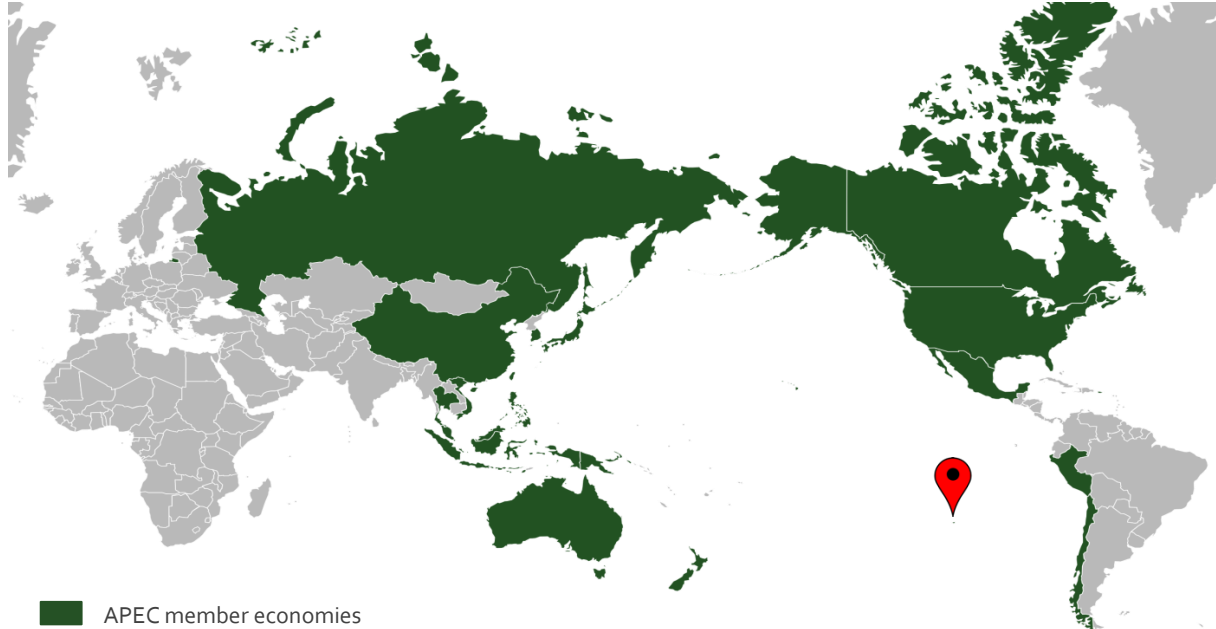


## Energy and transport profile: Easter Island, Chile



This profile has been authored in October 2019 by Dean Gioutsos and Alexander Ochs, SD Strategies, as part of the APEC project “Supporting the transition to energy-efficient electric transport systems.” It presents key information and observations on the energy and transport sectors in Easter Island as important input for a Roadmap for the Integration of Sustainable Energy and Transport (RISET). Electricity and transport services on islands are often insufficient to meet the needs of their populations. Existing systems are economically, socially, and environmentally unsustainable. Quick and bold transitions to integrated, efficient energy and transport solutions based on domestic renewable sources can make services in both sectors affordable, reliable and sustainable.

### KEY FINDINGS

#### *Current challenges:*

- Electricity system is currently almost completely dependent on diesel generation.
- The high motorization rate poses a significant challenge to the community, with excessive traffic as well as limited transport regulation and enforcement and poor road traffic safety.

#### *Renewable potential:*

- Solar and wind resources across the island are very high. Potential to harvest them is significant.
- Four PV energy projects are in planning and development, with potential for much more.

#### *Transport opportunities:*

- At local level, the lack of existing sector plans and limited regulation allow for examining a wide range of solutions and future pathways.

#### *Opportunities for integration:*

- The trial and implementation of electric mobility can increase electricity demand and be a stimulus to catalyse domestic, sustainable, renewable energy

#### *Key goal for RISET:*

- To develop an inclusive, comprehensive strategy for sustainable energy and transport.

## EASTER ISLAND, CHILE - IN BRIEF

### GENERAL INFORMATION

**Land area:**  
163.6 km<sup>2</sup>.

**Population:**  
7,750 (2017), avg.  
household size: 3.1

**Administration:**  
Island Province and  
Commune, falling under  
the regional  
administration of  
Valparaíso, one of 16 of  
Chile's regional  
administration units.

