

PROFILES

WOMEN IN GEOTHERMAL

Promoting the education, professional development, and advancement of women in the geothermal community.



Spotlight on Women in Geothermal USA - May 2024

Dita and Lucien Bronicki, Co-Founders of Ormat Technologies

The Formative Years Before the Establishment of Ormat



Known for being pioneers in the geothermal industry, Ormat Technologies' story is greatly shaped by the inventive minds and life journeys of its founders, Lucien and Dita Bronicki. Lucien was born in present-day

Ukraine, then a part of Poland, and after World War II relocated to France with his family when he was 12 years old. In school, Lucien dedicated himself to his studies and eventually obtained a Master of Science in Physics from a French university, focusing his thesis on solar engines. At the time, the concept of solar engines was being explored but their production hadn't yet escalated. During this period, coal was the dominant energy source and the people in the "coal country" in northern France suffered from pollution. Experiencing these environmental challenges first-hand inspired Lucien's commitment to developing sustainable energy solutions, leading to the founding of Ormat Technologies.

Before founding Ormat, Lucien spent six years at the National Physical Laboratory in Israel focusing on developing a power unit, specifically, an engine that could operate at relatively low temperatures provided by flat plate collectors developed in the Laboratory. Working on engines of 1 to 3kW range between a solar collector at 100 deg C and cooling at 30 deg C he was struck by the big difference between the theoretical efficiency of applying the second law of thermodynamics of 20% and the efficiency of commercially available engines and turbines of less than 4%. Analyzing the losses, he showed that they could be minimized by using fluids with different physical properties. Facing the absence of existing thermodynamic tables for most of the suitable fluids, Lucien had to prepare such tables by calculating the needed values from meager information available. This led him to pioneer a novel type of Rankine Cycle including a recuperator markedly improving the cycle's efficiency and enhancing the Organic Rankine Cycle (ORC) technology in this field, now widely used by all designers of ORC power systems.

Being a Female in Geothermal during the 1960-80s

Dita observed that initially there were very few women in business in general during the early years at Ormat. She often found herself as the only woman in meetings, a fact that did not go unnoticed by her colleagues who would consequently moderate their tone and humor. However, this gradually changed over time.

In 1982, during a business trip to Japan with Lucien, Dita encountered a situation that highlighted these gender disparities. One day, needing to use the restroom during lunch, she discovered there was no women's restroom on their floor. After quietly discussing in Japanese, the men informed her she needed to go several floors down. Embarrassed by the oversight, the Japanese representative of Ormat advised her not to attend the next day's meeting to avoid further embarrassment.

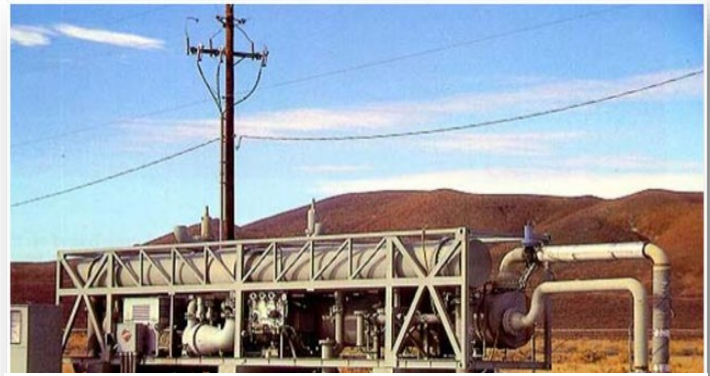
The Foundational Years at Ormat

The solar energy project at the laboratory was ultimately terminated due to limited interest in solar energy. For the same reason, no company was willing to continue development of the small demonstration engine. The year 1964 marked the founding of Ormat, sixty years ago, using funds from the sale of an apartment gifted to Lucien and Dita by their parents. The name "Ormat" comes from Hebrew: 'Or' means light, and 'mat' is taken from 'metal', indicative of their use of metal to capture sunlight.

Lucien and Dita acquired a small metal workshop to manufacture the solar engine units, which also provided crucial working capital from its regular operations. This setup enabled them to advance their research and development on the ORC Unit. The first order Ormat received was from an Israeli organization aimed at supporting agricultural projects in Africa. The initial unit was designed for water pumping and was deployed on a cattle ranch in Mali, Africa.



1966: Ormat's first solar powered unit of 600 W powering a water pump in Mali



1984: Ormat's 700 kW Power Unit in Wubaska, Nevada. First commercial ORC in the U.S.

