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Cibele Fonseca Januário

HOW TO DEVELOP PHOTOVOLTAIC PARKS SUSTAINABLY WHILE ADDRESSING LOCAL COMMUNITY CONCERNS

Porto Alegre
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Undergraduate Thesis presented as a partial requirement for obtaining the title of Bachelor in Environmental Engineering from the Hydraulic Research Institute at the Universidade Federal do Rio Grande do Sul.

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Final Project for obtaining the title of Bachelor in Environmental Engineering at the Federal University of Rio Grande do Sul.
Defended and approved on August 21, 2024, by the evaluating committee composed of the following professors:

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The world has enough for everyone's needs,
but not enough for everyone's greed.

Mahatma Gandhi

ABSTRACT

JANUARIO, C. F. How to develop photovoltaic parks sustainably while addressing local community concerns. 2024. Bachelor's Thesis (Environmental Engineering) – Institute of Hydraulic Research, Federal University of Rio Grande do Sul, Porto Alegre.

The rapid expansion of photovoltaic parks as a renewable energy source in Europe brings both opportunities and challenges, particularly in terms of sustainable development and the need to address local community concerns. Through a case study and an analysis of impact assessments in the Provence Alpes Cote d'Azur region of southern France, this research identifies best practices for community engagement that can be applied to the development of solar parks in other countries. The results highlight the importance of early and transparent communication with the local population, the effective inclusion of stakeholders in decision-making processes, and the reduction of ecological, human, and landscape impacts. This study proposes suggestions that facilitates collaboration between developers and communities in photovoltaic projects, aligning them with sustainability goals and the interests of the local population, thereby contributing to the transition to renewable energy.

Key words: Sustainable Development, Photovoltaic Parks, Solar Energy, Community Engagement, Environmental Impact, Landscape Integration, Renewable Energy.

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RESUMO

JANUARIO, C. F. Como desenvolver parques solares de maneira sustentável levando em consideração as preocupações das comunidades locais. 2024. Trabalho de conclusão de curso (Graduação em Engenharia Ambiental) – Instituto de Pesquisas Hidráulicas. Universidade Federal do Rio Grande do Sul, Porto Alegre.

A rápida expansão de parques fotovoltaicos como fonte de energia renovável na Europa traz tanto oportunidades quanto desafios, especialmente no que se refere ao desenvolvimento sustentável e à necessidade de abordar as preocupações das comunidades locais. Através de um estudo de caso e análise de estudos de impacto na região de Provence Alpes Cote d'Azur, no sul da França, essa pesquisa identifica as melhores práticas de engajamento comunitário, que podem ser aplicadas no desenvolvimento de parques solares em outros países. Os resultados ressaltam a importância de uma comunicação precoce e transparente com a população local, da inclusão efetiva das partes interessadas nos processos de tomada de decisão, e na redução de impactos ecológicos, humanos e paisagísticos. Esse estudo propõe sugestões que permitem a colaboração entre desenvolvedores e comunidades em projetos fotovoltaicos, alinhando-os com os objetivos de sustentabilidade e os interesses da população local, contribuindo assim para uma transição para a energia renovável.

Palavras-chave: Desenvolvimento Sustentável, Parques Solares, Energia Solar, Engajamento Comunitário, Impacto Ambiental, Integração Paisagística, Energia Renovável.

LIST OF ILLUSTRATIONS

LIST OF ABBREVIATIONS AND ACRONYMS

CO_2 Carbon Dioxide

DLVAgglo Durance Luberon Verdon Agglomeration Community
(translated from French – *Communauté d'Agglomération Durance Luberon Verdon*)

MEP Multiannual Energy Plan
(translated from French – *Programmation Pluriannuelle de l'Energie*)

PV Photovoltaic

SCoT Territorial Coherence Plan
(translated from French – *Schéma de Cohérence Territoriale*)

SDIS Departmental Fire and Rescue Service
(translated from French – *Stratégie Nationale Bas Carbone*)

SNBC National Low-Carbon Strategy
(translated from French – *Service Départemental d'Incendie et de Secours*)

SRADDET Regional Plan for Development, Sustainable Development, and Territorial Equality
(translated from French – *Schéma Régional d'Aménagement, de Développement Durable et d'Egalité des Territoires*)

ToR Terms of Reference

SUMMARY

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INTRODUCTION

The transition to renewable energy sources is a critical component of sustainable development, aiming to reduce dependence on fossil fuels and mitigate environmental impacts (Cavallaro; Sessa; Malandrino, 2023). Photovoltaic (PV) parks play a significant role in this transition by harnessing solar energy, a clean and abundant resource. However, the development of PV parks must be carefully managed to address the concerns of local populations and preserve the natural and cultural landscapes.

This study aims to explore how to develop photovoltaic parks sustainably while addressing local community concerns. The primary focus is to understand the impact of solar parks on the human environment and the landscape integration by an analysis of impact studies of solar parks from Engie GREEN Provence Alpes Côte d'Azur. A case study analysis of a public consultation project by the DLVA agglomeration in southern France, which integrated citizens between the development of solar parks, is also included.

The final objective of this study is to propose a methodology that can be applied to solar projects worldwide. This methodology aims to enhance the acceptability of solar projects by ensuring that development is done through a decision-making process with the local community. By aligning the development of PV parks with local concerns and environmental considerations, this research seeks to contribute to the broader goal of sustainable and socially responsible energy transition. In summary, this work address the following key aspects:

- Assessing the human and landscape impact of solar park development through existing assessment studies.
- Analyzing a successful public consultation project to draw lessons for broader application.
- Proposing an applicable methodology to improve the acceptance of photovoltaic park projects.

PART 1 : CONTEXT

1 RENEWABLE ENERGIES AND THE ENERGY TRANSITION

1.1 ENERGY TRANSITION

The impact of climate change, driven by the increase of greenhouse gases released from human activities, is already evident. The average global temperatures have risen by 1.1°C compared to pre-industrial levels, and extreme weather events such as droughts, floods, and marine submersions are becoming more frequent. (Ministère de la Transition écologique et de la Cohésion des territoires, 2024a)

The greenhouse gas effect is driven by multiple factors, prominently the use of fossil fuels such as coal, petroleum, and natural gas. Since the Industrial Revolution fossil fuels are the primary energy source and the leading cause of CO_2 emissions. Harnessing the energy stored in fossil fuels necessitates combustion, which unavoidably leads to the release of emissions and particulates into the atmosphere. Furthermore, the extraction and transportation of these fuels result in substantial pollution, causing serious issues such as air and water contamination, soil degradation, and global warming. (Jasim Hasan AlTimimi, 2023) In recent years, geopolitical factors have affected the cost and security associated with fossil fuels, including coal, petroleum, and natural gas. For example, the conflict between Russia and Ukraine caused caused oil prices to rise by more than 50% in 2022, leading to higher fuel and energy costs and a greater cost of living. (Mutumbi; Thondhlana; Ruwanza, 2024)

Mitigating climate change and global warming by reducing greenhouse gas emissions play an important role in every country's policies. There are various mitigation strategies, such as energy transition. The energy transition involves moving from energy systems that rely on fossil fuels to those that utilize low-carbon and renewable energy sources (National Council on Climate Change, 2024), such as solar and wind energy. (Calvin *et al.*, 2023)

Achieving net zero CO_2 energy systems requires significantly cutting fossil fuel consumption, using minimal unabated fossil fuels, and employing carbon capture and storage for the remaining fossil fuel use. This includes developing electricity systems with no net CO_2 emissions, promoting widespread electrification, utilizing alternative energy carriers for less electrifiable applications, enhancing energy conservation and efficiency, and improving integration within the energy sector. Major emissions reductions at costs are largely from solar and wind energy, energy efficiency upgrades, and methane emission reductions from coal mining, oil and gas, and waste management. Diversifying energy sources (e.g., wind, solar, small-scale hydropower) and managing demand (e.g., through storage and efficiency improvements) can enhance energy reliability and mitigate climate vulnerabilities. Smart-grid technologies, robust transmission systems, and improved capacity to address supply shortages are highly feasible in the medium to long term, offering mitigation co-benefits. (Calvin *et al.*, 2023)

In France, the *Schéma Régional d'Aménagement, de Développement Durable et d'Egalité des Territoires* (SRADDET) serve as tool for coordinating the energy transition across French regions. This document guides each region in setting renewable energy goals and developing strategies for climate change mitigation and adaptation within an overall framework of territorial planning. (Ministère de la Transition écologique et de la Cohésion des territoires, 2019)

1.2 RENEWABLE ENERGIES

Greenhouse gases pose a significant challenge to sustainable development. One strategy to address this issue is to increase the use of renewable energy sources (Goldemberg, 2004). Renewable energies, powered by the sun, wind, geothermal heat, water flows, and tides, can generate electricity, heat, cooling, gas, fuel, and combustibles. These energy sources are considered endless for human use and produce little to no waste or pollution. Unlike fossil fuels, which are polluting and running out, renewable energies are more reliable, especially in times of crisis. (Ministère de la Transition écologique et de la Cohésion des territoires, 2024b)

