FINAL REPORT

Energy in the EU Outermost Regions

(Renewable Energy, Energy Efficiency)

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Energy in the EU Outermost Regions

Current status

The EU Outermost Regions - OR (*Guadeloupe*, *French Guiana*, *Martinique*, *Mayotte*, *Reunion*, *Saint-Martin*, *the Azores*, *Madeira and the Canary Islands*) can be characterised by a set of common characteristics:

1. They are all small in terms of land area, far away from continental Europe and, with one exception (*French Guiana*), they are all small islands or groups of islands (archipelagos);

2. In terms of energy supply, and despite the important natural renewable energy sources that most OR have, better than in continental Europe, all the **OR are mostly heavily dependent on imported oil**;

   The electric grids in the ORs are all, without exception**, isolated, unconnected to the continental grids**. In archipelagos, with few exceptions, each island is an isolated grid (in Guadeloupe, three smaller islands are connected by submarine cable to the main island and, in the Canary Islands, Lanzarote and Fuerteventura are also interconnected by a submarine cable). In *French Guiana*, the electric grid only covers part of the territory (closer to the coast) and there are small isolated systems to provide power to isolated communities in the rest of the OR – there are no connections to the neighbouring countries either;

3. **Renewable Energy sources represent between 1.5% (*Saint Martin*) and 64% (*French Guiana*) of the total electricity supply** (see table 1). The higher percentages correspond to OR with hydro and geothermal resources that are able to provide stable power supply, unaffected by the large fluctuations associated to solar, wind and other renewable sources;

Table 1: Current presence of Renewables in Electricity production in the OR (%)

	Guadeloupe	French Guiana	Martinique	Mayotte	Réunion	Saint Martin	Azores	Madeira	Canary Islands
Total	11	64	7	5	36	1.5	32	23	12
Of which:									
Wind	5	na	2	na	1	na	23	17	50
PV	10	11*	74	100	26	100	na	17	50
Hydro	2	89	na	na	47	na	11	66	na
Geothermal	78	na	na	na	na	na	66	na	na
Biomass	5	11*	24	na	26	na	na	na	na

na – not applicable (negligible or non-existent).
*in French Guiana, 11% for PV and biomass together (including *bagasse*).

4. Despite ongoing efforts and plans for energy efficiency in most OR, ranging from modest to ambitious depending on the OR, **energy needs are still growing in absolute value in most OR**, as their economies, with lower GDPs than their corresponding national average, are still growing,

often also as a result of population increase (e.g., French Guiana and Mayotte). Table 2 summarises the information reported by the OR, where available.

Table 2: 2020 and 2030 energy targets for the Outermost Regions

	Guadeloupe	French Guiana	Martinique	Mayotte	Réunion	Saint Martin	Azores	Madeira	Canary Islands
% RES 2020	50*		50*	10	50*		59	50	30
% RES 2030	100*		100*		100*				
Electricity Growth (%) *(from 2015)*	-3%/y to -5%/y	-7% in 2018 -17% in 2023	+1,8% in 2018 +6,6% in 2023	+2%/y	+4%/y		+10% by 2020		

Values reported by the OR regional governments to DG REGIO (2016).

Empty cells mean no data provided by the OR (or no target fixed by 2016).

* National targets. The French OR have set their own local targets in their regional PPE (*Programmation Pluri-annuelle de l'Energie*), for example these targets are set as 25% RES penetration by 2018 and 58% by 2023 in the Martinique PPE.

Notes on table 2:

a) negative values in electricity growth mean a projected reduction in energy consumption.
b) French Guiana: targets aim at 10% electric vehicles plus efficiency in buildings (HVAC and solar water heaters), but 100,000 new dwellings are needed for the increasing population, leading to growth in the global primary energy demand.
c) Azores: for several islands, renewable (RES) targets for 2020 can reach 75-100% (including 76% in the largest island – S. Miguel – with 50% of the population of the Azores).
d) Madeira: Porto Santo island 100% renewable (all sectors, including transport) in the long term.

5. **Obligations imposed on energy suppliers by the Energy Efficiency Directive (EED) for reduction of energy consumption are mostly non-existent in all the OR** or have had little impact so far, both in the buildings and industry sectors;

6. Energy efficiency in the buildings sector is lagging in most OR. **Few OR have building regulations well adapted to their local climatic and socio-economic conditions** and, in some French OR, energy building regulations do not yet apply to all building typologies;

7. **Transport is one of the biggest energy challenges in the OR** as it represents more than half of their primary energy needs. All **the transportation sectors are** still almost **fully based on fossil fuels** in every OR. Many regions are starting to promote electrical mobility, deployment charging stations and offering incentives for purchasing electrical vehicles, but penetration is still negligible.

Applicable Legislation

The OR, as part of the EU, are subject to same EU legislation (Directives, Regulations, etc.) as the rest of Europe. The ORs benefit from some specific measures in the EU legislation, due to their particular circumstances but, in the Energy Efficiency/Renewables area, the three applicable Directives (the EED - Directive 2012/27/EC Energy Efficiency Directive, the RED - Directive 2009/28/EC Renewable Energy Directive, and the EPBD - Directive 2010/31/EC Energy Performance of Buildings Directive) do not contain any of such measures for the Outermost Regions.