Priced at \$3,000 this system proved economically feasible for providing water for 400 cattle in an area with limited water resources. Generating less than 1 kilowatt (kW), the hermetically sealed unit operates like a domestic refrigerator. Contrary to diesel engines, this unit didn't need fuel, maintenance, or overhaul. The need was evident, and the economics were favorable: the income from 400 cattle at local prices would cover the investment in less than two years. However, African farmers and countries lacked the funds for such investments, and international organizations did not believe in solar energy. Ormat converted the unit from solar power to affordable fossil fuels, such as LPG or kerosene. Thanks to its no-maintenance feature, they sold these units to telecom companies for their remote microwave repeater stations. In the following 20 years Ormat sold 3000 units to telecom companies and SCADA systems along pipelines.

In 1972, Ormat expanded into the U.S. market by establishing its subsidiary, Ormat Systems Inc., which supplied 120 units to the Trans-Alaska Pipeline. Installed in 1975, these units are still operational in 2024. The success of this \$20 million Ormat project on the high-profile Trans-Alaska Pipeline was instrumental in establishing Ormat's reputation. The surge in oil prices and growing concerns over energy shortages in the mid-1970s led the company to refocus on its original specialty and further develop solar ponds. This innovative method combined both energy collection and storage into a single system. Supported financially by the World Bank, Ormat built a 5 Mega Watt (MW) demonstration solar pond project that included a solar pond, a collector, and a turbine. This setup harnessed the solar pond's thermal energy approximately 85 degrees Celsius to produce electricity with the ORC, which was then cooled by the pond's top water layer at around 30 – 35 degrees Celsius. Ormat aimed to generate electricity at a cost competitive with oil priced at \$80 per barrel, and they achieved this technically. However, when oil prices later dropped to as low as \$16 per barrel, solar pond technology became uneconomical. After six years of operation, the plant was decommissioned and Ormat had to find another market. A notable achievement during this period was the establishment of a solar pond demonstration plant in El Paso, Texas. This plant not only generated electricity but also supplied power to a desalination facility near a pickle farm.

From Solar Ponds to Geothermal

Initially, the company entered into a power purchase agreement with Southern California Edison for a solar pond project located at the Salton Sea, but the plan did not come to fruition due to difficulties in attracting investment amid low oil prices. Nevertheless, Ormat's experience in harnessing heat from solar ponds to generate electricity paved the way for its pivot toward geothermal energy.

By 1982, Ormat had officially shifted its primary focus to geothermal energy. The company's strategy involved targeting locations where oil exploration wells had inadvertently discovered hot water and were subsequently abandoned because they were not hot enough to produce steam for steam turbines. At that time, steam was already being used for power generation in the Geysers region of California. With a different market approach, Ormat decided to focus on areas that had been overlooked by other geothermal industry players instead of competing for known steam resources. Ormat began its search for geothermal resources by purchasing maps for ten dollars from USGS that marked the locations and characteristics of abandoned oil wells. This approach led to the commissioning of Ormat's first geothermal plant in Wubaska, Nevada in 1984, which produced 700 KW of electricity.

The Origins of Project Financing

Project financing has played a crucial role in Ormat's history. Originally, Ormat introduced modular units to the geothermal industry, initially focusing on selling equipment rather than managing projects. The concept of raising funds for ventures like geothermal power plants emerged as a novel idea in the 1980s. Convincing bankers that hot water would consistently be available underground as a sustainable source for a geothermal project over 30 years presented significant challenges. Ormat would structure a 20-year loan based on the assumption that the power plant would operate for 30 years to service the debt. This financing model had to account for both long-term operational risks and short-term construction risks, such as drilling production wells to provide the heat for the power plant.



1986: 30 MW Ormes 1 Geothermal Plant in East Mesa, California



1992: Ormat's Geothermal Combined Cycle Power Plant of 28 MW in Puna, Hawaii

In the 1980s, there was a significant upsurge in interest and investment in geothermal energy that was spurred on by companies like Ormat and supported by governmental bodies like the U.S. Department of Energy (DOE). A key project for Ormat was Ormesa located in East Mesa California. The initial developer, Republic Geothermal, had secured a DOE loan guarantee of \$10 million but failed in the early stages of development and was unable to repay the DOE loan. Ormat acquired the geothermal development leases from Republic Geothermal and assumed the DOE loan guarantee. One year later the 50 million dollars 30 MW geothermal power plant was operational.

The financial structuring for the 30 MW Ormesa project included tax arrangements to benefit from the tax incentives available for geothermal investments at that time. Ormat secured private funding from insurance companies and equity investors. Within 2 years, the Ormesa 20 years term loan was fully repaid to the DOE. This marked a significant shift towards private financing in geothermal energy. The financing for Ormesa was finalized in 1986, and by 1987, Ormat was funding a second, entirely privately financed 20 MW power plant adjacent to the original. While Dita was modest in her retellings, the impact of these developments was indeed revolutionary and paved the way for new private funding for geothermal projects.

During the 1990s, Ormat focused on the development of geothermal projects outside of the United States. No large geothermal projects existed around the world before this time, and it was during this period that non-recourse financing of geothermal projects outside the US took off in places such as the Philippines.

