The Economic Benefits of Non-Conventional Renewable Energy in Chile

Chile has the opportunity to become a leader in sustainable energy generation. To achieve this, the country must commit to developing its non-conventional renewable energy (NCRE)* resources, options already proven to be technically viable, economically competitive and a valuable addition to Chile's energy mix. Chile has remarkable natural resources close to its energy demand centers, a stable and strong economy, and significant interest from national and international private sector in NCRE. Furthermore, in its National Energy Strategy 2012–2030, the government recognized the important role NCRE can play by identifying the sector as one of the cornerstones needed to achieve the goal of a secure and diversified energy mix. The question, then, is exactly how significant should this role be? To address this issue, it is critical not only to analyze the direct financial costs and benefits of the sector, but also to consider the economic and social impacts that greater NCRE deployment would have in Chile.

The Natural Resources Defense Council (NRDC) and the Chilean Renewable Energy Association (ACERA) agreed in 2012 to partner on a new study analyzing how increasing NCRE's share of the energy mix would impact the broader Chilean economy. Conducted by international and national experts from PricewaterhouseCoopers (PWC), the study, "The Economic Benefits of Non-Conventional Renewable Energy in Chile," compares the social and macroeconomic impacts of a scenario with greater NCRE penetration to a base case for 2013 through 2028. The results are conclusive: **The total estimated impacts in the NCRE scenario represent a net benefit of more than U.S. $1.6 billion** to the country's economy.** Specifically, the study presents the future impacts that more NCRE would have on Chile's gross domestic product, costs to the national electricity system, employment, greenhouse gas emissions, local emissions, and the use of natural resources like land and water.

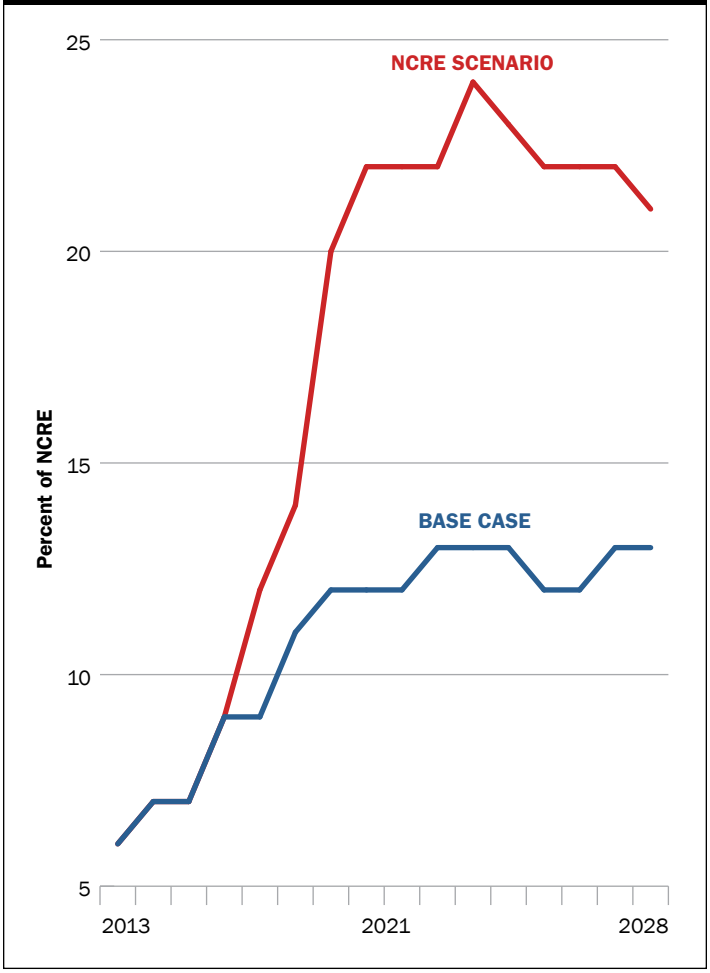
*In Chile, the term "non-conventional renewable energy" is used to exclude large hydroelectric plants with an installed capacity above 20MW from the category.
**All values are in U.S. dollars

TWO SCENARIOS: BASE CASE VS. NCRE

To determine these impacts, PWC compared two scenarios. The base case followed the government's "Transmission System Expansion Plan: 2012–2013", which assumes a minimal level of NCRE as per Chile's 2010 law. The second scenario, the NCRE scenario, was built to include an NCRE penetration of 20 percent by 2020, maintained at that level until 2028. In 2012, Chile's Congress began debating a bill requiring 20 percent of national energy generation to come from NCRE sources by 2020, and so PWC based the "NCRE scenario" on this parameter. Although the bill's goal was eventually modified to 20 percent by the year 2025, it is important to note that all benefits identified in the report remain unchanged, the only real difference being that they will come a bit later due to the revised time line.