Transposition of the three EU Directives, however, **is the competence of the MS** and, therefore, their implementation in the OR may be different than in the respective mainland. So, for example:

- As the EED only requires setting national targets for reduction of the overall energy consumption, the MS may "exempt" OR from any contribution towards such reduction, as long as, overall, the MS reaches the overall target;
- The situation for the RED is similar, i.e., the MS may reach the national (required and voluntary) targets with or without any contribution from the respective OR.

As OR only represent a very small part of the national energy balances, there is an ample margin for the MS, when dealing only with overall national targets, **to set national policy regarding Energy Efficiency and Renewable Energy targets for the OR** to anything from ambitious targets to no contribution.

The EPBD, however, offers no such exception. **The EPBD requires that every part of the MS territory must comply with EPBD requirements "*on a national or a regional basis*"**. But, once again, MS can (and should) **adjust requirements to local conditions**, e.g., through well designed "cost-optimal minimum requirements" and "Nearly-Zero Energy Buildings (NZEB) definitions". So, every OR should have a functional energy efficiency regulation for the building sector, and enforce it. This is not the case, though, in every OR: some OR either have no building energy regulations at all, or they simply do not enforce them, as described in the previous chapter (Current Status).

With small, isolated electrical systems, the outermost regions benefit from important exceptions from Electricity Market Directives and Regulations. As in every isolated system (namely, other EU islands not linked to a continental grid), integration of distributed generation and renewable energy sources, namely solar and wind, due to their inherent fluctuations, must be carefully balanced and controlled. Storage is a problem, due to high costs and challenging technical issues. Water-pumping is a good solution where possible, but it requires suitable geography, not available everywhere. France has set up a legally-binding 30% upper limit for the share of the installed power of (fluctuating) renewable energy and distributed energy sources in isolated electrical grids to safeguard grid stability.

In the current revision process of these three Directives, the Commission should recognise and could better reflect the specific conditions of the OR in order to **ensure a more efficient framework that fit the local socio-economic and geographical/climatic constraints of the OR**. The Member States should also ensure the full transposition and implementation of the current Directives, while taking into account the specificities of the OR.

Future Perspectives

Increase Renewable Sources in Electricity Production

Decarbonisation of the electricity sector is a must for sustainability everywhere and, of course, it is also a strong priority in the Outermost Regions (OR). This is translated by **introduction of renewable energy sources in the electricity sector at increased pace** during the next decade(s).

Electricity prices for consumers in the OR are the same as in their corresponding mainland (a national policy, to protect the local consumers), despite much higher real production costs. This policy is politically fair and it is most welcomed by all the OR. However, the ongoing **liberalisation of the EU electricity market**, required by EU legislation, **may bring some uncertainty about the future of electricity prices in the OR**. Policy action at national and EU level may be required to ensure the continuity of this good practice.

Intermittent sources of renewable energy, notably wind and PV, are more competitive in the OR because they can produce electricity at a lower cost than by burning expensive fuel oil. Moreover, most of the OR have better renewable energy resources than mainland Europe, e.g., higher solar radiation for solar thermal and PV, as well as better potential for geothermal energy in a few of the OR.

However, **OR markets are not taking full advantage of this price differential** due to existing long-term contracts with baseline producers, needed for ensuring network stability, that dilute the increased production costs of burning fossil fuels in the OR among all the national consumers. The feed-in tariffs for renewable energy in the OR are also mostly based on the "pool price" in the respective mainland, markets to which the OR are not linked and cannot access (they are not connected to the European grid). **As investment costs in renewable energy sources are higher in the OR and the price of the produced electrical kWh is the same, investors tend to favour locations in the mainland markets where return on investment is quicker**, especially after the best locations in the OR, in terms of availability of the resource, are already being explored. As the national electricity "pool price" is much lower than the real cost of electricity production in the OR (mostly based on burning fuel oil), **the OR feel that the local feed-in tariffs for renewable should be higher, based on the real local cost of producing conventional electricity, to offset the increased local investment costs in renewable energy sources**. Producing renewable energy locally, in this scenario, would be more profitable than burning fuel for the "national pool" and, at the same time, penetration of renewable energy in the OR would receive an important impulse. Although this is an issue best dealt with at national level, EU legislation (e.g., regulations, Directives) or EU guidelines could help set a more favourable policy in this respect, e.g. by allowing derogations until specific targets are met.

Transportation costs added to smaller markets result in higher costs for the deployment of renewable energy solutions in the OR than in mainland Europe. OR estimate a 20-30% cost increase relative to typical "European" prices (in the two largest islands in the Canarias, the cost increase is smaller but still significant). This creates an economic barrier to the penetration of renewable energy in most of the OR. For private citizens considering installation of solar thermal or PV systems, this results in both higher

investment costs (already a barrier in mainland Europe with lower costs) and longer payback periods (as the electricity cost for the consumer is the same in the whole country), despite the larger solar resource available in most of the OR (the solar resource in the Azores is not larger than in mainland Portugal).