**Climate:** Tropical,  
rainforest (Köppen  
classification: Af).

**Geographic  
characteristics:**  
Approx. 3,700 km west  
of central Chile. Volcanic  
high island (highest  
elevation of 507m).

**Primary economic  
activities:**  
Tourism, local industry/  
manufacturing (for local  
demands only).

**Income level:**  
9,466 USD per capita  
and year (2014).

### ENERGY

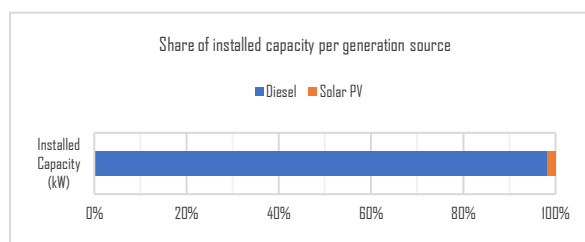
**Share of electricity generation capacities:**  
5,585 kW – Diesel Power Plants

**Annual energy demand:**  
15,000 MWh (2019 projection)

**Demand growth rate:**  
6.5% (2019 forecast)

**Share of GDP spent on  
electricity:**  
Information not  
available

**Connection to mainland elec. grid:**  
None, and no current plans



### TRANSPORT

**Access to the island:** By airplane, limited boat options

**Private vehicle fleet size:**  
3,155 vehicles, 723 motorcycles (2018)<sup>1</sup>

**Public vehicle fleet size:**  
0 buses or trams; other public vehicles, N/A.

**Demand growth rate:**  
15.5% growth of registered vehicles (2018)<sup>2</sup>

**Motorization rate:**  
398 cars and 93 motorcycles per 1000 inhabitants

**Transport modal split:**  
Mobility is exclusively organized through private transportation. There is a privately organized, yet unregulated taxi system (see below).

### EMISSIONS

**GHG of energy generation:**  
13,500 tCO<sub>2</sub>-e (2015 estimate)

**GHG of transport:**  
N/A for Easter island – Nation-wide for Chile: 26,936,370 t CO<sub>2</sub>-e (2016)<sup>3</sup>

<sup>1</sup> Municipality of Rapa Nui Department of Transportation (Dirección de Tránsito): "Vehicular Circulation Permits, Paid During 2018"

<sup>2</sup> Municipality of Rapa Nui Department of Transportation (Dirección de Tránsito): "Vehicular Circulation Permits, Paid During 2018"

<sup>3</sup> OECD, 2019. OECD Statistics, GHG emissions. [https://stats.oecd.org/Index.aspx?DataSetCode=AIR\\_GHG](https://stats.oecd.org/Index.aspx?DataSetCode=AIR_GHG)

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# Introduction to Easter Island

Easter Island - also known as Isla de Pascua or Rapa Nui - is one of the most isolated inhabited islands in the world. The nearest continental point is 3,700 km away, in central Chile. It is part of the Polynesian Triangle formed by Hawaii to the north and New Zealand to the southwest, which contains a series of islands and archipelagos. It has a population of 7,750 inhabitants, of which around 3,500 are native Rapa Nui people, an ancestral culture which has inhabited the island since the thirteenth century according to research. The island is triangular in shape, roughly 25 km long and 12 km wide at its widest point.

Easter Island is a volcanic high island, consisting of 3 main extinct volcanoes which give the island its triangular shape. The island is predominantly constituted of hawaiite and basalt flows which are rich in iron. The highest point of the island is the top of the volcano Terevaka at an altitude of 507 m.

The Rapa Nui National Park is one of the main tourist attractions of the Island, due to its wealth of archaeological heritage. The National Park is managed by the Rapa Nui Ma'u Henua Indigenous Community and is visited by thousands of tourists each year. It was listed as a World Heritage Site by UNESCO in 1995, whose recognition was an incentive for tourism and research. Additionally, the existing culture on the island preserves its traditions and customs, an extra incentive and spectacle for the flock of tourists who visit. Tourism is the main source of income for the island, with its economy dependent on 89% of income from services, 6% from industry, and 5% from agriculture.