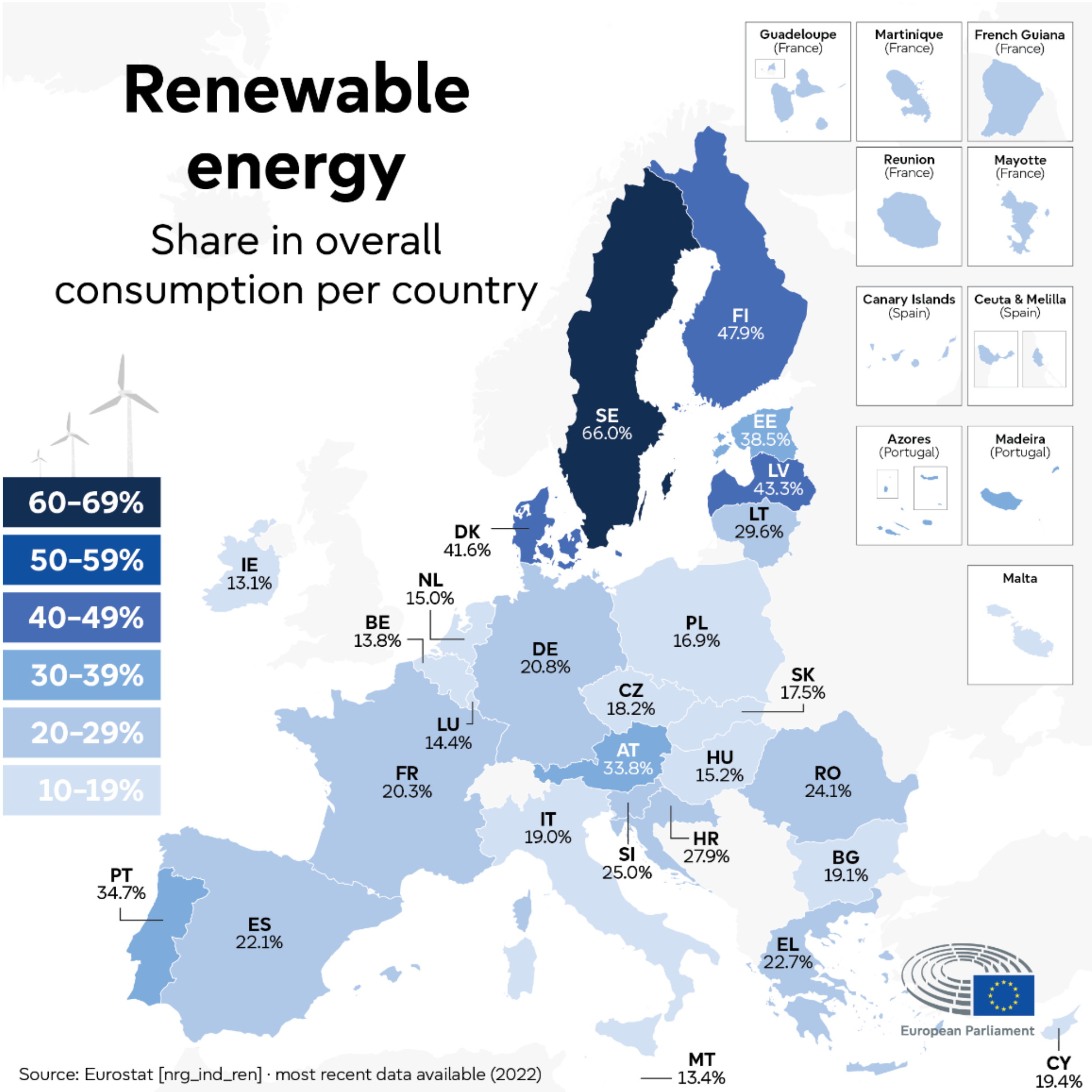
According to Werner, Lazaro (2023) alternative renewable sources present new challenges due to their dependence on climate conditions, making them less controllable and increasing system vulnerability, particularly in the face of climate change. Energy policies, programs, and plans must consider the interdependencies with other resources and sectors involved in energy generation. Proper spatial planning for the expansion of solar energy is essential to prevent conflicts over land use, such as taking over agricultural areas, which can impact food production and the associated demand for water and land.

1.3 RENEWABLE ENERGY OBJECTIVES

The energy sector accounts for over 75% of the European Union's (EU) greenhouse gas emissions. Of this, 33.9% is attributed to energy use in the industry, particularly in electricity generation, while 29.4% comes from transportation (Ministry of the Energy Transition, 2023). To address this, the EU aims to rapidly increase the adoption of renewables to help achieve its target of cutting net greenhouse gas emissions by at least 55% by 2030 and become climate neutral by 2050. (European Parliament, 2024)

In September 2023, the European Parliament endorsed a new target of 42.5% share of renewables across power generation, industry, buildings, and transport by 2030. This higher target aligns with the European Commission’s REPowerEU plan, introduced in May 2022, which emphasizes accelerating the transition to clean energy and reducing dependence on energy imports from Russia. As of 2022, the proportion of renewable energy in the EU’s overall energy consumption had risen to 23%, up from 21.8% in 2021. Sweden leads in 2022 with the highest share, utilizing 66% renewable energy, Finland follows with 47.9% renewable energy, while Latvia holds a 43.3% share. (European Parliament, 2024)

Figure 1 Renewable energy share in overall consumption per European country (2022)



Source : European Parliament (2024)

In response to the climate emergency, France has committed to achieving carbon neutrality by 2050. This commitment is reflected in the updated National Low-Carbon Strategy (SNBC), which was adopted by decree in April 2020 and outlines the path toward carbon neutrality. The SNBC outlines how to reduce emissions across all sectors and decrease France's overall carbon footprint. Complementing this, the

Multiannual Energy Plan (MEP) for 2019-2028, also established by decree in April 2020, details the priorities for managing energy resources in line with the SNBC, ensuring a cohesive approach to meeting France’s climate objectives. (Ministry of the Energy Transition, 2023)

The MEP aims to increase the share of renewable energy to 33% of total final energy consumption by 2030. Specifically, the photovoltaic sector is expected to account for 28% of renewable electricity production by 2028. (Ministère de la Transition écologique et de la Cohésion des territoires, 2024b) To achieve this, the MEP prioritizes the development of ground-mounted photovoltaics, which are more cost-effective and should be installed on artificialised land, waste ground, and parking areas, ensuring that projects also address biodiversity and agricultural land conservation. Furthermore, the MEP promotes innovation in the photovoltaic sector by supporting new technologies, such as agrovoltaics and floating power stations. (Executive summary Multi Annual Energy Plan)

Despite these efforts, France has faced challenges in meeting its renewable energy targets. For 2020, the Renewable Energy Directive set a goal of 20% renewable energy in the gross final energy consumption of the 27 EU member states. Given France's above-average renewable energy capacity, its target was set at 23%. However, France only reached 22.2% by 2023, falling short of its 2020 target. (Messad, 2024)

PART 2 : SOLAR PARK DEVELOPMENT

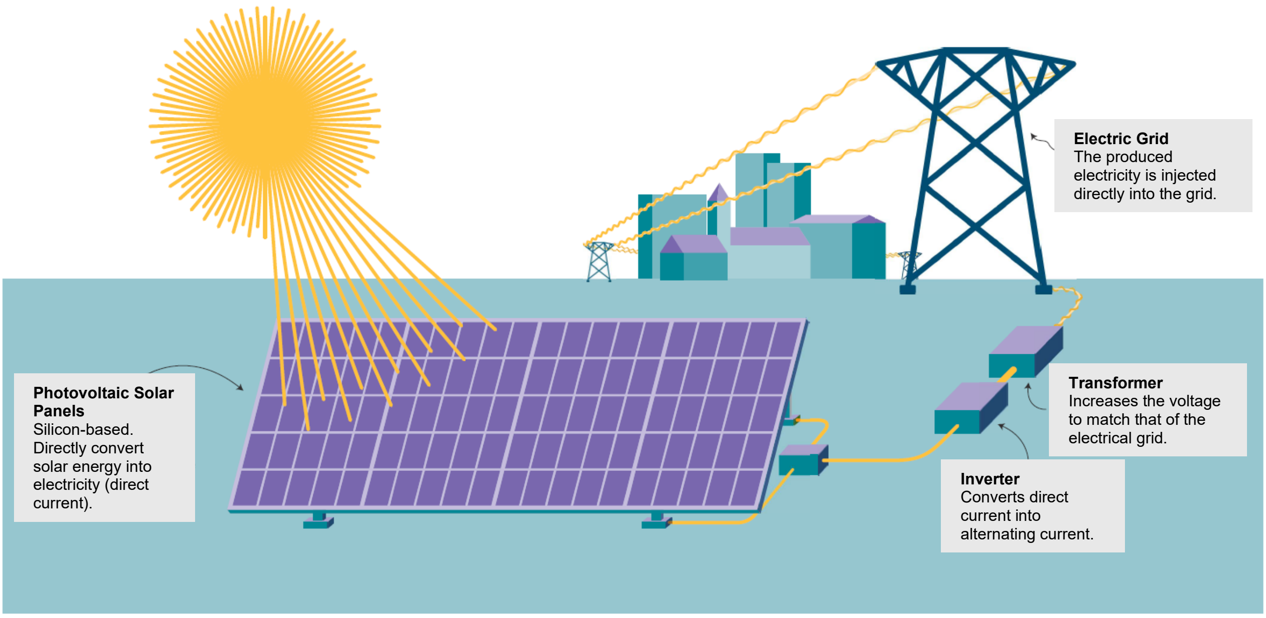
2 PHOTOVOLTAIC PROJECTS

2.1 PV PARKS

Solar energy can generate either heat or electricity through various capture methods: photovoltaic, thermal, and thermodynamic. Photovoltaic cells convert sunlight into electricity, making solar energy, a completely renewable source. However, since solar energy production is limited to daylight hours, it presents challenges for meeting peak energy demand, particularly in the evening. This limitation requires the development of flexibility solutions to ensure a steady energy supply. The electricity produced by solar energy can either be used on-site or fed back into the electrical distribution network, providing versatile options for energy management. (Ministère de la Transition écologique et de la Cohésion des territoires, 2024b) In this context, this work specifically explores the development in PV technology.