In almost all categories, the NCRE scenario produces more benefits than the conventional options offer, demonstrating that a future with more electricity generation from NCRE will improve Chileans' quality of life.

Base Case vs. NCRE Scenario: Percent of National Energy Generation, by Year



KEY FINDINGS

- **Gross Domestic Product (GDP):** According to the analysis, the NCRE scenario generates $2.246 billion more in GDP than the base case from 2013-2028, including direct and indirect impacts. These results also demonstrate that renewable sources can create more productive supply chains in the country.

- **System costs:** The authors analyzed the direct costs to Chile's two main grids, the Central Interconnected System (SIC) and the Northern Interconnected System (SING), under both the base case and NCRE scenario. Within these two scenarios, the authors also conducted sensitivity analyses to determine the impacts of changing two important assumptions: fuel costs and capital costs.

  The differences between the two scenarios are significant. The base case assumes that fuel costs remain low and NCRE capital costs remain relatively high. As a result, from 2013-2028 the net capital costs are $2.8 billion. However, fuel savings due to NCRE reduce this amount by $2 billion in the same period. Moreover, when the authors changed the assumptions to reflect a 5 percent increase in fuel costs and 15 percent reduction in NCRE capital costs—a scenario they consider more realistic—the NCRE scenario showed a net benefit of $251 million.

- **Employment:** When measuring employment, it is necessary to analyze both direct jobs— jobs generated in the construction and operation of a plant—as well as indirect jobs—those generated in the rest of the economy due to the increased production in the sector. The analysis shows that the NCRE scenario generates more jobs than the base case: 3,444 more direct jobs and 4,325 indirect jobs, for a total of 7,769.

- **Greenhouse gas emissions (GHGs):** Chile has committed to reducing its GHG emissions 20 percent by 2020, and it makes sense that NCRE be a part of the solution. According to the analysis, the NCRE scenario could prevent the emission of 83 million tons of carbon dioxide (CO_2) between 2013 and 2028, equal to eliminating the CO_2 emissions of 32.9 million cars in one year—10 times the number of cars in Chile today.

- **Local emissions:** There are strong links between air pollution and public health impacts due to the emission of fine particulate matter ($PM_{2.5}$) and other contaminants. PWC's analysis concludes that the base case generates 15 percent more $PM_{2.5}$ than the NCRE scenario from 2020–2028 in the SIC alone. Furthermore, at the national level, the NCRE scenario cumulatively mitigates the emission of 9,000 tons of $PM_{2.5}$ emissions in the evaluated period.

■ **Land use:** Project data reported by the Environmental Evaluation Service indicates that NCRE tends to require a larger land area than conventional technologies. However, it is necessary to consider additional aspects that are particular to each technology when evaluating land use. For example, the effective area used by wind turbines is only 0.2 to 3 percent of a project's total reported area; the remainder can be used for other activities, such as agriculture and solar PV generation. Equally important, the report notes that thermoelectric plants often have an impact on land far beyond their immediate footprints.

■ **Water consumption:** When you avoid using reservoirs for power generation by running other types of plants, you can save the water in the reservoir for other uses, such as agriculture. Due to the current scarcity and importance of water in Chile, this resource has a high societal and economic value. The NCRE scenario could use 11 percent less water in the electricity sector compared with the base case. This would save 120 million cubic meters of water through 2028, or the water consumption of 60,000 people for one year. The technology that requires the most water is coal.

Summary of the Net Value of the Impacts of the NCRE Scenario Compared with the Base Case

Type of Impact		Aspect Evaluated	Description of the Impact	Million US$
SYSTEMIC	-	Investment costs	Increases investment costs	-2,874
	+	Fuel costs	Reduces fossil fuel consumption	+2,031
	-	Operating costs	Increases operating costs (excluding fuel)	-76
	+	"Peak Shaving" analysis	Can improve supply/demand management	N.E.
	+	"Water Saving" analysis	Can reduce water use costs	N.E.
	-	In net present value the sum of the evaluated systemic impacts represents a net cost of:		-919
MACRO-ECONOMIC	+	Employment generation	Generates 3,444 additional direct jobs Generates 4,325 additional indirect jobs	N.E.
	+	Contribution to GDP	Directly contributes $1.503 billion to GDP Indirectly contributes $744 million to GDP	+2,246
	+	The sum of the macroeconomic impacts represents a net benefit for the country's GDP at net present value of:		+2,246
EXTERNALITIES	+	Avoided GHG emissions	Presents the opportunity to avoid emitting 83 million tons of CO_2 equivalent	+272
	+	Avoided local emissions	Reduces future local emissions equivalent to 9,000 tons of $PM_{2.5}$ emissions	N.E.
	-	Land use	Requires a greater surface area of 7,641 hectares	N.E.
	+	Water Consumption	Reduces water consumption by 11%, saving 127 million cubic meters of water	N.E.
	+	The sum of the evaluated externalities' impacts represents a net benefit of:		+272
	+	The sum of all of the impacts evaluated in the NCRE scenario represents a net benefit for Chile with a value of:		+1,600