## Power and transport on Easter Island today

### *Current configuration of energy and transport system*

#### Electricity sector

Easter Island's electricity system is currently 100% dependent on diesel generation. There is 5.6 MW of installed capacity and total electricity generation was 14,082 MWh in 2018. The average demand is 1.3 MW and peak demand is 2 MW. As shown in Figure 1, the minimum demand occurs between 4 am and 5 am and the peak demand occurs at 10 pm. There is a distinct need to diversify the island's energy mix, however alternative projects and developments have been limited to date.

There are currently 4 renewable energy projects in planning and development on Easter Island: The first and most recent, is a 2.99 MWp photovoltaic (PV) power plant close to Mataveru Airport. Its main objective is reducing diesel consumption by the central power plant currently in operation. The project is undergoing a pre-feasibility study on engineering, the local topography and archaeology in order to determine a suitable location. The second project is an on-grid project in Tama te Ra'a which has installed 106 kWp of PV capacity. The system has been connected to the grid (managed by the public utility, SASIPA) and was a donation from the renewable energy and infrastructure company, ACCIONA.

The third installation is an off-grid hybrid microgrid based on PV, diesel and batteries. It will consist of 429 kWp of PV capacity, 200 kVA of diesel generation capacity and 1,152 kWh of batteries. The project is intended to serve 120 houses in Vai a Repa, covering community electricity consumption (both residential and public lighting). The system will be connected to the main grid, once it is upgraded from its current 6.8 kV operation to the required 13.2 kV; The fourth is a PV project that was initiated in 2009 for Hanga Roa Hospital. This

project sought to cover an annual demand of 101 MWh, however it is yet to be implemented due to other construction priorities at the hospital.

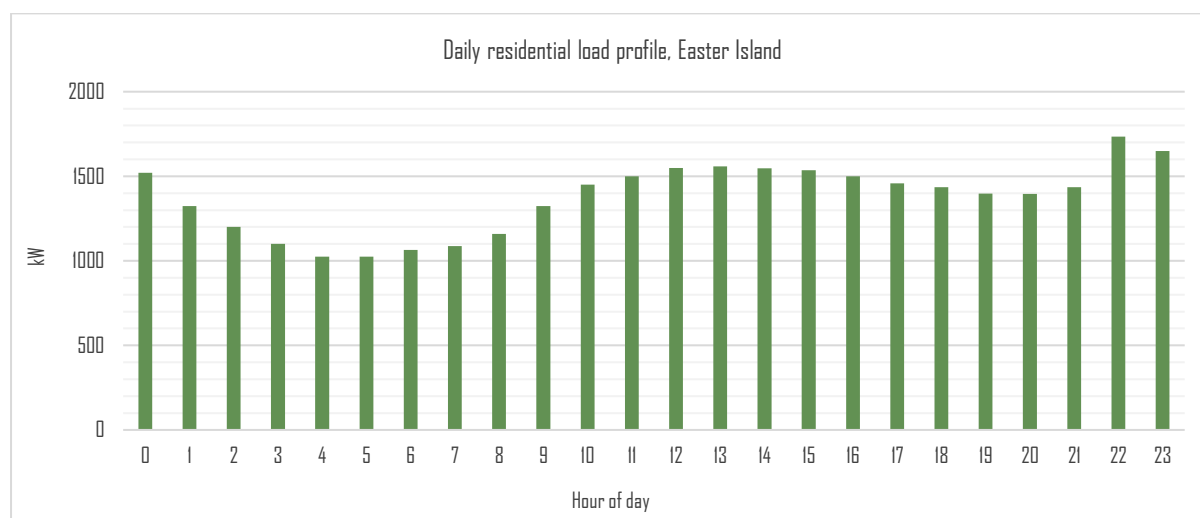


Figure 1: Daily residential load profile on Easter Island (Ministry of Energy, 2019)

An average generation cost proxy per unit of electricity on Easter Island is approximately USD 258 per MWh. This cost is not covered by the electricity tariffs despite the subsidies that are applied to diesel and tax breaks specifically for SASIPA. As a result, the governmental public agency Corporación de Fomento de la Producción (CORFO) covers the difference between SASIPA’s revenues and costs such that it can sustain its operations.