In practice, a PV plant operates using thousands of interconnected photovoltaic panels, which consist of photovoltaic cells. These cells, often made from silicon, a semiconductor material, capture the light energy from the sun's rays. When photons of light hit the cells, they transfer their energy to the electrons in the semiconductor material, causing the electrons to move and generate a direct electric current. This direct current is collected by a fine metal grid and then converted into alternating current by an inverter. The alternating current is then increased to the appropriate voltage by a transformer before being fed into the distribution network. (ENGIE Green, 2022)

Figure 2 Operation of PV Parks



Source: translated to English from France Nature Environnement (2022)

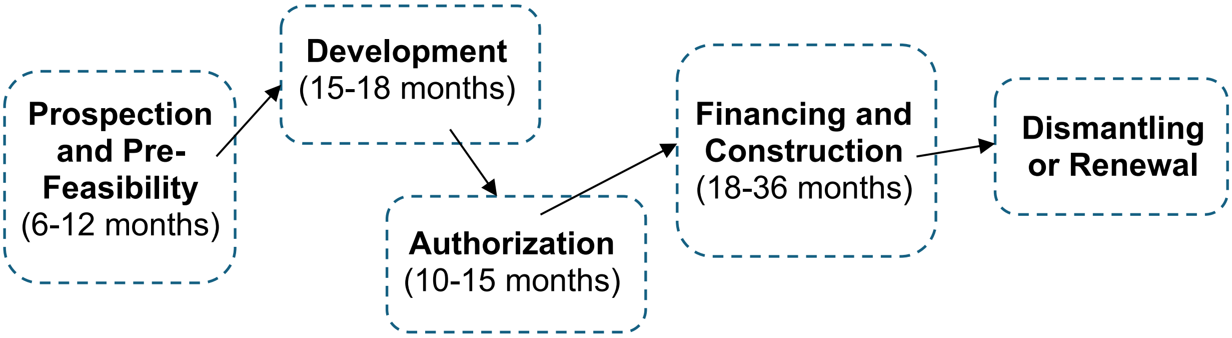
Solar PV technology is also known for being affordable, reliable, profitable, and clean energy source with low maintenance costs and extended longevity. (Mutumbi; Thondhlana; Ruwanza, 2024) Between 2010 and 2019, the unit costs of solar energy saw a significant decline of 85%. This reduction was driven by a combination of policy measures, including public research and development, financial support for demonstration and pilot projects, and demand-driven incentives like deployment subsidies to achieve scale. (Calvin *et al.*, 2023)

In the las two decades, solar energy has become increasingly economically advantageous for residential, commercial, and industrial applications. This collective shift towards solar energy not only offers economic benefits but also supports the global effort to reduce greenhouse gas emissions and combat climate change.

2.2 PHASES OF A PHOTOVOLTAIC PROJECT IN FRANCE

The process of establishing photovoltaic projects in France is a multi-faceted process, involving several phases to ensure successful implementation. This chapter outlines the key stages of a photovoltaic project, detailing the timelines and activities associated with each phase. From initial site prospection and development planning to obtaining necessary authorizations, securing financing, and ultimately constructing the photovoltaic systems, each step is essential in bringing a solar energy project to fruition.

Figure 3 Steps and associated durations until the commissioning of a ground-mounted photovoltaic park



Source: adapted from WWF (2023)

2.2.1 PROSPECTION AND PRE-FEASIBILITY (6-12 MONTHS)

The process begins with the prospection phase, which lasts between 6 to 12 months. During this time, suitable sites for the photovoltaic installation are identified and evaluated for feasibility. Before negotiating for a land parcel and securing land rights, a preliminary site assessment is necessary to determine if it is suitable for a photovoltaic park. This stage involves various analyses, including topography, available area, biodiversity and landscape considerations, nearby risks, geotechnical constraints, and compliance with regulatory documents. If the project developer finds no significant preliminary issues after these analyses, negotiations with the landowners begin, and a lease option is signed to secure the land.

2.2.2 DEVELOPMENT PHASE : IMPACT STUDIES AND BUILDING PERMIT APPLICATION (15-18 MONTHS)

Following prospection, the project moves into the development phase, which takes approximately 15 to 18 months. This stage involves detailed planning, design, and preliminary engineering works, ensuring that all technical and environmental aspects are considered. Various studies are undertaken to confirm the project's technical feasibility and profitability. This includes an impact study focusing on key areas such as general aspects, hydraulics, landscape, biodiversity, and forestry, all conducted by independent firms. The biodiversity study should span all four seasons to assess the effects of installing a solar park on the local area and its biodiversity. Based on the findings, measures are proposed to avoid, reduce, and compensate for any residual project impacts.

The project developer is responsible for creating the terms of reference (ToR) to begin the studies and guide the research firm on-site. The ToR outlines the mission description, the expectations from the research firm, preliminary diagnostic information, specific focus points for each expert, and the definition of immediate, intermediate, and distant study areas.

2.2.3 AUTHORIZATION OF THE BUILDING PERMIT (10-15 MONTHS)

Next is the Authorization phase, which typically spans around between 10 and 15 months. During this period, the necessary permits and regulatory approvals are obtained from relevant authorities, ensuring compliance with local and national regulations. For ground-based photovoltaic projects over 1 MWc, building permit applications require review and may need additional approvals under the Environmental Code and Forestry Code, including deforestation permits, protected species exemptions, and environmental authorizations or declarations under the Water Act. The Departmental Directorate of Territories and the Sea oversees these applications and organizes several consultations as part of the review process.

Public inquiry

A public inquiry, which lasts at least 30 days, is conducted if the project requires an environmental assessment. This inquiry process gathers feedback from citizens, associations, and particularly residents of the involved municipality of the potential site. The municipality and their associations are consulted about the entire project. If necessary, the Prefect can extend the consultation to nearby municipalities. The feedback collected during these consultations is forwarded to the Prefect, who will make the final decision on whether to approve the project, potentially including additional conditions or requests. (France Nature Environnement, 2022)

The minimum legal requirements for public consultation in France are dictated by environmental regulations and vary significantly depending on the size of the ground-based solar park. Regarding general public information outside of key consultation periods or inquiries, there are no specific obligations. However, project developers are encouraged to initiate bilateral meetings, information sessions, or communicate through the Internet. Information can also be directly accessed when documents are made public during information or consultation phases. (France Nature Environnement, 2022)

2.2.4 FINANCING AND CONSTRUCTION (18-36 MONTHS)

Once authorization is secured, the project enters the Financing phase, lasting between 6 to 12 months. This stage involves securing the required financial investments and funding to support the construction and operational phases of the project. The final phase is Construction, which takes about 1 to 2 years. This phase involves the actual building and installation of the photovoltaic systems, culminating in the operational start of the photovoltaic plant. The construction process includes building roads, setting up fences, trenching for electrical and communication connections, assembling structures and modules, installing inverters and the electrical delivery station, connecting to the grid, conducting commissioning tests and other need works. Depending on site challenges and administrative issues, the timeline of 8 months can be extended.

2.2.5 DISMANTLING OR RENEWAL

The average operational lifespan of a PV park ranges from 30 to 35 years (Office of Energy Efficiency & Renewable Energy, 2024), during which electricity is produced, installations are maintained, and environmental monitoring is conducted. At the end of this period, the park is either dismantled and the site restored, or the operator may choose to continue operations by replacing some or all of the modules.

2.3 RENEWABLE ENERGY ACCELERATION ZONES (APER LAW)

In the context of energy transition, prioritizing the production of renewable energies is essential for addressing the current climate and energy challenges. To support this priority, the French law n° 2023-175 of March 10, 2023 - known as the APER law - aims to accelerate the development of renewable energy projects by significantly reducing the time required to complete them, with a strong emphasis on self-production to enhance energy independence.

The APER law focuses on speeding up authorization processes for renewable energy projects and ensure the availability of suitable land, especially in areas that are already developed or have minimal environmental impact (WWF, 2023). To facilitate this, the law promotes the creation of Renewable Energy Acceleration Zones, encouraging municipalities to designate specific areas for the development of various projects, such as photovoltaics, wind power, biogas, and geothermal energy.

The APER law was introduced in response to the 2020 European targets for reducing greenhouse gas emissions and increasing the share of renewable energy in the overall energy mix. This legislation aims to facilitate the installation of renewable energy projects and enable France to address the shortfall it experienced in 2020. (Flipo, 2024).

3 IMPACT ASSESSMENT OF PHOTOVOLTAIC PARKS

The construction and operation of photovoltaic parks can significantly impact the local population and habitat, particularly during the construction phase, which typically lasts between six and twelve months for the studied sites. Key concerns include disruptions to access and traffic, noise, dust, and vibrations and the risk of fire accidents for workers and residents. Additionally, the project can alter the landscape and affect local biodiversity. However, careful planning and mitigation measures can minimize these impacts, ensuring the long-term benefits of renewable energy with minimal disruption to the community and environment. On the positive side, these projects can create local jobs and stimulate participation in the local economic activity.