Smaller islands (or entire OR) are prime candidates for becoming self-sufficient communities based on renewable energy. Some islands could be the leaders of the transition towards a renewable energy future, becoming **lighthouse projects for other regions in Europe**. E.g., small islands are particularly well suited for implementation of electric mobility as distances are small and the required autonomy is already compatible with the autonomy of current electric vehicles. A smaller population would also make behavioural changes easier to study and to quantify impacts. **OR should** thus **be seen as good opportunities for the on-site development of these future sustainable energy systems and become Energy Efficient Communities rather than be seen as a cost and a burden** on the national and the EU budgets.

Increased penetration of renewable energy in isolated island systems would require adequate guarantee of system stability and storage capacity, namely, batteries, reversible hydro stations where possible, flywheels, etc., as well as smart grid technology, micro-generation and electric mobility (batteries in vehicles acting also as storage for the grid, charging in periods of excess availability of renewable energy and discharging during peak consumption hours). Some OR are increasing storage capacity by installing reversible hydro-power stations with pumping, but these stations cannot handle by themselves the rapid network load fluctuations that are inherent to intermittent renewable energy sources. The use of other more effective stability providers (e.g., flywheels and batteries) is a must. There are relevant pilot projects being deployed or planned in the Outermost Regions to use batteries to move to this new paradigm (e.g., in the Azores – Graciosa island (2.6 MW), in Reunion (1 MW/7 MWh), in Madeira – island of Porto Santo (4 MW/4 MWh) and in the Canary island of La Graciosa).

Public support for demonstration projects that could significantly increase the penetration of renewable energy in the electricity grid, e.g., in smaller islands first, would be an important step. It is necessary to organise promotional campaigns focused on the population, as there is some strong local opposition to some solutions (e.g., as a consequence of the visual/sound impact of wind turbines). **It is essential to dispel the risk of investments in renewable energy projects through successful demonstration pilot projects.**

In a context of energy efficiency in the land transport sector, replacing conventional engines by electric vehicles shall necessarily increase electricity demand. Moreover, the local economies of most of the OR are still underdeveloped and growing, creating an added demand for energy, including electricity. **For the OR** and other regions (namely, islands) pursuing ambitious targets towards electric mobility, **it would be more appropriate to consider the overall target for reducing primary energy and CO_2 emissions rather than for electricity alone**.

Opportunities and recommendations

- Most of the **OR have better renewable energy resources (RES) than continental Europe**, **but they are not being used to their full extent due to technical, economic and legislative barriers**. Legislative barriers are mostly at national level, as EU legislation only sets goals and gives MS full freedom to choose the best solutions for each situation. **MS should be encouraged by EU legislation to promote preferential schemes for implementation of RES in the OR**.
- **Smaller islands** could be the leaders of the transition towards a renewable energy future, becoming **lighthouse projects for other regions** in Europe and elsewhere. **OR should** thus **be seen as good opportunities for the on-site development of** these future **sustainable energy systems** and become Energy Efficient Communities rather than be seen as a cost and a burden on the national and the EU budgets.
- Transportation costs added to smaller markets result in ca. **20% higher costs for the deployment of renewable energy solutions** than in continental Europe. This **creates a strong economic barrier to the penetration of renewable energy** in most of the ORs. Therefore, **the feed-in tariffs for renewable energy in the OR should be based on the real local cost of producing electricity** rather than the current practice, based on the national pool.
- Technical barriers for **implementation of renewable energy penetration require demonstrating the feasibility of solutions**.
- **Public support for demonstration projects** that could significantly increase the penetration of renewable energy in the electricity grid, e.g., in smaller islands first, would be an important step. **It is essential to dispel the risk of investments in renewable energy projects through successful demonstration pilot projects**.
- **National legislation should follow the needs of the OR more closely and avoid imposing obstacles to the implementation of innovative solutions**, along the "innovation principle".
- In revising **the EU legislation framework, the EU co-legislators should better take into account the increased needs of electricity** in the OR, resulting from increasing economic activity as well as from the impacts from the substitution of traditional vehicles by new solutions with electric propulsion.
- MS and the EU Commission should take the needed steps to ensure that **the liberalisation of the electricity market should not have a negative impact on** the current good practice of **the same electricity price** for consumers in the OR and in the respective mainland in Europe.

Energy Efficiency

Demand is as essential for sustainability as the decarbonisation of **Supply**.

However, while planning a sustainable *Supply* of energy with Renewable Energy Sources is relatively easier to address as only a few major players are involved in the relevant decisions (e.g., installing a large-scale renewable energy plant), *Demand* often depends on the cooperation of the millions of citizens, as individual behaviour is essential for reducing energy needs. This is why *Demand* often takes second place in the decision process, while, in reality, *Demand* reduction should come first: **the logical approach consists of first reducing energy needs, and then providing the reduced needs with renewable energy sources** in a win-win combination that requires smaller investment needs. The EU strategy for sustainable energy systems calls precisely for a combination of both vectors: reduce energy needs (Demand) and increase the penetration of renewable energy sources. This strategy also increases the energy independence (and security) of Europe and of the Outermost Regions (OR).