SASIPA provides tailored tariffs based on the volume and type of monthly electricity consumption. For low level consumers (less than 75 kWh), usage between 0 and 50 kWh is charged at a rate of USD 0.11/kWh, and for between 50 and 75 kWh the price increases to USD 0.24/kWh. Current electricity tariffs for consumers greater than 75 kWh are: between 0 and 10 kWh, USD 0.11/kWh; between 11 and 75 kWh, USD 0.24/kWh; and more than 75 kWh, USD 0.40/kWh. The unified industrial tariff is USD 0.42/kWh.<sup>4</sup>

Tariff bracket	Amount (CLP/kWh)	Amount (USD/kWh) <sup>5</sup>
<b>Single phase rate for consumption less than 76 kWh per month</b>		
0 – 50 kWh	76.70	0.11
50 – 75 kWh	169.94	0.24
<b>Single phase rate for consumption more than 76 kWh per month</b>		
0 – 10 kWh	76.70	0.11
11 – 75 kWh	169.94	0.24
More than 75 kWh	282.39	0.40
<b>Three-phase tariff</b>		
Single Industrial Rate	296.52	0.42

Table 1: SASIPA electricity tariffs for Easter Island

<sup>4</sup> Exchange rate: 1 CLP = 0.0014 USD. XE Money, 2019. <https://www.xe.com/currencyconverter/convert/?Amount=1&From=CLP&To=USD>

<sup>5</sup> Exchange rate: 1 CLP = 0.0014 USD. XE Money, 2019. <https://www.xe.com/currencyconverter/convert/?Amount=1&From=CLP&To=USD>

## Transport sector

Local transport in Easter Island is largely unregulated and highly dependent on private vehicles; there is no public transport network on the island. The municipality registered 3,121 traffic permits (these are vehicle permits, and different from driving licenses) in 2018, and 3,200 in 2019. Tourists on the island have three alternative options to travel around island: 1) "Taxis Colectivos" or "Colectivos": This taxi service is unregulated and operates informally. It is separated in three zones which have approximately 150 cars in total. The cars are not distinguishable from regular private vehicles, and there is no accreditation or licencing required. The tariff can vary widely per trip. A recently established local norm aims at regulating such paid transport services. The norm is currently in the last phase of legal approval by the authorised institution (Contraloría General de la República de Chile); 2) Touristic transport buses: Easter Island has around 94 minibuses<sup>6</sup> which transport people to the island's local attractions but can also be used for local transport. Trips are arranged with local tour operators; 3) Rental vehicles: Visitors to Easter Island can also hire their own vehicle for their stay on the island. There are a handful of rental agencies operating from Hanga Roa.

The main centre of Hanga Roa is connected with the rest of the island by a main ring road that circles the south side of the island. Several smaller arterial roads branch off from the ring road, though they are less developed. The total paved road network spans approximately 50.5 km in length<sup>7</sup>.

Socially and environmentally responsible transport is a significant challenge for Easter Island. The island's road traffic safety situation could be considered poor, relative to other communes in the country<sup>8</sup>. The community repeatedly claims the transport system is hampered by the excessive motorization rate and number of vehicles on the island, the lack of respect for road regulations and the lack of monitoring entities to ensure safe and effective road transport.

Electric mobility on the island is a hurdle, since it combines the existing challenges of electricity generation (which currently faces supply and distribution difficulties) with the issue of high vehicular density. The reduction of vehicular density has been a recurring request by the Rapa Nui community. This remains a difficult issue to address, since the constant increase in the tourism sector makes the business of vehicle rental and paid passenger transport economically attractive, which generates various social and environmental impacts. There are currently no registered electric vehicles on the island<sup>9</sup>

## *Policy and investment environment*

Decision-making in Easter Island often results in long processes due to the complex sociological implications - being a small island and home to a native population means significant consideration needs to be given to ensure the needs of the island's people, history and environmental sustainability are met. Adding to this complexity is the fact that not only the island's territorial laws, but also particular indigenous territorial laws apply, such as ILO Convention 169<sup>10</sup>. All decisions related to development and lands must pass through the Easter Island Development Commission (CODEIPA) which is created by its '*Indigenous Law*.' CODEIPA consists of different Ministries and Services representatives, the Provincial Governor of Easter Island, the

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<sup>6</sup> Easter Island Tourism chamber, n.d.

<sup>7</sup> Ministry of Public Works (Ministerio de Obras Públicas), 2019. National Roadway Network shapefile.