The abundance of sunlight in the south of France makes the area a good place for solar development. While solar PV systems are acknowledged as a means to combat climate change, renewable energy initiatives also raise environmental and equity issues. This section analyses the impacts and measures of mitigation of solar parks based on mainly 3 Impact Studies : Peyroules (2017) - already constructed site, Flayosc (2020) and Sigottier (2022) – not constructed yet. Some references may also relate to the constructed site of Rians. All studies are conducted by Engie GREEN in the Provence-Alpes-Côte d'Azur region of southern France.

3.1 CREATION OF LOCAL JOBS AND PARTICIPATION IN LOCAL ECONOMIC ACTIVITY

Investing in a photovoltaic project generates both temporary and permanent employment opportunities. These jobs are directly related to the construction and operation of the solar park and indirectly support other economic activities. (Mocanu; Mitrică; Persu, 2019) The positive impact of these new job opportunities is debated, as most positions are temporary and primarily filled by local community members with lower and medium skill levels. (Mocanu; Mitrică; Persu, 2019).

Most new jobs created during the construction phase are temporary, with local community members filling these positions. Various skilled trades are required for the project, including equipment operators, electricians, installers, and heavy truck drivers. Specific tasks, such as installing photovoltaic modules and making electrical connections, require specialized qualifications and are assigned to specialized companies, whether local or from outside the area. Other tasks, like clearing and brush removal, can be handled by local businesses. Permanent roles include maintaining the park grounds (such as mowing the lawn and maintaining roads), upkeeping photovoltaic panels and related infrastructure, and providing security for the park.

During the construction phase of a solar park, the presence of numerous workers in the community can stimulate the local economy. This influx of workers can lead to an increased demand for local goods and services, benefiting local businesses and potentially creating new economic opportunities. Local businesses such as restaurants, bakeries, and catering services particularly profit during this time, as construction workers tend to stay in the area during their lunch breaks. At the end of a solar park's operational life, when all equipment is dismantled, this process similarly benefits the local economy.

In the case of the solar park in Flayosc, Sigottier and Rians, the impact study shows that a partnership with a local farmer allowed sheep to graze under the solar panels. The operator, ENGIE Green, committed to providing the farmer with free access to the site and refraining from using phytosanitary products. The farmer, in return, agreed to maintain the pastoral equipment on-site and ensure the biological upkeep of the area, which helped managing vegetation around the photovoltaic installations. At Peyroules, there are also plans to introduce sheep grazing; however, this will only begin once the grass has grown sufficiently.

Figure 4 Sheep grazing on the solar park of Rians

Source : ENGIE Green (2024)

A report of ENGIE Green's construction sites reveals an average of 200 man-days per megawatt, with roughly half of this work being assignable to local companies that do not specialize in renewable energy and can therefore be easily sourced locally.

3.2 IMPACTS ON ACCESS AND TRAFFIC

The construction of a solar park can generate an impact on road access and traffic. During the construction phase, this involves the arrival of trucks and some special transport for delivering electrical stations and certain machinery. However, during the operational phase, traffic is typically minimal, limited to maintenance vehicles using the same access routes as during construction.

To ensure proper access to the site of Flayosc and Sigottier, road signage is planned to be installed around the construction area of the solar parks. This signage marked will be used to access points for construction vehicles and machinery, as well as inform local residents about the ongoing work. Furthermore, there was a commitment to maintaining the surrounding roads in good condition. If the special transport convoys associated with the construction caused damage to public roads, the operator could provide funding for all necessary repairs.

In the case of Flayosc, an access road to the solar park was chosen to avoid passing in front of residential areas. In Sigottier, the nearest residences were located 700 meters north of the solar park study area. Despite this distance, some disturbances were expected at the residences during the construction phase.

Keeping the community informed can also serve as an effective mitigation strategy. Maintain transparent communication with local residents by offering regular updates on construction timelines, traffic modifications, and other pertinent information is a good practice. Additional mitigation measures involve developing traffic management plans, specifying routes for construction vehicles, scheduled delivery times, and alternative routes for local traffic. Scheduling deliveries and construction activities during non-peak hours can help minimize disruption to local traffic. Moreover, avoiding early morning and late afternoon periods can help mitigate traffic congestion during peak travel times.

3.3 IMPACTS CAUSED BY NOISE, DUST AND VIBRATIONS

Noise, dust, and vibrations are significant concerns that can affect both the local environment and the well-being of nearby communities. The construction phase generates noise and vibrations from construction vehicles and assembly work, including the installation of screws, structures, and modules. Dust emissions are also likely, particularly during dry periods. Residences that are close to the site will be most affected by these effects. During the operational phase, the solar park does not produce vibrations. Occasional maintenance vehicles may cause minor dust during dry and windy conditions, but these emissions tend to be minimal. As a fixed installation, the solar park generates minimal noise, with the only sound emanating from technical equipment.

Based of the sites of Flayosc, Sigottier ans Peyroules, there are some mitigation measures that can be implemented on solar parks:

Noise

1. **Use of low-noise equipment**: Employ machinery and vehicles specifically designed to operate at reduced noise levels. Regular maintenance ensures these machines continue to function quietly
2. **Noise barriers**: Install technical equipment (transformers, inverters, fans) in shelter-type enclosures to reduce noise propagation.
3. **Scheduling and restrictions**: Limit noisy construction activities to daytime hours and avoid weekends and public holidays. For example, restricting working hours to 7:00 AM to 6:30 PM.

Dust

1. **Water Systems**: Use water sprinklers on-site to moisten dry areas as needed, especially during dry and windy conditions. Install a spraying system on access roads to limit dust dispersal.
2. **Speed restrictions**: Limit the speed of machinery and vehicles on-site to 30 km/h to enhance safety and minimize dust emissions.
3. **Vegetation and ground cover**: Plant vegetation or apply ground covers on exposed soil to stabilize it and reduce dust.
4. **Regular cleaning**: Implement regular cleaning of solar panels and surrounding areas to prevent dust accumulation if necessary.

Vibrations

1. **Construction methods**: Utilize mechanical construction methods that do not involve explosives to minimize vibrations.
2. **Machinery restriction:** Limit the number of machines on-site to reduce noise and vibrations.

Engaging in community communication also serves as an effective mitigation measure. Keeping local residents informed about the construction timeline and anticipated noise, dust ou vibrations levels is crucial. Regular updates can help manage their expectations and minimize community dissatisfaction.

3.4 FIRE ACCIDENTS

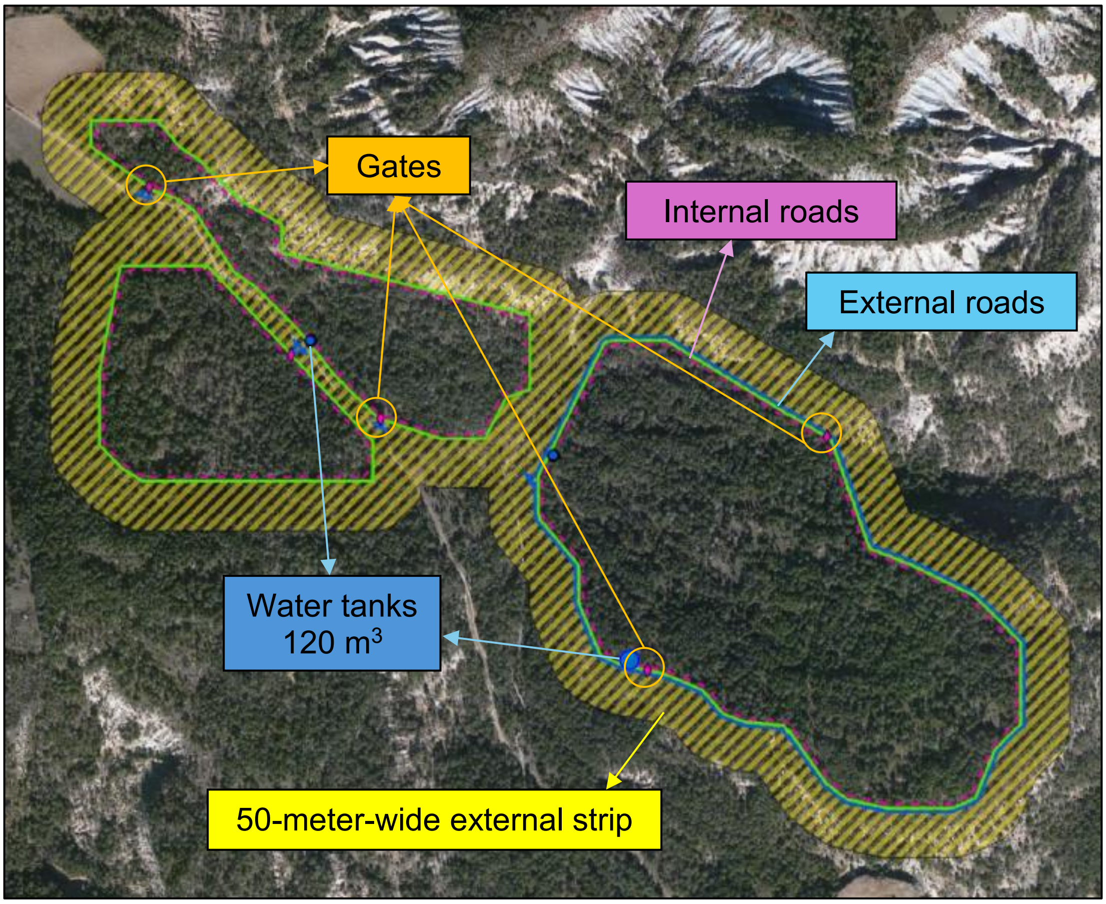
Fire accidents is a significant safety concern due to the increasing adoption of photovoltaic technology. During construction, there is a potential fire risk due to the presence of fuel-powered machinery and human activity on the site (e.g., cigarettes). This risk is higher when there's wooden areas surrounding the site. As an electrical installation, the solar park carries fire risks also during the operational phase. Potential sources of fire include:

- Electrical fires originating from transformer stations.
- Electrical fires from the delivery station.
- Fire propagation following transformer explosions.
- Short circuits from photovoltaic modules.
- Fires caused by human activities.