Dita Assumes the Role of CEO

While Dita didn't assume the official role of Ormat's CEO until 1991, she co-managed the company with Lucien throughout its formative years. Their sustained success over decades stemmed from their ability to collaborate while also respecting each other's space and understanding each other's strengths and weaknesses.

In 2014, Dita and Lucien retired, yet they remain keen observers of the geothermal industry. They advise startups to secure financing quickly, thoroughly prepare, and learn from others' mistakes. They advocate for leading with integrity and contributing positively to society, emphasizing that success at a smaller scale can pave the way for larger achievements. They highlight that there is much to learn from the oil industry, particularly because the challenges lie beneath the surface, not above it.

Lucien and Dita also reflected on their past exploration of Enhanced Geothermal Systems (EGS), emphasizing the importance of resource development. They believe that the future of geothermal asset development will greatly benefit from the experiences and techniques refined in the oil and gas industry and at national laboratories like Sandia, where many complexities and opportunities also reside below the surface.

Giving Back to the Community



Dita and Lucien dedicated themselves to empowering local communities by establishing schools in several areas where they have power plants. One of their core principles was to ensure that the power plants were operated by locals. Ormat operates in various countries outside the U.S., including Kenya, Nicaragua, and Guatemala. In Guatemala, Ormat has supported local schools and provided medical and dental care to the community. In Kenya, Ormat has created jobs for local members of the Maasai community at the power plant and funded primary schools for the children.

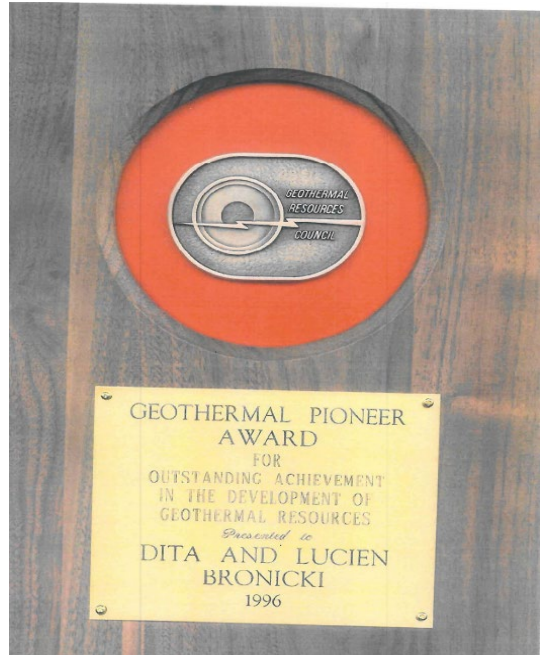
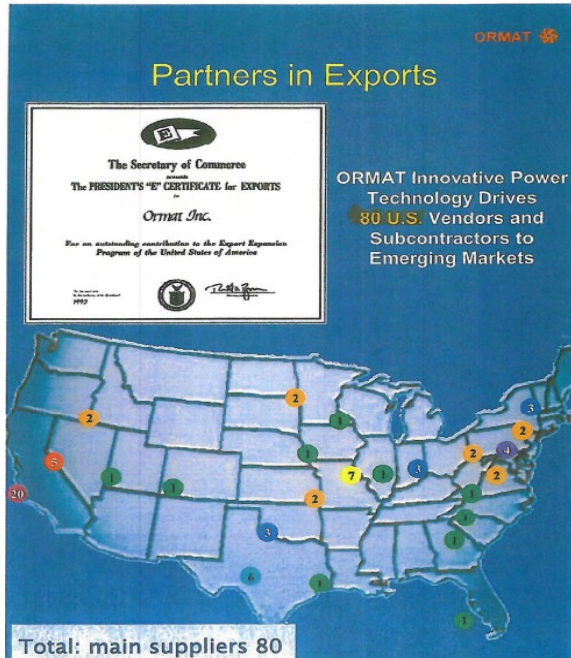
What Advice Would You Give to Your Younger Self?

Do something good for people. This has been a motto that they have taken throughout their careers.

What Advice Would You Give to Females in Geothermal?

To all females, you are all equal. Believe in what you can do and do it.

Awards and Accolades



Authors of Spotlight on Women in Geothermal USA

Please send your suggestions for future editions of Spotlight on Women in Geothermal directly to the authors.



Elizabeth Cambre

North America BDM New Energies
– Geothermal, Vallourec

WING USA Chapter Committee
Member

Elizabeth.Cambre@vallourec.com



Lauren Lopez

Global BDM – Energy Transition,
NOV

WING USA Chapter Committee
Member

Lauren.Lopez2@nov.com



Analiese Andersen

Account Executive

WING USA Chapter Committee
Member

AAndersen@microseismic.com