Demand side management is usually implemented through **a combination of regulation, information campaigns and incentives** (taxes, financial instruments and direct subsidies) for behavioural change. They must cover all sectors: buildings (residential and non-residential); industry; agriculture; and transport. Many OR are already putting this type of strategies into practice to reach sustainable energy systems in the medium term (see annex with best practice examples: Porto Santo (Madeira) Smart Fossil Free Island; La Graciosa (Canarias) Sustainable Island; El Hierro (Canarias) Sustainable Island; and Reunion Sustainable Island).

There is some evidence that **regulations for energy efficiency in buildings in some of the OR may need to be improved** to match the local climate and social/economic conditions. **OR with tropical climates would be among those with the best potential for improvement** (Guadeloupe and Martinique already have their own building climate-adapted regulations and Reunion did so for residential buildings only). **The definitions of Nearly Zero-Energy Buildings (NZEB) should also be adapted to local conditions** in each OR, as the relevant EU Directive (the EPBD) allows and recommends. Adoption of a unique country-wide definition may result in solutions that may be far from cost-optimal in the OR.

Transport is one of the biggest energy challenges in the ORs as it represents more than half of their primary energy needs. **It is** however **possible to implement sustainable fossil-free solutions** through a combination of better public transport and reduced use of individual cars. A gradual change to electric vehicles must be supported by public policies, including grants and incentives as well as an adequate infrastructure in public places and in residential buildings, and availability of enough renewable energy to charge every vehicle and use them as storage for an efficient smart grid to reduce the rejection of renewable electricity at night.

The GDP in most OR is below their corresponding national average. **Citizens of the OR are thus even more focused on solutions with low initial cost** than residents in mainland Europe. Incentives schemes and information campaigns, namely highlighting the rate of return for investments and production

efficiency, need to consider these special circumstances. De-risking these types of investments through successful demonstration pilot projects would also help overcome this barrier.

Local utilities (electricity and/or gas distributors) in the OR could/should play a larger role towards energy efficiency in the OR, through **well designed Energy Efficiency obligation schemes** (as defined and required by the Energy Efficiency Directive – EED), targeting the specific social and economic needs of the OR population and addressing industry as well as residential and non-residential buildings.

Opportunities and recommendations

- **Energy efficiency and buildings regulations in the ORs need to be improved** to match the local climate and social/economic conditions.
- The **definitions of Nearly Zero-Energy Buildings** (NZEB) **should be adapted** by the national or regional authorities **to local conditions in each OR**.
- **The OR should quickly implement an effective strategy of gradual change to electric vehicles supported by public policies, including grants and incentives**. The OR must lead by example with electric public transport and official fleets, provide an adequate infrastructure for charging electric vehicles in public places, require installation of charging points in residential buildings, and ensure the availability of enough renewable energy to charge every vehicle and use them as storage for an efficient smart grid to reduce the rejection of renewable electricity at night.
- National and/or Regional authorities should ensure that **local utilities** (electricity and/or gas distributors) in the ORs **should play a larger role towards energy efficiency** in the ORs, **through well designed Energy Efficiency obligation schemes** (as defined and required by the Energy Efficiency Directive – EED) for both industry and buildings.
- **When designing incentives schemes and information campaigns, the OR should** carefully consider the specific social constraints and the financial capacity of the local population, and **aim at demonstrating** to them **that investing in renewable and energy efficiency does offer** them **a good payback.**

Availability of Funds and Human Resources for Energy Efficiency and Renewable Energy projects

Most OR (though not all) **have** limited **national and EU funds** (e.g., ERDF) specifically **available for energy improvements** in all sectors. **"Energy" is a priority of the Smart Specialization Strategies in all but one of the OR** (Saint Martin).

However, the energy projects in the OR are often too small in terms of investment size to be eligible for, e.g., direct EIB or EFSI financing, which require minimum levels of investment (typically, more than 7.5 M€). For amounts below 7.5 M€, intermediaries (e.g., financial institutions, public organizations, etc.,) financed by the EIF (European Investment Fund) are required. **Aggregation of projects** may be needed, which **poses an additional barrier** as this requires an intermediary and the consequent added costs. Commercial banks need to be offered special compensation for handling large numbers of small loans. ESCOs (Energy Services Companies who invest in energy efficiency and are paid on the basis of the savings they achieve) may have an important role to play.

Funding from other EU instruments specifically directed to large-scale investments in energy projects, notably CEF (Connect Europe Facility), are not in practice available for the OR due to the small dimension of the projects. This perhaps justifies offering a specific compensating scheme for improvements of the energy systems in the OR at the required scale.

Higher equipment costs than in the mainland, lack of local resources (manpower and equipment) for implementation, as well as administrative barriers for approval of funding that cause long delays are also problems that OR face for funding local energy efficiency and renewable energy projects. **The OR would like to have the prevailing funding regulatory procedures streamlined**. Connecting a small renewable energy installation to the grid should be almost automatic and not require often lengthy procedures to obtain the required permits. Promoting **one-stop-shops for individuals and companies applying for funding at local level**, capable of making decisions locally without case by case examination from the respective national capitals, would much ease this process.