Improper installation and inadequate maintenance practices can significantly increase the risk of fire. Issues such as poor electrical connections, inadequate spacing between panels, and failure to follow safety guidelines can create conditions conducive to fire outbreaks. (White; Doherty, 2017) Fire risk in PV installations can be assessed and mitigated by adhering to guidelines such as those provided by the Departmental Fire and Rescue Service (SDIS) of France. These guidelines aim to compile and propose a wide range of techniques, enabling each SDIS to develop its own departmental doctrine.

The guidelines recommend thorough inspections and maintenance, minimum widths for internal and external roads, the number and capacity of water tanks required for the project, specifications for gates, areas that should be cleared to reduce fire spread risk, spacing between PV panels, and designated turnaround and suction areas for firefighting purposes. These measures should be adjusted based on SDIS recommendations during the review process.

Figure 5 Fire risk measures foreseen in the Peyroules impact assessment (2017)



Source: adapted from Peyroules impact assessment (2017)

In Peyroules, a key measure involved establishing a 4-meter wide firebreak within the park, encircling the sections. Adequate spacing between rows was provided to allow vehicle passage. Delivery stations are placed at the public road edge, with transformation stations positioned behind accessible rows. Turnaround areas were created outside the park. The *Obligation Légale de Défrichement (OLD)* was implemented, creating a 50-meter-wide external strip starting from the fence. Two 120 m^3 fire water tanks were installed, accessible from outside the park. Additionally, cables were buried, and safety instructions along with emergency contact numbers were displayed.

3.5 LANDSCAPE

The landscape represents the connection between a site's natural features and the human activities associated with the economic use of that territory. It is a complex relationship that encompasses the natural elements shaping the landscape and the human events that have influenced its use based on societal needs. (WWF, 2023)

The landscape study of an impact assessment aims to create a detailed initial assessment of the landscape and heritage to identify the key issues and sensitivities of these areas, while considering social perceptions and representations of the landscape. (Territoires & Paysages, 2024) The landscape assessment's goal is to identify the key issues related to the territory and site-specific issues, incorporate them into the project approach, and then evaluate the effects and recommend measures to be implemented.

The company conducting the landscape assessment aims to advise the project owner on the best approach to project development. The study's findings evaluate the project's feasibility by identifying sensitive areas and guide project adaptations in response to these findings. The assessment highlights areas with minimal constraints, zones suitable for development under specific conditions, and regions that should be preserved. Additionally, the study offers recommendations for actions to eliminate, reduce, or, if necessary, compensate for any remaining negative impacts.

The landscape assessment of a solar park considers various factors, with the visual impact of deforestation being a key element. Deforestation alters the landscape's visual character across all three scales of analysis by creating a noticeable gap in the forested area, which changes the site's visual perception. From a distant view, deforestation modifies the site's appearance by changing its tone and texture, as the disappearance of tree canopies is replaced by exposed soil. In close proximity, deforestation increases ground-level light penetration which can alter perceptions depending on the surrounding vegetation.

3.5.1 LANDSCAPE SENSIBILITIES WHILE PLANNING A SOLAR PARK

The project developer should consider existing landscape structures and identified sensitivities when planning the installation.

3.5.1.1 PANELS

The arrangement of solar panel rows should align with the natural contour lines to improve landscape integration. Landscape features can be emphasized by varying the spacing between the panel arrays and adjusting their density, depending on the terrain, surrounding vegetation, and land use. The solar panels are usually tilted at a 20° angle, with usually a maximum height of 3 meters. They are mounted on steel profiles that form a supporting structure, giving the entire setup a lightweight appearance. The supporting elements and the underside of the tables are made of galvanized steel, initially a light gray color. The perceived color is slightly influenced by the surrounding environment, such as grasses, plants, and bare earth. The undersides and structures beneath the panels remain shaded, making them appear relatively dark. The top of the tables, exposed to sunlight, consists of photovoltaic cells encased under clear glass panels framed in aluminum. The cells are blue or navy blue, and the glass is clear, reflecting the color of the sky. Depending on the observer's position and the angle of the sun relative to the panel, the perceived color can range from white (under specific conditions with the observer and sun directly south) to moderately dark blue, with light blue/gray being the most common appearance.

3.5.1.2 STATIONS

For stations, materials and colors are selected to harmonize with the local environment. The delivery station and other technical buildings may be clad or painted in colors that blend with their surroundings. These stations are built from standard prefabricated modules, equipped with one or more access doors and several ventilation grills. For these projects, a galvanized steel gray color is usually chosen to better integrate with the surroundings.

3.5.1.3 FENCE AND GATES

If fencing is required, the preference is for local wood posts and mesh that visually integrates into the landscape (like a green color). The solar park's fencing usually consists of twisted wire mesh attached to uniformly colored posts, making them noticeable at close and immediate distances. The gates and related structures, measuring usually between 4-7 meters wide and constructed from steel profiles, are larger and more visible from a distance compared to the fences, which tend to fade from view.

3.5.2 SCALES OF ASSESSMENT

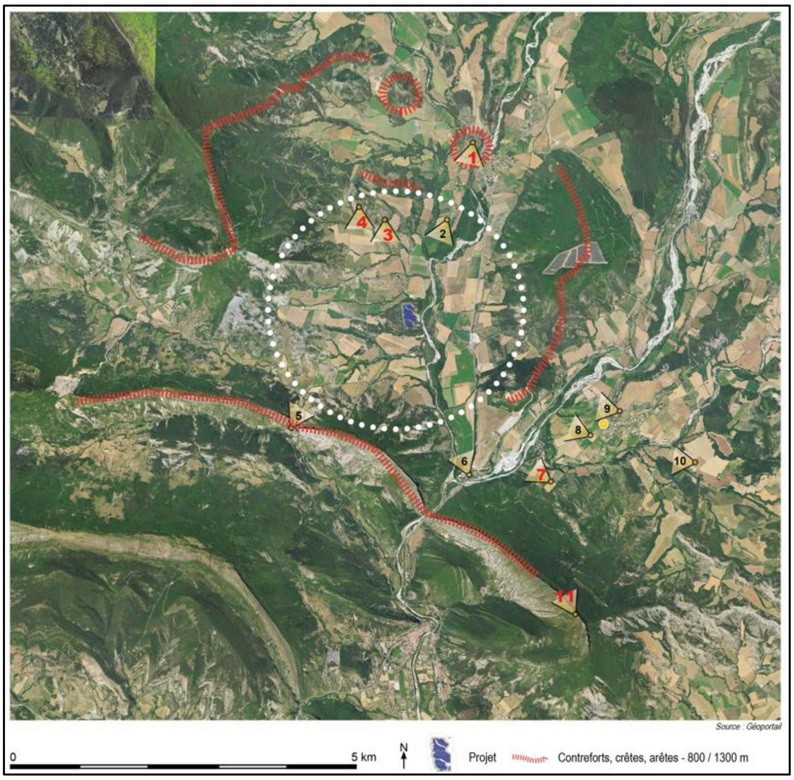
The landscape assessment is conducted at three different scales: immediate, nearby, and distant, each corresponding to distinct study areas. The company responsible for the landscape study determines these three areas, ensuring that they follow the general methodology used for the assessment study.

1. **Immediate Study Area:** This area covers the specific location where the project could be developed. At a minimum, it includes a regulatory 50-meter radius zone that must be left around the fence of the photovoltaic park.
2. **Nearby Study Area:** This zone ranges from a 50 meters to 5 kilometers radius around the potential project's immediate area, depending on the specific study needs. It includes important landscape features and visibility-sensitive points such as main roads, significant sites, residential areas, and key tourist and heritage locations.
3. **Distant Study Area:** This area typically covers a radius of 5 to 15 kilometers around the potential site for the solar park. It extends further to include large landscape units, areas of cultural or historical significance, key interest points, distant perceptions, and major transportation routes.