<sup>8</sup> Comisión Nacional de Seguridad de Tránsito (CONASET), 2018. Información estadística de siniestros de tránsito en comunas, distritos, circunscripciones y regiones de Chile. <https://www.conaset.cl/wp-content/uploads/2019/05/Distritos-Circunscripciones-2018.pdf>

<sup>9</sup> Email communication with Carlos Serey Yusta, Director of Transport for the Municipality of Rapa Nui.

<sup>10</sup> The Indigenous and Tribal Peoples Convention, 1989 is an International Labour Organization Convention, also known as ILO-convention 169, or C169. It is the major binding international convention concerning indigenous peoples and tribal peoples, and a forerunner of the Declaration on the Rights of Indigenous Peoples.

Municipality of Easter Island, the Rapa Nui Council of Elders and five elected members of the Rapa Nui people.

Chile's Nationally Determined Contribution (NDC) commits the country to unconditionally reducing its carbon dioxide (CO<sub>2</sub>) emissions per GDP unit by 30% below their 2007 levels by 2030. This commitment is made under the consideration that economic growth continues at a similar rate to that of the preceding ten years (excluding the global financial crisis 2008-09), which allows the country to implement adequate mitigation and adaptation measures. Subject to the grant of international monetary funds, the emissions reduction target could be raised to between 35% and 45%<sup>11</sup>.

## Electricity sector

The main instrument in place for stimulating renewable energy generation in Chile is the Non-Conventional Renewable Energy Law<sup>12</sup>. The law requires electricity-providing companies to use at least 5% of electricity from non-conventional renewable energy sources. An updated law increases this obligation by 1% annually between 2013 and 2020 and 1,5% annually between 2020 and 2025, in order to reach 20% non-conventional renewable penetration in 2025.<sup>13</sup> However, this regulation doesn't apply to Easter Island, due the low capacity of the system (classified as a medium size system). Unofficially, SASIPA (local utility) has communicated a goal of 30% of renewable energy supply before 2021<sup>14</sup>.

## Transport sector

The Government of Chile, in its national electromobility strategy, has set the goal of achieving a share of 40% electric vehicles on its roads and 100% of public transport being electrified by 2050<sup>15</sup>. As previously mentioned, there are several challenges to socially and environmentally responsible transport in Easter Island. The local community claims that the motorization rate and number of vehicles on the island is too high, that there is a lack of (respect for) transport regulations and a lack of monitoring entities to ensure safe and effective road transport. To address these challenges the Ministry of Transportation and Telecommunications is working on two main fronts. The first is the development of a regulation for public and private paid passenger transport. The second, is a survey to inform the regulation of other aspects of transport in the province, including electric mobility, motorisation rate, vehicle imports and public transport. The survey is currently in process and results are expected to be received in the coming months.

## *Main stakeholders/actors*

### Electricity sector

SASIPA has the sole responsibility for electricity generation, transmission and distribution on the island. It maintains approximately 5.6 MW of diesel generation capacity. Energy planning and infrastructural development decisions are made in an integrated approach by SASIPA, with consultation of the Local Government of Rapa Nui, Regional Government of Valparaíso and Central Government Ministries (Energy, National Assets). Additionally, tourism companies, small- and medium-enterprises and the Easter Island

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<sup>11</sup> Gobierno de Chile, 2015. Contribución Nacional Tentativa de Chile (INDC) para el Acuerdo Climático París 2015

<sup>12</sup> IEA, 2019. Non-conventional renewable energy law (Law 20.257).

<https://www.iea.org/policiesandmeasures/pams/chile/name-24577-en.php>

<sup>13</sup> Law 20.698 of 2013, see [http://www.minenergia.cl/mercadoenrc/?page\\_id=1373&lang=en](http://www.minenergia.cl/mercadoenrc/?page_id=1373&lang=en)

<sup>14</sup> La Tercera, 2019. El plan para abastecer a Isla de Pascua en un 100% de energía renovable.

<https://www.latercera.com/pulso/noticia/plan-abastecer-isla-pascua-100-energia-renovable/457848/>

<sup>15</sup> Ministerio de Energía, 2019. Estrategia Nacional de Electromovilidad

[https://www.apecchile2019.cl/apec/site/docs/20190604/20190604193408/estrategia\\_electromovilidad\\_27dic.pdf](https://www.apecchile2019.cl/apec/site/docs/20190604/20190604193408/estrategia_electromovilidad_27dic.pdf)

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Development Committee (CODEIPA) all share a stake in decision-making.