Opportunities and recommendations

1. **Funding and regulatory procedures for energy efficiency and renewable energy projects in the OR must be streamlined**. National and/or Regional authorities should promote one-stop-shops for applications for funding, capable of making **quick decisions at local level**, as this would much improve and quicken the deployment of the projects.
2. The EU should work together with the OR and their national governments to put in place **specific EU funding** for the OR, **targeting projects** with the correct size and objectives **for the transition of the OR towards autonomous, sustainable islands**.
3. **Keeping a capable local workforce**, well-trained in the new energy technologies, **able to install and maintain small renewable energy systems, is a major challenge** in small markets with little demand. Pooling of trained workers among neighbouring OR could facilitate a solution.

Research and Innovation (R&I)

Research and Innovation activities are paramount for competiveness. They produce new products and services, they improve productivity and promote economic growth, and they create new jobs.

Few **OR** have functional Research and Innovation institutions and programmes for Energy issues, and they thus **are mostly absent from EU R&I Framework Programmes** (the Canary Islands, or, in reality, the island of *Gran Canaria*, is the notable exception). Only 4 OR have a history of participation in the last 3 FPs, as shown in table 3.

Table 3: Number of EU FP Energy projects in the Outermost Regions

	FP6 (2003-2006)	FP7 (2007-2013)	H2020 (2014-2016)
Canary Islands	2	17	10
Reunion	0	1	1
Azores	0	2	2
Madeira	1	1	3

There are however excellent expertise in energy issues in many OR, capable of producing valuable and innovative results and they have established a formal network in 2015 (the ***OR Energy network***)

The participation of experts and institutions from the OR in the EU R&I programmes is often hampered by the "impact" criterion during the evaluations, given the small size of the OR and their local markets. **Proposals should focus on wider impacts**, e.g., producing solutions that may be applicable in all islands and regions with isolated electricity networks, as well as demonstrating pilots for new technologies (e.g., renewable energies, self-production, local storage, smart grids and mobility) that can be used in larger conventional grids or targeting deployment in Developing Countries, namely in Africa, where there is ample room for improvement of the electricity grids.

Moreover, **the EU FPs have not traditionally offered sufficient R&I topics that suit the needs of the OR**. The Outermost Regions have specific constraints and research needs that are not being covered by the yearly Work Programmes of the Energy theme in Horizon 2020, which are dominated by wider EU interests driven by the large EU stakeholders (industry and research institutions, as well as the grand priorities defined by the European Strategic Energy Technology Plan – the SET-Plan). Yet, the EU FP should support all EU policies and priorities, including OR strategy. Thus, offering topics specifically devoted to OR issues would result in a significant increase in the opportunities for local institutions (including SMEs) and experts to produce innovative solutions for the problems that the OR face and that can be "exported" to other parts of the EU, namely for islands, and elsewhere. As it was already discussed earlier, **smaller islands (or entire OR) are prime candidates for becoming self-sufficient communities based on renewable energy**, becoming **lighthouse projects for other regions in Europe**. **OR should be seen as good opportunities for the on-site development of future sustainable energy systems and become Energy Efficient Communities**.

The EU FPs have traditionally recognized countries or regions with an R&I performance below EU average, and **offered special programmes aimed at less-developed regions (including OR)** to make progress and catch up with the rest of the EU. Notably, **FP7 offered the REGPOT programme**, targeting institution-building in convergence regions, including the OR. **The current EU FP (Horizon 2020) no longer offers this programme**: it created the "Spreading Excellence and Widening Participation" programme that targets whole countries with the lowest R&I performance in Europe (below 70% of the EU average, calculated on the basis of a specific JRC indicator). Portugal is part of "Widening" group of countries and, thus, the Azores and Madeira are eligible to participate, but the **Spanish and French OR must participate as "advanced partners"** (i.e., participants from EU countries with a high R&I performance). This creates **a major hurdle for institutions from most of the OR to benefit from capacity-building opportunities in the current EU FP** (Horizon 2020).

Opportunities and recommendations

- **Small islands (or entire OR) are prime candidates for** becoming self-sufficient communities based on renewable energy, **becoming lighthouse projects** for other regions in Europe. **OR should be seen by the EU Framework Programmes as good opportunities for the on-site development of future sustainable energy systems and become Energy Efficient Communities**.
- **The EU Framework Programmes should offer a sufficient number of Energy topics that would** suit the needs of the OR, to **allow for the development of innovative solutions for the special needs and circumstances of the OR**, much different from those in mainland Europe. These innovative solutions would find markets outside of the OR, as many other regions (namely islands) face the same problems.
- **The EU Framework Programmes should offer targeted capacity-building actions to allow all the OR to develop competitive R&I centres of excellence** that may compete on equal terms with their counterparts in the EU.
- **The OR Energy Network should be encouraged to carry out detailed studies, funded by the EU, to define the best renewable energy solutions** for each OR/island, to **promote a more successful participation of OR experts in EU R&I programmes**, to **provide improved training programmes** for local human resources, as well as identifying problems and opportunities for the ORs **and play an interface role with regional, national and EU authorities**.
- **The OR should be encouraged to improve their Energy R&I systems**, investing in new or improved centres of excellence, using national or other funds, namely EU regional funds, to become more competitive and more active in the EU FPs.
- Experts in the OR, when responding to FP calls, should demonstrate that they can **create impact at EU and global levels** rather than just focussing on impact on their local markets or in the Outermost Regions alone. This would allow for better chances to succeed in securing funding in calls that are extremely competitive and with a very low success rate.