Figure 6 Immediate Study Area

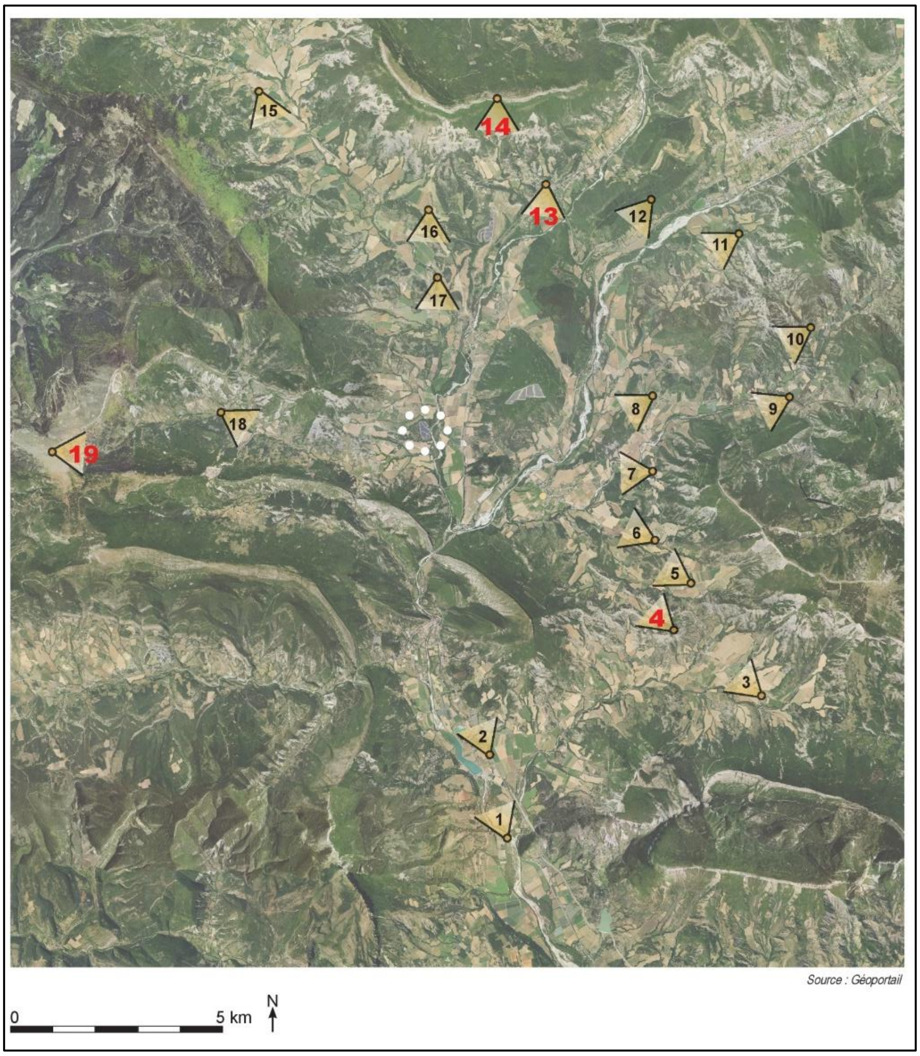
Source: Sigottier's Impact Study

Figure 7 Nearby Study Area



Source: Sigottier's Impact Study

Figure 8 Distant Study Area



Source: Sigottier's Impact Study

3.5.3 KEY COMPONENTS OF A LANDSCAPE STUDY

Different aspects should be included in the landscape assessment. It includes a comprehensive analysis of relevant landscape framework documents. For France, this includes examining regulatory documents such as the Territorial Coherence Plan (SCoT) guidelines and the Local Urban Plan, with a focus on their landscape expectations. The assessment should also analyze both static and dynamic elements of the landscape, encompassing natural features like topography, vegetation, and water bodies, as well as human-made components such as buildings, infrastructure, heritage sites, and land uses. Understanding these elements is crucial for capturing the character and structure of the landscape where the project will be situated. Moreover, the assessment should include all known current elements, such as existing solar parks, other renewable energy installations, and areas influenced by human activities.

Overall, the analysis of the landscape impacts includes several key aspects:

⇒ Assess how the site's topography affects visibility from major travel routes and distant viewpoints.

⇒ Determine the visibility of the site from key roads.

⇒ Analyze the extent to which the site is visible from nearby hiking trails, considering the obstructive effect of surrounding woodlands.

⇒ Evaluate the visibility of the site from inhabited areas, with a focus on understanding the visual impact on local communities.

⇒ Assess the impact of the site's visibility on nearby historical and cultural sites.

⇒ Conduct photographic documentation and visual simulations to illustrate the site's visibility from key viewpoints and to aid in assessing visual impacts.

⇒ Study the role of existing vegetation in obscuring or revealing the site from various viewpoints, including potential visual impacts during different seasons.

⇒ Explore potential measures to mitigate visual impacts, such as strategic planting, adjusting the site layout, or altering the colors and materials of structures.

Based on the site's location and visitor frequency, appropriate measures might include creating community gathering spaces such as shared gardens, playgrounds, and picnic areas. Additionally, developing hiking trails with informational signage related to energy transition, site-specific features, and the solar power facility can enhance public engagement. Measures can also focus on the project area itself, particularly in areas that were avoided during construction, with an emphasis on ecological restoration, especially for degraded or polluted sites. (WWF, 2023) Specifically for the Flayosc site, the preservation of a wooded area between the departmental road and the park was adopted, as well as the reduction of the footprint on the site's edges were prioritized to limit views and maintain the tranquility of the identified group of residences.

4 SOCIAL CONSIDERATIONS

4.1 SOCIO-POLITICAL ACCEPTANCE

In the 1980s, when policy programs for renewable energy technology began, the importance of social acceptance was mostly overlooked. Many developers, such as energy companies, authorities, and private local investors, assumed implementation would not be an issue, as initial surveys on public acceptance, especially for wind power, showed strong support for the technology. (Wüstenhagen; Wolsink; Bürer, 2007)

Despite ambitious government goals to boost the proportion of renewable energy in many countries, it is becoming evident that achieving these targets may be limited by social acceptance. According to Wüstenhagen et al. (2007), there are three dimensions of social acceptance: socio-political, community, and market. Although this study concentrates on community acceptance, it is essential to recognize that all types of social acceptance play an important role.

Figure 9 The triangle of social acceptance of renewable energy innovation

Source: Wüstenhagen; Wolsink; Bürer (2007)

(1) Socio-political acceptance represents the broadest and most general form of social acceptance. At this level, it involves the approval of key stakeholders and policy actors towards effective policies. This form of acceptance encompasses several dimensions: Acceptance of technologies and policies; acceptance by the public; acceptance by key stakeholders; acceptance by policymakers (Wüstenhagen et al. 2007).

(2) Community Acceptance refers to specific acceptance of renewable energy projects by local communities directly affected by these projects, which include decision-makers, local stakeholders, and residents, towards proposed energy infrastructure projects. (Salehi; Mirzakhani; Schelly, 2023)

(3) Market Acceptance examines the reactions of current and potential users, such as consumers, investors, and businesses, to the availability and demand for energy technologies (Salehi; Mirzakhani; Schelly, 2023)

4.2 PUBLIC ENGAGEMENT AND COMMUNITY ACCEPTANCE

A study by Hanger *et al.* (2016) conducted in Ouarzazate, Morocco with 232 people living less than 20, 40 and 60 km from the “Noor I” power plant revealed that 92% of respondents anticipated either positive or neutral environmental impacts from solar power, viewing it as fundamentally beneficial compared to traditional fuel sources. The primary source of information about the plant for most individuals (approximately 47%) was family and friends, followed by mass media at around 40%. Information from public authorities was significantly less influential, with only 4.5% of respondents citing it as a source. Despite the availability of these information channels, 45% of the local population felt inadequately informed, reporting that they were either poorly or not at all informed about the project. Additionally, 75% of respondents expected the project to have very or somewhat positive socio-economic impacts.

Interestingly, the study found that less informed individuals tended to have a more positive outlook on the solar project. This result suggests that an overload of information in the early stages of the project could potentially foster greater opposition. However, existing literature, primarily from case studies in Europe and North America, indicates that this strategy of limited early information could be risky. If unforeseen negative impacts emerge, this could lead to significant backlash and intensified opposition in the future. Therefore, public awareness and acceptance are most important and effective during the planning and initial construction phases of infrastructure projects. Once the power plant becomes operational, influencing public perception becomes considerably more challenging.

Wolsink (2007) illustrates that the usual trend of local acceptance for a project follows a U-curve, starting with high acceptance, dropping to relatively low acceptance during the siting phase, and then rising again to high acceptance afterwards. Individuals mainly concern is about the aesthetics and perceived safety of the systems (Lo *et al.*, 2018)

In order to achieve community acceptance, it is essential to involve various stakeholders in the planning, development, and management of renewable energy projects. Including local communities in the governance of these projects can foster community acceptance and help prevent construction delays. (Modikela Nkoana, 2018)

Some authors say that opposition to certain projects arises because individuals support renewable energy only when it is not located “in their own backyard”. Unlike fossil or nuclear energy, which remains largely unseen in daily life due to its extraction occurring below the earth’s surface, renewable energy installations generate power in a more visible manner. This often results in renewable energy conversion taking place nearer to the energy consumers' homes ("in their backyard"), thus increasing its visibility and making the environmental impact more apparent to local residents. (Wüstenhagen; Wolsink; Bürer, 2007) Much of this opposition stems from the insufficient involvement of local communities in the planning process. (De Sena; Ferreira; Braga, 2016) This highlights the necessity of considering the socio-economic and cultural characteristics of the population when developing compensation schemes or strategies to address “Not In My Back Yard” conflicts.