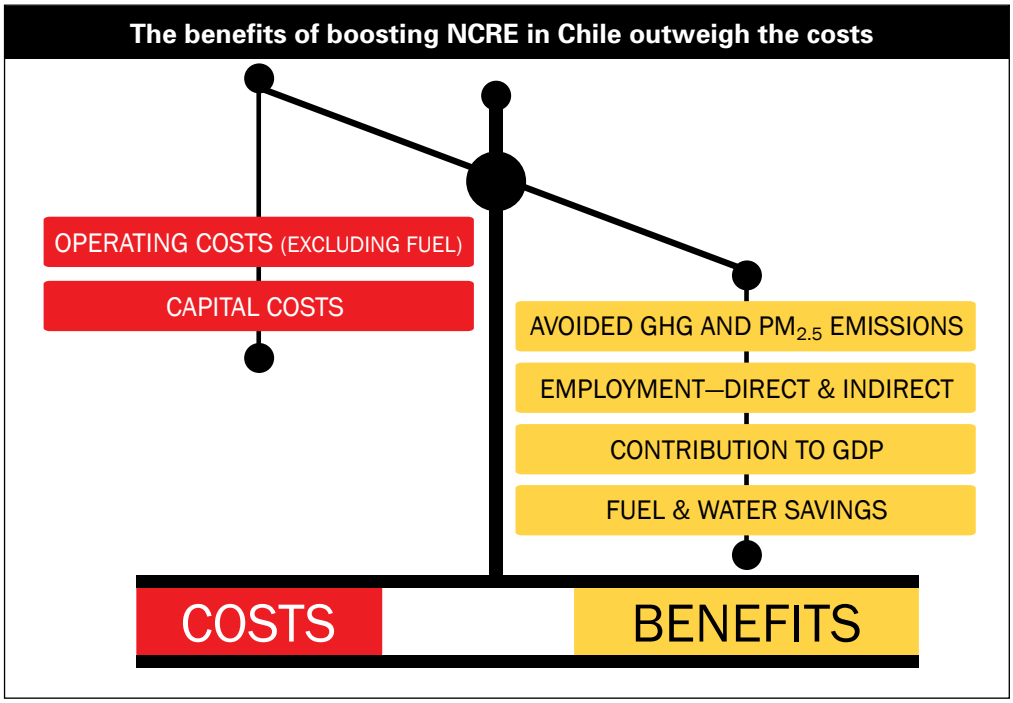
+ = Benefit **-** = Cost **N.E.** = Not Evaluated (qualitative analysis)

Information provided by PWC in "The Economic Benefits of Non-Conventional Renewable Energy in Chile"

CONCLUSION

The new information presented in this analysis shows that a higher penetration of NCRE in Chile has important benefits for society and in the daily lives of Chileans. These technologies generate more jobs and result in less-damaging emissions and public health impacts. NCRE also consumes less water, preserving critical reserves for other uses. Furthermore, the scenario with greater NCRE penetration contributes more to Chile's GDP. Based on to international trends in fuel costs and capital costs, NCRE not only has all of these benefits, but can also reduce costs to the electricity system. Therefore, when evaluating relevant energy policies and the future development of the sector, Chile's decision-makers should take into consideration the full range of benefits NCRE provides.

The authors of the study emphasize that the assumptions used are quite conservative. Their results should be considered as minimum values, or a floor. The new data in the study should contribute meaningfully to the national conversation in Chile about how to create a stable, secure, clean, and sustainable energy future.



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About NRDC

The Natural Resources Defense Council is a nongovernmental nonprofit organization, based in the United States that relies on the law and science to protect the planet, tackle climate change, and create a clean energy future. Founded in 1970, NRDC has more than 1.4 million members and online activists and the extensive experience of more than 350 scientists, lawyers, and other experts of various nationalities. For more information about NRDC, please visit www.nrdc.org.

About ACERA

The Chilean Renewable Energy Association is an industry and nonprofit organization that brings together national and foreign companies interested in the development of non-conventional renewable energy (NCRE) in Chile. ACERA was founded in 2003 and to date has 115 members representing all the technologies that qualify as NCRE under Chilean law. Among these companies are generators, project developers, service and equipment providers, consultants, among others. Since its inception, ACERA has worked to demonstrate the economic, technical, and environmental benefits of NCRE in Chile's energy matrix. For more information about ACERA, visit www.acera.cl.