Further Actions by the EU Commission

The previous sections of this report include several recommendations for EU actions towards improving the Energy context in the Outermost Regions under various thematic areas.

There are however other policy actions that the EU Commission can undertake within major undergoing initiatives, as recommended below.

The special conditions of the OR should be recognised in the EU Directives, as their departing point is not the same as in the rest of Europe. E.g., their economies are still growing and this means that energy consumption shall still be increasing for many years; distance increases transportation costs and local small markets result in higher prices for goods manufactured outside of the OR, resulting in different economic boundaries for the introduction of renewable energy sources, as required by the RED; the cost of producing electricity by conventional means is much more expensive in the OR than in mainland Europe and this justifies establishing a higher feed-in tariff for renewable energy in the OR, based on real local costs rather than on the continental pool to which the OR are not connected to; tropical climates in some of the French OR are not mentioned in the EPBD and the applicable building regulations are not well adapted to local conditions.

Moreover, most of the OR are islands or archipelagos and their problems are often common to those of many other islands. The OR are experimenting in the field of energy and could share their experience with other islands while solutions for islands may be useful for the OR too. Thus, the EU should include the OR in the Smart Islands Initiative that the EU is planning for 2017.

Opportunities and recommendations

- **In the current revision process of the three Directives (EED, RED and EPBD), the co-legislators should** recognise the specific conditions of the OR and they should **create a more efficient framework for energy efficiency and penetration of renewable sources of energy that better fit the local socio-economic and geographical/climate constraints.** The three Directives should make a specific reference to the OR and their particular conditions.
- **Involving the OR in the "Smart Islands Initiative"** that the Commission is promoting in 2017, covering the more than 2000 islands in the whole EU, would be most welcome and might create very important synergies.

Annex: Good Practice Examples in the Outermost Regions

Reunion Island 100 % renewable electricity
Combined use of solar, hydro energies, wind, geothermal and the use of smart autogrids

The main goal is an inclusive strategy in renewable energy production, combined with the reduction of electricity needs in residential buildings.

- public policy engaged by the authorities and particularly the Regional Council in favour of the energy revolution, framed by the 2015 French law ("Energy transition for a green growth") which states that the island must be fully autonomous by 2030 (ground transportation included), including zero imports of fossil fuels;
- public policy aiming to fund solar systems installed by low-income households to produce electricity or domestic hot water to reduce their electricity bill by at least 30 % (2289 solar water heaters installed in 2006, 244 GWh of PV electricity produced by 2283 residential installations in 2015);
- public policy to fund self-production of PV electricity, with or without storage;
- combine solar, water, biomass and biogas, together with an intelligent combination of smart grid technologies on a small territory to continuously provide the required electricity without any blackout or any decrease in the quality of 50 Hz frequency;
- promote buildings that are air-conditioned using fully renewable solutions;
- install a sodium/sulphur (NaS) battery of 1 MW/7 MWh to optimise the intermittent RES on the network, thereby overcoming the 30% rule (the maximum rate for instant supply by intermittent RES must not exceed 30% of the load, in order to respect system stability).

Specific achievements so far:

- PV plants have been installed at the roofs of top firms and public administration buildings;
- Two wind power stations have been built, one in the northeast, another in the far east of the island. They are both located in hurricane-prone areas, which posed special difficulties and increased costs;
- Hydropower has been increased with three new power plants. In the 1980's, existing hydro supplied 80% of the island's needs, but, even with the newly added capacity, this is now down to 47%;
- Two power plants burning "Bagasse" (sugar cane biomass) have been installed, replacing 6 months of imported coal from South Africa;
- A demonstration pilot project of a naturally cooled building, with no use of electricity for AC, (the Amphiteatre Bioclimatic in Reunion University), under the design principle named "*Bati Tropica*l", has been built;
- Agri-farms have been put in place in the southern part of Reunion Island. This solution helps farmers to produce foods, protect their crops and produce solar energy. This system has been developed in La Reunion and then exported to other islands or tropical regions, e.g., in Indonesia, Australia, Brasil, as well as in Europe.

Porto Santo (Madeira) smart fossil free island including 100% renewable smart grids and electric mobility

Porto Santo is a small island (5500 inhabitants) with important seasonal tourism in summer. As the electric grid is isolated and very small, the penetration of intermittent renewables (currently, 1,1 MW of wind and 2 MW of solar PV) is limited by technical constraints, as the power fluctuations of solar PV and wind have strong impacts on the electric grid stability and may cause a general blackout in the island. The objective is to make Porto Santo a smart fossil free island in 20 to 30 years, based on new smart energy technologies, namely by:

- Implementing energy efficiency in buildings, including energy performance contracts with ESCOs (aggregated call for tenders grouping some similar installations and services to get enough scale to be attractive for ESCOs);
- renewable energy sources for domestic hot water and electricity (self-production);
- substitution of conventional street lighting by LEDs with remote control in the entire island;
- electric mobility (100% electric vehicles in the public fleet and increase the number of charging stations for private electric vehicles);
- energy storage (installation of a 4 MW/4 MWh battery to improve stability of electric grid and increase the share of renewable energy sources);
- installation of smart meters for all electricity users and smart grid solutions;
- study the technical and economic feasibility to install a submarine power cable between Madeira and Porto Santo (60 km cable for a 45 km distance, at depths up to 2000 m) during 2017. Porto Santo has excellent conditions for offshore renewable energy, namely from wind, and the interconnection to Madeira would improve grid stability and allow transfer of the excess energy when the production from intermittent renewables is higher than the demand.