Low carbon energy projects are frequently situated on land and within communities that have been degraded by previous fossil fuel infrastructures. These areas, which have become inexpensive and easily exploitable, are often linked to historical social deprivation or are located near protected indigenous lands. (Sankaran *et al.*, 2022) Yalamala *et al.* (2023) gives an example of the relationship between indigenous community with energy projects: it depends not only on developing trust and long-term relationships with community, but also sharing social and environmental benefits of these projects. To successfully design and execute with indigenous communities, it is crucial to interact in culturally respectful ways that acknowledge treaty rights, celebrations, and traditional hunting and fishing practices. Community partners need to collaborate with stakeholders and energy developers, aligning on shared cultural values and project expectations.

4.3 SOCIO-ECONOMIC CONTROVERSY

The potential of renewable energy projects has often been described positively, highlighting their ecological and social advantages over fossil fuels. Yalamala et al. (2023) highlight that collaborations in renewable energy have provided First Nations with both economic advantages and social gains. These initiatives have played a significant role in restoring land rights, improving land management systems, and promoting self-reliance. Moreover, energy projects offer significant economic opportunities that help communities achieve independence from colonial institutions and promote self-sufficiency.

The surplus funds generated for local budgets could be used to finance several investment projects, including upgrading communal roads, modernizing schools, and completing the water supply network for households and supporting the energy needs of the community.

However, some authors express concerns regarding who actually reaps the benefits from the use of solar and wind power. Ryder et al. (2023) present a perspective noting skepticism among some interviewees in the UK regarding how 'community' benefits allocated to local governments might be managed and distributed. This sentiment was shared across various communities, where there was a lack of clarity about who would receive the benefits and how they would be distributed. There were concerns that if incentives were directed to local governments rather than individual households, it might not be clear who in the community would truly benefit.

From an ethics of care perspective, the priority changes from the rapid advancement of proposed projects to ensuring the protection of people and the environment. Achieving meaningful and effective engagement involves developers changing their approach to relationships with local host communities. An important aspect of this is ensuring that developers are deeply and genuinely committed to community engagement. This commitment can lead to innovative efforts that go beyond the bare minimum, enhancing the decision-making processes for energy infrastructure. (Ryder *et al.*, 2023)

PART 3 : CASE STUDY AND RESULTS

5 DLVA FRENCH CASE STUDY

5.1 TERRITORY CONTEXT AND STRATEGY

The Durance Luberon Verdon Agglomeration Community (DLVAgglo) is an agglomeration community in France, founded on November 16, 2012 (DLVA, 2024). According to Légifrance (2024), an agglomeration community is a public establishment that facilitates cooperation among multiple municipalities, forming a connected area with no gaps, having a population of over 50,000 people when it started, centered around one or more core municipalities with populations over 15,000.

Figure 10 Presentation of the DLVAgglo territory

Source: DLVA (2021)

DLVAgglo is situated within the Alpes-de-Haute-Provence and Var departments, in the Provence-Alpes-Côte d'Azur region of France. It represents one of the two agglomeration communities in Alpes-de-Haute-Provence. The agglomeration consists of 25 municipalities: Allemagne-en-Provence, Brunet, Corbières-en-Provence, Entrevennes, Esparron-de-Verdon, Gréoux-les-Bains, La Brillanne, Le Castellet, Manosque, Montagnac-Montpezat, Montfuron, Oraison, Pierrevert, Puimichel, Puimoisson, Quinson, Riez, Roumoules, Saint-Laurent-du-Verdon, Saint-Martin-de-Brômes, Sainte-Tulle, Valensole, Villeneuve, Vinon-sur-Verdon, and Volx.

Beyond its intercommunal ambition for energy autonomy through sobriety, efficiency, and the development of renewable energies, DLVAgglo must contribute to achieving regional objectives set by the Regional Plan for Development, Sustainable Development, and Territorial Equality (SRADDET), as well as the broader national goals, considering territorial amenities. As the potential for renewable energy generation in the south of France is primarily dominated by solar resources, DLVAgglo is prioritizing the development of photovoltaic systems.

The energy transition involves comprehensive changes in how energy is produced, distributed, and consumed within a territory to make the system more environmentally friendly. Effective management of this development is crucial because the landscapes of DLVAgglo are a valuable heritage and resource that people cherish. The goal is to integrate the development of the photovoltaic energy with the preservation of landscapes and biodiversity. During the inaugural session for the launch of workshops of this subject, various individuals expressed their desire to have a direct exchange with DLVAgglo officials regarding this territorial energy development strategy.

In its efforts to achieve an energy transition while preserving landscapes and biodiversity as well as integration the public into the participation, DLVAgglo initiated a plan: the Landscape and Energy Transition Plan. This plan is a collaborative project designed to engage residents, users, and developers in collaborative reflection to develop appropriate adaptation strategies that preserve the quality of the environment. The aim was to co-create a well-managed energy transition with the citizens of DLVAgglo, identifying the least impactful areas for installing photovoltaic panels in terms of landscape and biodiversity.

Mayors of the 25 municipalities in DLVAgglo have launched a detailed analysis of landscapes and biodiversity. The Landscape and Energy Transition Plan utilized a range of criteria to identify potential zones for photovoltaic panel installation and areas where such installations would be restricted. An initial assessment was carried out on municipal lands to pinpoint suitable locations for the photovoltaic industry. This identification process took into account biodiversity, landscape, heritage, agricultural, and forestry concerns. To further analyze these designated areas, residents of the 25 municipalities were invited to participate, regardless of their age, gender, or occupation.

Knowing that public participation is crucial for a successful energy projects, a wide-ranging consultation, led by the National Commission for Public Debate, began in mid-December 2022 with an online questionnaire to gather feedback from the community. Between the next 20 months, several key activities took place:

1° An online survey to gather public opinions
2° A dedicated email address for inquiries
3° Mobile debates held in the markets of four communes (Manosque, Riez, Oraison, and Vinon) to inform citizens and invite them to contribute to the discussion
4° Four voluntary workshops for deeper participation in the study
5° Two on-site observation days with experts and operators

5.2 RESULTS

The community within DLVAgglo has demonstrated a significant interest in the Energy Transition, with strong support from local associations focused on biodiversity and landscape conservation. This interest reflects a broad awareness among all stakeholders, including the general public, of the crucial role that renewable energy and environmental preservation play in the region's future. Photovoltaic energy is generally accepted by the community, but this acceptance comes with conditions that emphasize transforming potential challenges into opportunities, such as through agrivoltaic systems that combine solar energy production with agricultural activities.

The landscape, as a concept, is closely tied to the community’s understanding of nature and its preservation. The significance of the landscape is recognized not merely for its aesthetic value but for its deeper ecological and cultural importance.

Social acceptability of photovoltaic installations is, therefore, linked to their broader societal benefits and their integration into the landscape in a way that respects these values. There is a clear expectation for a strategic and thoughtful approach to integrating photovoltaic systems into the landscape. This approach should be rational and adaptable, prioritizing the preservation of biodiversity, natural and built heritage, and the territorial identity of DLVAgglo, with the potential to even enhance these aspects. While there is no strict opposition to large PV installations, these must be carefully planned to avoid unnecessary fragmentation of the landscape.

Forested areas hold significant value for the community, and there is a consensus that deforestation for renewable energy projects is an "ecologically nonsensical" and poses social feasibility challenges. Instead, the community advocates for the development of solar energy in areas already impacted by human activity. The strategy should prioritize the use of already developed or degraded areas, such as parking lots, industrial sites, and unused agricultural zones, for new solar projects. This approach would minimize further environmental degradation and create opportunities for landscape restoration.

In line with this, there is a collective desire to preserve landscapes by safeguarding them from human impact. This can be achieved through controlled urban development, and minimizing visual pollution. The community expressed concerns about the inadequate integration of power lines and photovoltaic panels into the landscape. Poorly managed expansion, particularly of photovoltaic systems, and their insufficient integration into the landscape are perceived as contributing to environmental degradation. Therefore, locals emphasized the need to harmonize human activities with the preservation of natural landscapes.

Biodiversity preservation also emerged as a concern, with many community members actively engaged in efforts to protect local ecosystems. However, over a third of the community feels that they lack sufficient information on biodiversity issues and practical preservation techniques. There is a strong demand for clear, practical information that enables individuals to contribute positively to the preservation of biodiversity in their immediate surroundings and the broader DLVAgglo area. Additionally, residents expressed a desire to be more actively involved in projects managed by local authorities. There is a preference for formats that encourage active engagement, such as workshops, training sessions, public debates, and newsletters, with an emphasis on ensuring that information is both locally relevant and easily accessible.

The energy transition is recognized as unavoidable, necessitating proactive and well-considered planning. Optimizing the development of renewable energy projects is important, particularly by utilizing already developed areas for new solar installations. Updating the conditions for the sale of green electricity and advancing recycling processes for renewable energy infrastructure are also seen as something important. Moreover, there is a recognized need for shifting lifestyles and consumption habits towards greater sustainability, with a particular focus on transportation and the adoption of alternative methods to reduce environmental impact.

The shift from planning to implementation also raised concerns. There is a perception of insufficient information regarding the initiatives undertaken for the energy transition, particularly at the local municipal level and even more so at the intermunicipal level. This lack of information is a significant barrier to effective action. The notion of delegating the development of renewable energy to the private sector is not well understood. Locals of the DLVA agglomeration advocated for removing barriers to enable local governments to invest in and manage these projects. Innovation, creativity and citizen involvement are seen as crucial in advancing the PV field, particularly in harmonizing photovoltaic systems with the landscape and enhancing its aesthetic and functional value.

