Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

NAMA CHILE Energías Renovables para Autoconsumo

Ministerio de Energía
Gobierno de Chile

Monitoring, Reporting and Verification (MRV) System for Renewable Energy Projects Implemented in Chile

Technical Note

NAMA Facility

Por encargo de:

Ministerio Federal de Medio Ambiente, Protección de la Naturaleza y Seguridad Nuclear
de la República Federal de Alemania

Department for Business, Energy & Industrial Strategy

European Commission

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Monitoring, Reporting and Verification (MRV) System for Renewable Energy Projects Implemented in Chile

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Santiago de Chile, December 2019.

Monitoring, Reporting and Verification (MRV) System for Renewable Energy Projects Implemented in Chile

Introduction

The countries that have ratified the Paris Agreement have committed to Nationally Determined Contributions (NDCs) that represent their efforts to mitigate Greenhouse Gas (GHG) emissions. Article 4.13 of this agreement states the need for countries to account for their emissions.

As a result, the **Monitoring, Reporting and Verification (MRV)** systems become more relevant, since they play a key role in the measures adopted in the field of mitigation of climate change effects, its report to specific institutions and later verification.

Chile's target associated with the **National Action Plan on Climate Change 2017-2022** includes the objective of reducing the intensity of emissions in relation to the country's GDP by 30% in comparison to the intensity of 2007. In this context, an MRV system of the Ministry of Energy has been developed with the purpose of **quantifying the reduction of GHG emissions generated from renewable energy projects implemented in Chile** and measuring the impact of the achieved mitigation.

The elaboration of the methodology and the MRV tool was the responsibility of the German GIZ GmbH, in the context of the NAMA Support Project for Self-Supply Renewable Energy (SSRE) [1] in Chile , in collaboration with the Sustainable Energy, and Environment and Climate Change divisions, both of the Ministry of Energy, as well as the Climate Change Office of the Ministry of the Environment.

The results of this tool will feed into the **MRV system of the energy sector**, which in turn will deliver information to the national MRV, under the Ministry of the Environment.

Methodology

The MRV system is bottom-up, i.e. it estimates emission reductions independently for each renewable energy project considered for evaluation. For this, two approaches have been developed based on similar methodological principles, in order to cover renewable energy projects for self-supply [2] and renewable energy projects connected to the transmission grid.

The first methodology considers electricity generation and thermal generation of renewable energy projects, aimed at self-supply, that is, initiatives designed to meet all or part of the energy demand of a user. It also quantifies the GHG emissions avoided during the lifespan of the projects, considering a minimum of 20 years. The renewable energy technologies considered are: **solar photovoltaic, solar thermal, wind power, mini-hydroelectric, geothermal heat pumps, biogas and biomass**, including cogeneration.

On the other hand, due to the growing uptake of renewable energy in the country's energy mix, the MRV system was adapted to quantify the reduction of emissions from projects connected to the transmission grid. Therefore, the renewable energy technologies considered in this MRV system are: **solar photovoltaic, concentrated solar power (CSP), wind power and hydroelectric power.**

It is worth to mention that the MRV methodology has been elaborated according to international standards

1 The NAMA Support Project for SSRE in Chile is funded by the NAMA Facility, a joint initiative of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), the UK Department for Business, Energy and Industrial Strategy (BEIS) and the European Commission. Its objective is to promote the incorporation of generation systems based on renewable energies for self-supply, creating adequate financial and technical conditions for early stages of development of this emerging industry.

2 Self-supply projects considered in this methodology: in the case of electricity generation, the MRV system contemplates projects of up to 9 MW of installed capacity (connected or not to the distribution grid), while in the case of thermal generation there is no such limitation, as long as they are self-consumption projects, and therefore excludes cases of district energy.

to perform the calculations, using the Project Accounting Protocol of the World Resources Institute (WRI) to estimate GHG reductions, and the equations of Chapter 2 of Stationary Combustion of the 2006 Guidelines of the Intergovernmental Panel on Climate Change (IPCC). At the same time, the system has been adapted to the Chilean context, since it uses capacity factors for different locations in the country, which have been calculated by the Sustainable Energy Division through its Renewable Energy Explorers (http://exploradores.minenergia.cl/).