Corvo Renovável ("Renewable Corvo") - Azores

Corvo is the smallest of the 9 islands in the Azores. It has only about 400 inhabitants. The regional government intends to increase the installed renewable electric power by installing a 80 kW PV station by 2021.

The regional government has already promoted the installation of solar thermal collectors and a heat pump in every house in the island through public contracting. This action was already completed in 2015, thus reducing electricity needs for water heating by 70%.

This has been so successful that studies are underway to investigate the possibility of implementing similar projects in other islands in the Azores.

Graciosa (Azores) installs high capacity solar+wind station with battery storage

Graciosa has about 4,500 inhabitants and is heavily dependent on fuel oil for electricity production. Renewables currently provide only 15% of the island's electricity needs.

This will change with a new 24 M€ hybrid power station, with 4.5 MW wind capacity and 1 MW PV capacity backed up by 2.6 MW of batteries, expected to supply 65% of all the island electricity needs by 2017/2018.

Overall cost to consumers will decrease, as the plant is not paid on the basis of a high feed-in tariff but, rather, on a fraction of the cost that the local utility would normally pay for a diesel based solution.

Energy storage with reversible hydro in Madeira

The electric system of Madeira is small and isolated. The wind and hydro capacity is over 100 MW and the demand during the night may be around just 50 MW. Moreover, it is necessary to keep the main thermal power station running to a minimum power to ensure ancillary services for the grid stability. As a consequence, part of the renewable energy has to be rejected during the night. In winter, the power rejected is sometimes more than 50% of renewable energy sources available and throughout the year the rejected wind energy may represent up to 20% of the annual wind production. This is a major constraint to have a renewable share higher than 30% as new investments in renewable energy sources, namely wind power, are not economically feasible if an important part of the energy is not received by the electric grid due to market characteristics and technical limitations.

Energy storage is needed to receive the excess of renewable production during the night and to help the electric system during peak-hours. Despite a strong scarcity of suitable locations in the island, the electrical utility in Madeira has started to build an energy storage system based on reversible hydro:

- The capacity of the turbine, placed at an altitude of 660 m, is 30 MW;
- the capacity of the pumping station is 17,7 MW;
- The water storage capacity is over 1 million m^3 at an altitude of 1,350 m.

This project is estimated to cost 86 M€ and it is to be co-financed by EU Cohesion funds with 45 M€. It is already under construction. Is it expected to start operating in 2019.

La Graciosa (Canarias) Sustainable Island

La Graciosa is a small island located north of Lanzarote. The island has a small resident population, and during the summer the island population increases due to tourism, which together with fishing represents the main economic activities. Currently, the population of this small island is being provided of electric power from neighbouring Lanzarote through a 1 kV submarine cable with a capacity of 1.4 MVA.

As part of the Canary Islands Smart Strategy, La Graciosa is to become 100% fossil free, reaching total self-sustainability by implementing an electric smart microgrid based on photovoltaic systems installed on the roofs of about 350 existing houses (1,500 kWp) and small wind turbines scattily installed across the village, as well as through the total conversion of the local fleet to electric vehicles. The microgrid shall include a diesel engine for back-up and 500 kWh batteries for energy storage and grid stability.

The installation of the batteries, PV and wind turbines is expected to be completed by 2018. As the decision to purchase electric vehicles depends on the initiative of local inhabitants, the total conversion of the existing conventional fleet of vehicles is expected by 2025-2030.

El Hierro (Canarias) Sustainable Island

Canarias plans to reach total energy and water self-sustainability of the island of El Hierro by upgrading the capacity of the existing hydro power plant (11.3 MW) with pumping (6 MW), installing additional wind power capacity (11.5 MW), by using only electric vehicles in the island and making further use of locally produced biomass. This system is expected to provide 70% of the yearly electricity needs and 100% of the demand during Summer.

The investment costs for the power station will be borne by the state (60%) and by the local utility (40%), The rest of the project (wind power, biomass and electric cars) is to be funded mostly by public funds. The Spanish Government is contributing 35 M€ in subsidies.

As in the case of La Graciosa, the goal to reach 100% electric mobility on the island by 2030.

Geothermal energy in Guadeloupe and Martinique

Located in a region that has a good potential for geothermal resources, Martinique has no geothermal energy in their energy mix and Guadeloupe has only 13.5 MW from geothermal origin in a total grid with about 550 MW total power installed.

Martinique has identified a possible suitable location with good conditions for capturing geothermal and is now planning its development and integration in the region’s electricity grid, together with increasing the capacity of the existing plant, aiming to reach a total of 40 MW installed geothermal capacity by 2023.

Guadeloupe intends to develop and expand its geothermal capacity to 45 MW by 2023.