Electricity on the island is predominantly consumed by residential demand. There is almost no industrial activity on the island, however tourism is responsible for a considerable share of consumption. It is difficult to split the consumption share between residents and tourists due to the significant occurrence of informal tourism and unregistered accommodation services.

## Transport

As mentioned above, the transport sector of Easter Island is largely unregulated. The Ministry of Transportation and Telecommunications has the ultimate responsibility for the regulatory aspects of the transport system. In terms of road administration, in urban areas the municipality has responsibility; in rural areas, the Road Direction from the Ministry of Civil Works leads. For enforcement and security, the Police (Carabineros de Chile) have primary responsibility and jurisdiction. The Municipality of Rapa Nui (Department of Transportation) (*Dirección de Tránsito*) is responsible for the registration of vehicles on the island and maintains records of these.

Touristic transport is coordinated by the Tourism local chamber. The chamber has submitted a document to push their case to regulate transport from tourism. The regulation is understood to be ready for implementation and sign-off.

## The way forward...

### *Opportunities to advance the energy and transport systems*

The meteorological conditions on Easter Island are quite good: The average solar irradiation over the entire island is between 1,900 and 2,000 kWh/m<sup>2</sup> (see Figure 2)—almost double the level of insolation in Germany, a world solar energy leader. For wind energy, there are a few selected areas in which the average wind speed is above 8 m/s; for most of the island, the average wind speed is closer to 6 m/s, still enough to generate productive energy yields year-round (see Figure 3).

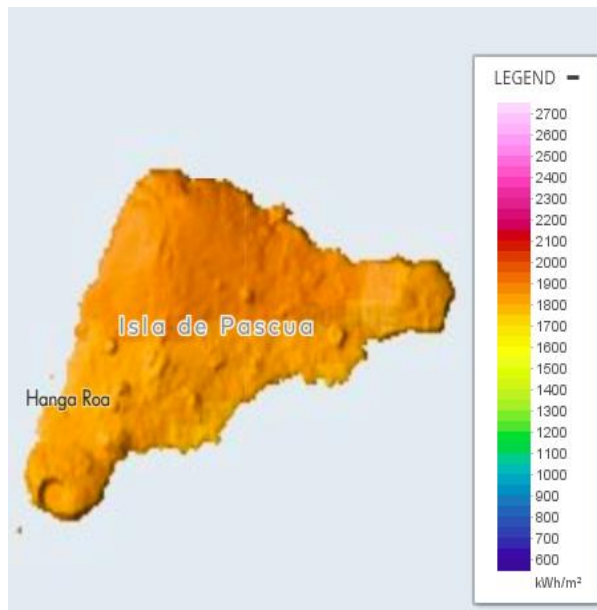


Figure 2: Global horizontal irradiation on Easter Island in kWh/m<sup>2</sup> (globalsolaratlas 2019)

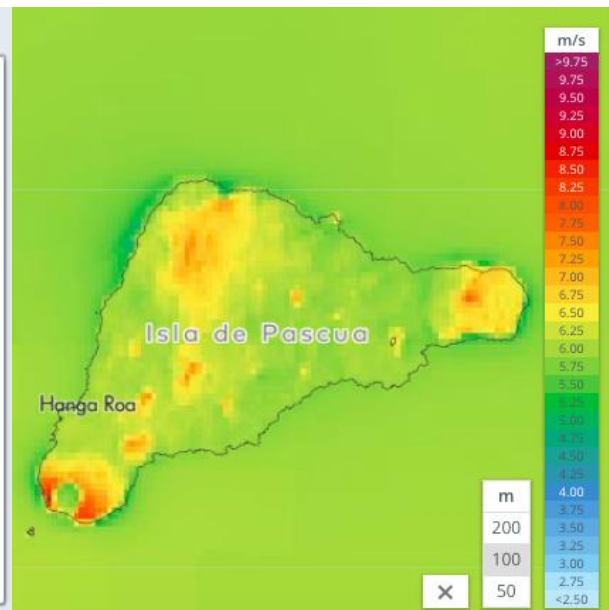


Figure 3: Average wind speeds on Easter Island in m/s (globalwindatlas 2019)

to take advantage of the favourable wind conditions present at multiple sites on the island. This could be an area to explore in order to meet the growing electricity demands in the future. However, community resistance to wind projects is a significant barrier. Some experts believe that this local resistance is so strong that onshore wind is unlikely an option in the next decade. The opportunities for offshore still need to be explored.

