sources. The geothermal resources located in Baja California in and around the city of Mexicali and south central states of Michocan and Puebla alone have the potential to generate approximately 2,400 MW.

México has a long tradition of converting its plentiful hydraulic resources into electricity. While large scale hydroelectric facilities currently generate approximately 21% of the country's installed generation capacity, hydroelectric projects are difficult to implement and are capital intensive. Small scale hydroelectric plants producing 10 MW or less have the potential to generate approximately 3,250 MW.

Notwithstanding the abundant resources available for renewable energy development, México's total installed capacity from renewable sources, primarily from geothermal and wind resources, is just 3% of total installed capacity.[8] (See Table 1)

Table 1 - Existing Renewable Energy Projects

Project Name	Technology	Capacity (MW)
Cerro Prieto I-IV, Mexicali, B.C.	Geothermal	720 MW
Tres Vírgenes, Mulagé, B.C.S.	Geothermal	10 MW
Los Azufres, Michoacán	Geothermal	195 MW
Húmeros, Puebla	Geothermal	35 MW
La Venta I-II, Oaxaca	Wind	85 MW
Guerrero Negro, B.C.S.	Wind	1 MW
Trojes, Jalisco	Small Hydro	8 MW
El Gallo, Guerrero	Small Hydro	30 MW
Chilatán, Michoacán	Small Hydro	14 MW

Source: Comision Federal de Electricidad

for its future economic development by harnessing the energy of its past.

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ENDNOTES

1. *Huitzilopochtli* was the chief god of the Aztecs and was considered their god of the sun and of war.
2. *Ehecatl* is often depicted in the form of the great *Quetzalcoatl* and had the power to bring life to all that is lifeless.
3. *Chantico* was the goddess of fires in the family hearth and volcanoes, and by extension, the energy emanating from the earth's core.
4. *Ley para el Aprovechamiento de Energías Renovables y El Financiamiento de la Transición Energética* , published in the *Diario Oficial de la Union* on November 28, 2008 (the "Law")
5. California ISO Generator Interconnection Queue (Aug. 10, 2007)
6. Insolation is a measure of solar radiation energy received on a given surface area during a given time.
7. The Volcanic Belt runs approximately 900 kilometers from the western state of Jalisco to the central Veracruz on the east gulf coast of Mexico.
8. Electricity generated from large hydroelectric plants accounts for 13.5% of Mexico's total installed capacity. For purposes of this article, only small hydroelectric plants of less than 30 MW are being considered as renewable energy projects.
9. Mexican Constitution, Article 27
10. Article 72, Regulations to the *Ley del Servicio Publico de Energía Electrica*
11. *Ley del Servicio Publico de Energía Eléctrica*
12. Annex F-R to the Form Interconnection Agreement between CFE and Renewable Energy Producers
13. *Ejidos* are communities that have their own legal identity and collectively own real property that can either be used entirely for the common use of its members, subdivided for the use of individual members or may be used for housing for its members. Each *ejido* is governed by an internal regulation and important decisions affecting the *ejido* are subject to the approval of all *ejido* members.
14. 2002 Agrarian Census, INEGI Statistics
15. Agrarian Law, Article 45
16. *Comisión Reguladora de Energía*
17. Lokey, E. "Barriers to clean development mechanism renewable energy projects in Mexico", Renewable Energy 34 (2008), Pg. 504
18. Renewable Energy Law, Article 14
19. Renewable Energy Law, Article 27
20. The *Secretaria de Hacienda y Credito Publico* functions as the national treasury.
21. Renewable Energy Law, Article 8
22. Electricity Exportion Permit No. E/182/EXP/2000, issued by CRE on December 12, 2000
23. Electricity Exportion Permit No. E/197/EXP/2001, issued by CRE on August 9, 2001
24. Electricty Regulations, Articles 116 and 117
25. Electricity Exportion Permit No. E/214/EXP/2002, issued by CRE on June 11, 2002

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Questions: Going Verde- Renewable Energy in Mexico

1. Mexico possesses renewable energy resources in abundance-wind resources, solar resources and geothermal sources.
❑ **True** ❑ **False**

2. Mexico has been a leader in the development and implementation of renewable power projects. ❑ **True** ❑ **False**

3. Private sector participation in energy development in Mexico has been restricted to self-supply and electrical sales via power purchase agreements. ❑ **True** ❑ **False**

4. Since the *Comisión Federal de Electricidad* ("CFE") is obligated to obtain electricity at the lowest cost available, and the cost of electricity from renewable sources has historically been much higher than the cost of electricity obtained from large hydroelectric facilities and conventional fossil fuel power plants, the CFE has not been able to add renewable energy projects to its generation portfolio. ❑ **True** ❑ **False**

5. As a result of restrictions imposed on the CFE, private renewable energy developers have been unable to enter into the energy market in Mexico. ❑ **True** ❑ **False**

6. Under the self-supply regulations, private companies or groups of companies are not permitted to build, own and operate a generation asset serving multiple clients who are also the owners.
❑ **True** ❑ **False**

7. Current regulations allow self suppliers to "bank" surplus energy monthly allowing an amount equal to the surplus to be delivered to an off taker during periods where electricity production is lower than actual consumption. ❑ **True** ❑ **False**

8. One of the main difficulties for self-supply projects is the lack of transmission capacity from remote areas where such projects are located to urban load centers. ❑ **True** ❑ **False**

9. *Ejidos* are collectively owned and administered parcels of land that tend to be located in rural areas. ❑ **True** ❑ **False**

10. Lack of contractual certainty has played a significant role in delaying the implementation of renewable energy projects.
❑ **True** ❑ **False**

11. Large hydroelectric projects (greater than 30 megawatts), nuclear plants and renewable energy projects developed for self-supply are in a prime position to take advantage of recent tax incentives and other benefits designed to promote the generation of electricity from renewable sources. ❑ **True** ❑ **False**

12. The Energy Ministry is empowered to enter into agreements with state and municipal governments to facilitate access to areas with high concentrations of renewal resources, to establish new guidelines for land use and to simplify the permitting process for renewable energy projects. ❑ **True** ❑ **False**

13. Despite a request from energy providers, the government is reluctant to establish tax incentives for the development of renewable energy projects. ❑ **True** ❑ **False**

14. Project developers must leave room for public participation in the planning stages and must invest and giveback to the communities they are located in. ❑ **True** ❑ **False**

15. The transition to renewable energy is to be supported economically by a fund that will be administered by the Executive Director of the CFE. ❑ **True** ❑ **False**

16. The Mexican government has allocated MX$3 billion pesos to fund renewable energy projects, and is expected to engage in direct lending and to provide loan guarantees. ❑ **True** ❑ **False**

17. Unfortunately, the new energy laws in Mexico do not permit the CFE to act as an intermediary between renewable energy projects and the purchasers of carbon credits in international markets.
❑ **True** ❑ **False**

18. The CFE intends to reserve the income derived from the commercialization of carbon credits for the benefit of the Mexican treasury; project developers will not be allowed to sell carbon credits. ❑ **True** ❑ **False**

19. The Energy Ministry has until May 2010 to submit a renewable energy strategy to the president and until July 2010 to publish regulations implementing the Law. ❑ **True** ❑ **False**

20. The expansion of the Mexican renewable energy market will also create greater opportunities for California-based renewable energy technology manufacturers. ❑ **True** ❑ **False**

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