MAIN RESULTS

MRV for self-supply renewable energy (SSRE) projects

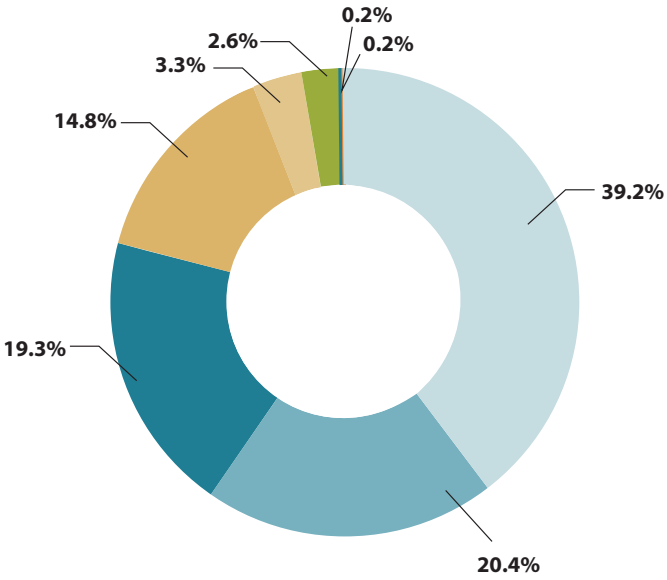
The MRV system has measured the reduction of GHG emissions from SSRE projects implemented between 2012 and 2017, that have been financed by seven public institution programs.

Out of a total of **3,293 projects**, it is estimated that more than **18,600 tons of CO_{2eq} (tCO_{2eq})** emissions were avoided from the start of the projects until 2017 and the emissions mitigated in 2018 are equivalent to **9,401 tCO_{2eq}**. Considering the lifespan of these installations, it was estimated that the reductions would add up to **174,855 tCO_{2eq}** in total.

The estimated emissions reduction by 2018 is equivalent to planting **588 hectares of native forest**[3] or that of 5,223 cars stop driving[4] (see Table 1).

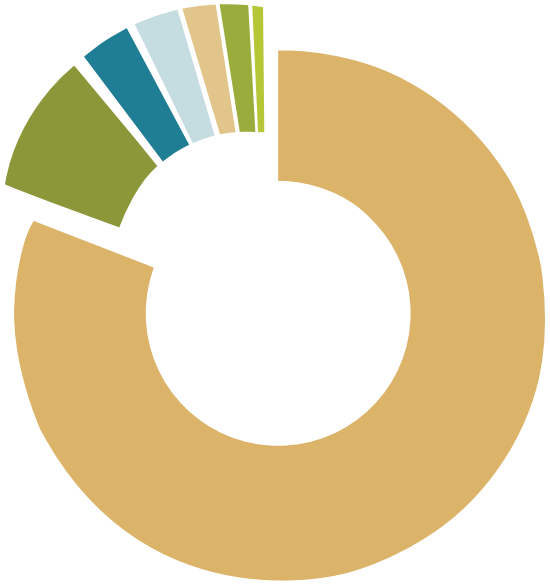
The results are broken down by programme and type of technology as follows.

Graph N°1: GHG emission reductions achieved through public financing, since the beginning of projects focused on self-supply (%).



3 16 tons of CO_{2eq} are equivalent to one hectare of permanent native forest. Source: Corporación Chilena de la Madera A.G., or CORMA (Chilean Wood Corporation A.G.).
4 A vehicle that stops driving for a year prevents 1.8 tCO_{2eq}. An average vehicle mileage of 15 km/liter was considered and an annual run of 12,000 km/year will produce n emission of 1,800kg/CO_2 a year. Source: Sustainable Energy Division of the Ministry of Energy of Chile.

Graph N°2: GHG emission reductions achieved by projects focused on self-supply, grouped by technology (%).



- Photovoltaic energy (80.8%)
- Biogas cogeneration (8.6%)
- Mini hydroelectric power (3.3%)
- Wind power (2.8%)
- Solar thermal system (2.0%)
- Biomass for thermal energy production (1.9%)
- Biogas for electricity production (0.7%)

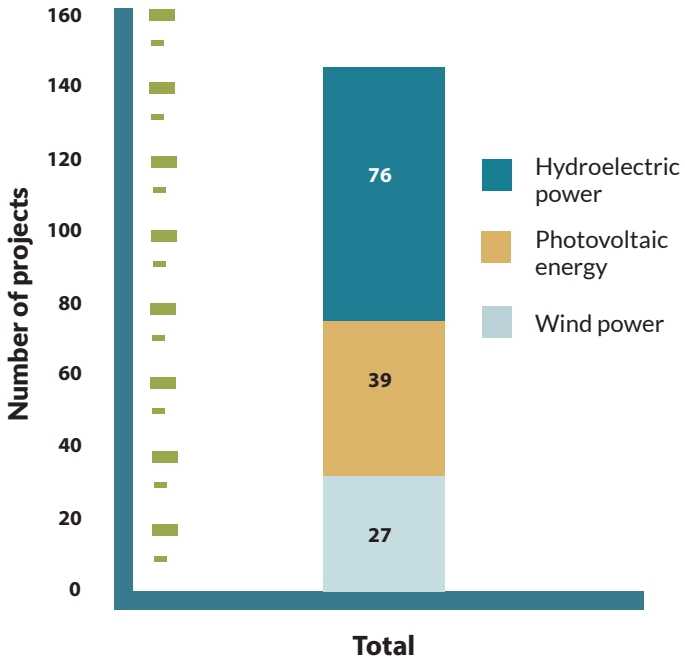
The results of the emission reductions reflect the contribution made by **local actors** and public institutions that co-finance renewable energy projects for self-supply consumption, in the global challenge of mitigating climate change.