The absence of clear plans for a sustainable transport transition is a challenge but also presents an opportunity. A coordination meeting could be facilitated among the relevant stakeholders to closely examine alternative electric and sustainable transport options. For example, given the distances required to be travelled and the nature and uniformity of the journeys, it is conceivable that an electric car or scooters sharing program could be an exciting and innovative solution to Easter Island's transport situation; electric vehicles can also increase the push towards the generation of renewable energy on the island, but consideration must be given to the full life-cycle impacts. Such a program could be agreed and implemented in coordination with the Local Government of Rapa Nui, Regional Government of Valparaíso and Central Government Ministries, SASIPA, tourism companies, small- and medium-enterprises and the Easter Island Development Committee (CODEIPA).

"Greening" the island's energy and transport sectors would create significant economic, social and environmental development opportunities, including reduced local pollution and improved public health; reduced traffic congestion and noise and subsequently improved quality of life; reduced GHG emissions; and an ultimately more sustainable tourism sector.

## *Integration roadmap for electrifying Easter Island's transport*



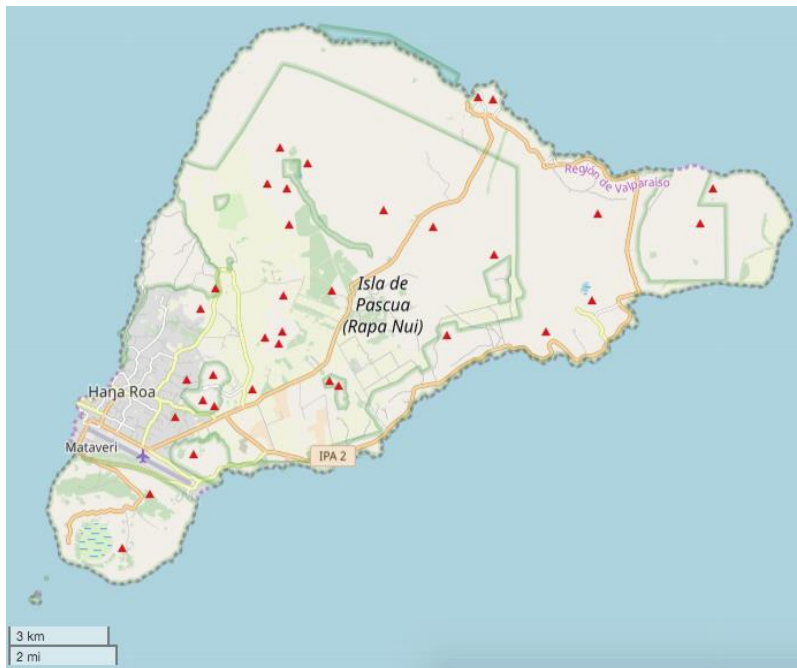


Figure 4: Road network (in yellow) on Easter Island (OpenStreetMap, 2019)

can be trialled in isolation or together in order to assess their uptake and user patterns. In addition to the use of e-vehicles by individual households and businesses, vehicle-sharing models can serve to reduce the motorisation rate if their availability is sufficient. They would be attractive to both touristic and local transport demands and can also serve as a stimulus and catalyst to replacing the island's diesel generation with generation from clean electricity sources. Some experts point out, however, that car-sharing among residents might be hard to achieve since at least at present, cars provide their owners with a sense of status and personal achievement. As for a vehicle-sharing program for tourists, there might be some resistance on behalf of the current owners of car-rental companies. Stakeholder consultations and paradigm changes might be necessary first and new ownership models might only be an option in the more distant future.

Despite the four ongoing solar PV projects, more needs to be done to not only mitigate the current use of diesel and fossil fuels for electricity generation and transport, but also to maximise the positive impact that electric forms of mobility can have for the island.

The absence of a clear current plan for the integration of the electricity and transport systems on Easter Island presents an exciting opportunity to examine a selection of electric mobility programs and technologies. Combustion-engine-powered passenger cars are the dominant vehicle class on the island, with approximately 2,199 of the total 3,155 registered vehicles. Electric vehicles could be an easily adopted alternative. Likewise, e-scooters could be a smarter, cleaner and ultimately cheaper alternative to the 723 motorcycles and 38 motorised tricycles registered on the island. These electric mobility options

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