Azores plans a 30% increase in renewable electricity from 2016 to 2021

Electricity production in the Azores is composed of nine isolated micro-systems. Considering the endogenous resources available in each island of the archipelago, a set of investments is foreseen to increase the penetration of renewable and endogenous sources in the production of electric energy in a 2021 horizon:

INVESTMENT IN RENEWABLE ELECTRIC ENERGY IN THE AZORES ARCHIPELAGO/ISLAND - MW		
ISLANDS	**2016**	**2021**
SANTA MARIA		
Solar PV	0	0.6
Wind	1,5	1,5
SÃO MIGUEL		
Wind	9	9
Geothermal	23	28
Hydro	5,1	19,1
TERCEIRA		
Wind	12,6	12,6
Geothermal	0	10
Hydro	1,4	8,4
GRACIOSA		
Solar PV	0	1
Wind	0	4,5
SÃO JORGE		
Wind	1,8	1,8
PICO		
Wind	2,4	2,4
FAIAL		
Wind	4,3	4,3
Hidro	0,3	0,3
FLORES		
Wind	0,6	0,6
Hydro	1,5	2,6
CORVO		
Solar PV	0	0,08

In each of the two larger islands (S. Miguel and Terceira), a reversible hydro pumping station will be built to provide the needed storage capacity for off-peak wind energy. A new hydro power station shall also be built in the island Flores, almost doubling the local hydro power availability.

The Azores government is already promoting electrical mobility, through information campaigns and fiscal incentives to individuals and to company fleets and by installing a network of fast-charging stations, as well as offering further perks as free parking and exclusive traffic lanes in cities.

A move towards full use of LED technology for public lighting is already under way through a pilot programme.

Guadeloupe develops building regulations specifically adapted to local conditions

To improve the energy efficiency of the buildings sector, Guadeloupe developed a specific set of regulations, adapted to local climate and conditions. They are in force since 2011. The French national regulations are not adapted to hot tropical climates and, therefore, OR do not apply them.

Guadeloupe also built the first positive-energy school building in 2009, a show-case that can be replicated elsewhere. It has:

- 700 kW of PV electricity (6,700 m^2 of PV collectors), to feed into the local grid;
- a 200 kW solar cooling installation (1,200 m^2 of solar panels), covering 40% of the cooling needs of the school;
- solar thermal collectors for producing hot water;
- modulating lighting controls to optimise daylighting use
- a centralised energy management system.

Three PV plants to be installed in Saint Martin

Through a public-private partnership, three PV plants capable of supplying the needs of 2,200 households shall be built. This decision, made in February 2017, involves two plants at Concordia and a third one at Green Valley, ranging from 1.7 MW to 5 MW and will cost between 5 M€ and 10 M€ each. The electricity produced at the PV plants will cost half of the present cost of producing electricity from oil at the island.

This partnership also intends to install PV on the roofs of all their building stock for rent, selling electricity directly to the tenants.

This initiative will be complemented by the creation of a locally available maintenance unit for PV systems, providing specialised local jobs and better service for the consumers.

Electric mobility in Madeira and Porto Santo

Transport is responsible for more than 50% of primary energy demand and CO_2 emissions in Madeira, based on fossil fuels. On the other hand, the use of intermittent renewable energy sources (RES) in the isolated small electric grids of Madeira and Porto Santo is limited by demand during off-peak hours and lack of storage capacity, requiring significant amounts of available wind energy to be lost. In this context, electric mobility is seen as a win-win solution for transports and electric sectors, improving energy efficiency and improving the ability to increase RES for electricity.

Massive charging of electric vehicles in isolated electric grids during off-peak hours will minimise the rejection of RES and will promote new investments in RES – net energy from new RES promoted by electric mobility strategy can be similar as the energy consumption of the electric vehicles (the annual consumption of 1,000 electric vehicles running 25.000 km/year each is equivalent to the annual production of 1 MW of wind power).

In this context, Madeira is taking some measures to promote electric mobility:

- the public charging network will be expanded with new 50 kW charging stations in Madeira and Porto Santo (completion expected by 2018).
- The Regional Government of Madeira is planning to launch in 2017 a call for tender for a new public transport concession requiring the introduction of electric buses for the whole of Porto Santo and for some routes in Madeira.
- To minimize the higher costs of electric vehicles, the regional authorities are also planning to launch an aggregated call for tender for the acquisition of electric vehicles for small companies and private users during 2018 and 2019.

Some of the actions to promote electric mobility and sustainable mobility are foreseen during 2017-2019 in the Civitas project *Destinations* supported by the European R&I programme Horizon 2020.

Mayotte plans for Sustainability

Mayotte is a small island and the national laws protecting the coastal areas, together with protection of farming land, create a great obstacle for the development of Renewable energy sources. So, the current plans call for:

- Double the share of renewable from the current 5% to 10% by 2020, and benefit from the lower production cost of PV electricity compared to present oil-based solutions;
- Install PV systems where possible, coupling them with battery packs and intelligent management systems to overcome its variable nature;
- Support the construction of a 12 MW biomass power plant by a private investor;
- Implement a wider use of solar water heaters for domestic buildings;
- Promote electrical mobility, starting with the purchase of 5 vehicles for the local authorities;
- Promote public transport to reduce use of individual cars.

Annex 2 : List of experts who participated in the "Expert Group Energy in the ORs" held in Brussels on 12/12/2016

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