MRV for Renewable Energy projects connected to the transmission grid

Of a total of **142 renewable energy projects connected to the transmission grid**, it is estimated that more than **72,631,150 tCO_{2eq}** have been avoided since their installment (first hydroelectric project in 1923) until 2018. Considering the lifespan of these installations, it was estimated by the MRV tool that, **by 2050** the reductions will amount to a **total of 748,498,074 tCO_{2eq}**.[5]

As for the reductions during **2018**, these are estimated at **12,459,948 tCO_{2eq}**, which is equivalent to **6.9 million gasoline-powered cars** stopping for one year, considering an average mileage of 15 km/liter and an average driving distance of 12,000 km/year. It also equals **778,747 hectares of native forest** .

Graph N°3: Number of Renewable Energy projects by technology considered in the MRV.



5 For this estimation, the emission factor (EF) of the year 2018 was used.

Graph N°4: GHG emission reductions achieved in 2018 from projects connected to the transmission grid.

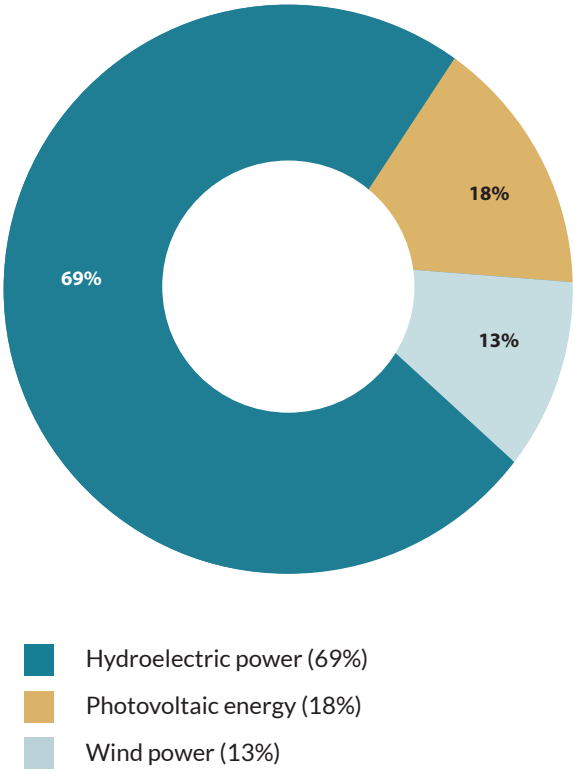


Table N°1 summarizes the emissions mitigated by each MRV system developed: MRV for SSRE projects and MRV for renewable energy projects connected to the transmission grid.

According to the estimations of the electricity generation sector, **32 million tCO_{2eq}** were emitted in 2018 in this sector. According to the estimates made using this MRV tool, it was determined that in 2018, renewable energy projects contributed to a reduction of **12.5 million tCO_{2eq} in that year**. Hence, without the contribution of renewable energy, that year's emissions would have reached **44.5 million tCO_{2eq}**. **Therefore, renewable energy has contributed to a reduction of 28%** of emissions in the electricity generation sector compared to a business as usual (BAU) scenario.

The results of the emission reductions shown have the relevance of reflecting the contribution that renewable energy projects are making to the global challenge of mitigating climate change.

Table N°1: Emissions mitigated by assessed projects.

Type of Renewable Energy project	N° of Projects	Installed capacity (MW)	GHG reductions in 2018 (tCO_{2eq})	Equivalence in vehicles that stop driving	Equivalence in hectares of planted native forest
Focused on Self-Supply	3,293	13.22	9,401	5,223	588
Connected to the transmission grid	142	9,905	12,459,948	6,922,193	778,747
TOTAL	3,435	9,918.22	12,469,349	6,927,416	779,335