6 RESULTS

Engaging local communities in the planning and development of photovoltaic projects is essential for fostering social acceptance and ensuring that the benefits of such projects are understood and appreciated. Effective community engagement involves inclusive decision-making, transparent communication, and addressing the specific needs and concerns of the community. This section aims to propose an applicable methodology for developers to enhance local community acceptance of PV projects.

<u>Site Selection</u>

1. **Social and environmental concerns:** Ensure that the project addresses social and environmental concerns in the impact study, such as preserving local biodiversity and minimizing visual impact. Respect local customs, traditions, and historical sites to maintain community harmony.
2. **Stakeholder feedback:** Collect feedback from local residents to understand perceived visual impacts and address concerns related to the site's visibility in relation to the project.
3. **Land use:** Prefer the use of previously developed land through thoughtful site selection in collaboration with local authorities to minimize environmental disruption.
4. **Economic opportunities:** Prioritize hiring local labor for the construction and maintenance of the PV park. Provide training and certification programs to enhance local employment prospects and foster a sense of ownership and pride in the project.

<u>Inform and train local stakeholders:</u>

5. **Transparent communication :** Ensure transparent and consistent communication with the community throughout the entire lifecycle of the project. This involves providing regular updates on project progress and offering clear information about the project's benefits and potential impacts.

6 **Empower communities:** Empower communities with the necessary knowledge and skills to engage in the decision-making processes. Allocate a local engagement budget proportional to the project's risk/return ratio and size to:
   a. Host regular information sessions to educate the community about solar technology, energy conservation, and related topics.
   b. Conduct workshops on renewable energy and sustainability
   c. Organize site visits.

7 **Ensure accessibility of information:** Ensure information related to the project is widely available and easily accessible to the public. This can be done by maintaining open communication channels and creating a dedicated website for project updates.

<u>Involve and consult local stakeholders in decisions:</u>

8 **Early community involvement:** Involve community members in the early stages of project planning. Avoid giving specific information too early to prevent unnecessary concerns. Use public meetings, workshops, and forums for community members to voice their opinions and concerns.

9 **Co-develop solutions:** Incorporate community input into project design to co-develop solutions that address local needs and preferences.

10 **Conduct surveys and assessments:** Tailor the project to meet local needs by conducting surveys and assessments to understand the community's priorities and incorporate their feedback into the project design and implementation. Use information and communication technologies to facilitate the process of consultation, such as electronic surveys.

11 **Collaborate with local governments:** Work with local governments to identify key priorities and determine how the project's revenue benefits will be distributed locally.

12 **Ensure diverse representation:** Ensure diverse representation from various community groups, including minority groups and vulnerable communities, to address a wide range of perspectives.

13 **Identify key stakeholders:**

i. Engage with local councils to understand the community network and identify key stakeholders.
ii. Speak to local organizations to gather insights and build connections.
iii. Reach out to residents within a pre-defined radius (e.g. 10km-15km) to ensure comprehensive community engagement.

7 LIMITS

This section addresses the limitations encountered in this study. This study considered the impact assessments of a single company located in the Provence-Alpes-Côte d'Azur (PACA) region in southern France. However, different impacts and measures might emerge if other geographical locations are considered. Additionally, the study do not take into account Agrivoltaics and Floating Solar technologies.

8 CONCLUSION

Engaging communities in meaningful decision-making processes is essential for the successful development of photovoltaic projects. Developers must maintain clarity and transparency, avoiding unrealistic promises, and should address community acceptance proactively from the beginning of project development rather than reacting to problems as they arise. It is important for all departments, such as construction and engineering, to understand the importance of these actions to avoid contradictions between development recommendations and actual implementation.

This study proposes a community engagement methodology that integrates **site selection**, **informing and training local stakeholders** as well as **involving and consulting** them in decisions.

When selecting a site for photovoltaic projects, it is important to address social and environmental concerns by preserving local biodiversity, respecting cultural traditions, and minimizing visual impact. Engaging local residents for feedback on these issues helps ensure their concerns are addressed on impact studies. Prioritizing the use of previously developed land can reduce environmental disruption, while hiring local labor can enhance employment opportunities and foster community pride in the project.

To effectively inform local stakeholders in photovoltaic projects, it is essential to maintain transparent and consistent communication throughout the project's lifecycle, providing regular updates and clear information on its benefits and impacts. Empowering communities with the necessary knowledge and skills through information sessions, workshops, and site visits enables them to participate meaningfully in decision-making. Making project-related information widely accessible via open communication channels and a dedicated website ensures that the community stays informed.

The process of involving and consulting local stakeholders begins with early community involvement through public meetings, workshops, and forums, allowing members to voice concerns and contribute ideas. Incorporating community input into project design helps co-develop solutions that reflect local preferences. Surveys and assessments further tailor the project to meet local priorities, while collaboration with local governments ensures that revenue benefits are distributed appropriately. Ensuring diverse representation and identifying key stakeholders through engagement with local councils and organizations also ensures a comprehensive and inclusive approach.

Currently, in France, citizens can participate in PV development through public inquiries, which inform the Prefect's decision-making process. They also have opportunities to engage in locally governed projects, such as the DLVA. To achieve sustainable development and address challenges, the strategy employed by DLVAgglo in the south of France could serve as a model for other countries to enhance local acceptance of solar park developments. This methodology aims to integrate local community participation, by (1) identifying suitable areas for solar park development considering not only technical aspects, but also biodiversity and landscape integration and (2) informing, involving and consulting local actors in the decision of these suitable areas for PV development. This was done by carrying out an online survey to gather public opinions, a dedicated email address for inquiries, mobile debates held in markets to inform citizens and invite them to contribute to the discussion, four voluntary workshops for deeper participation in the study and two on-site observation days with experts and operators.

Moreover, ensuring the representativeness of public participation is vital. Participants must feel sufficiently numerous and legitimate to identify notable entities within the territory and provide informed opinions on future photovoltaic installation placements. A high level of participation is necessary to ensure that responses are representative.

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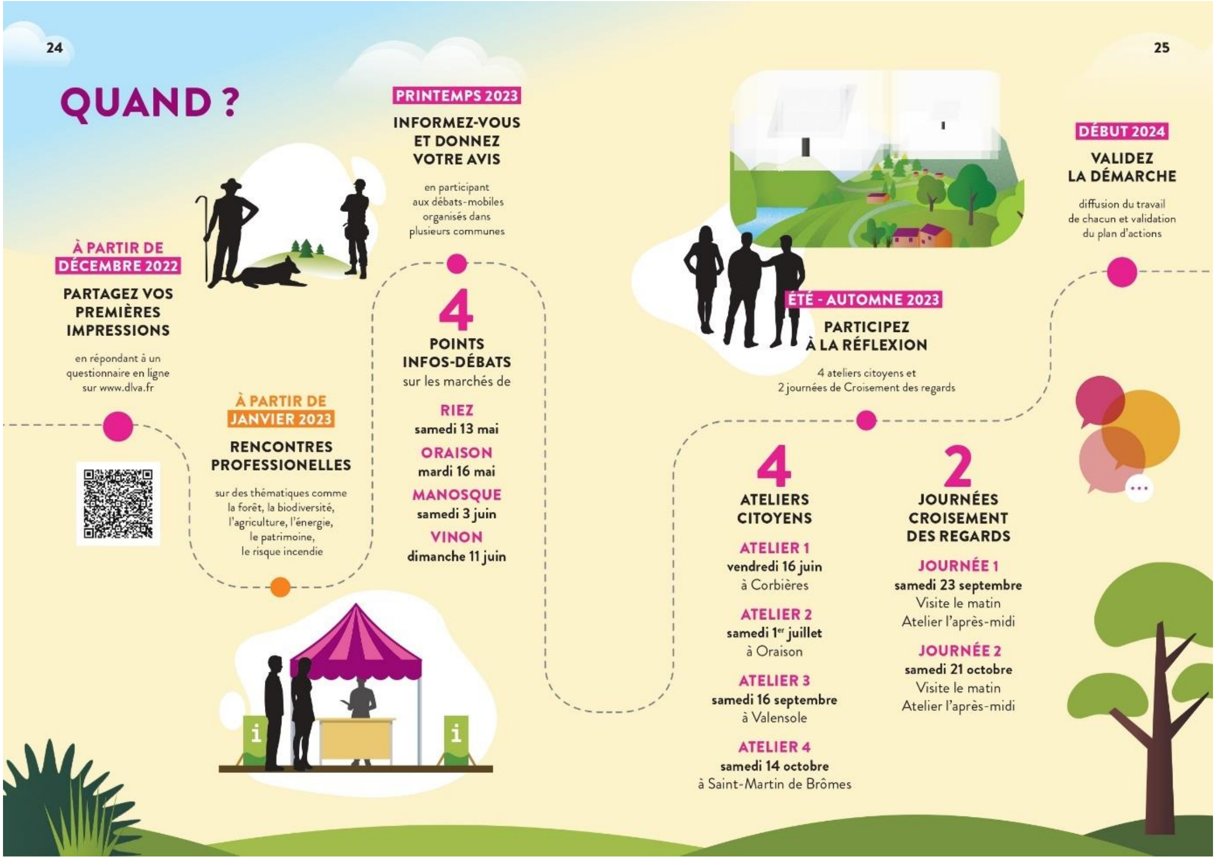
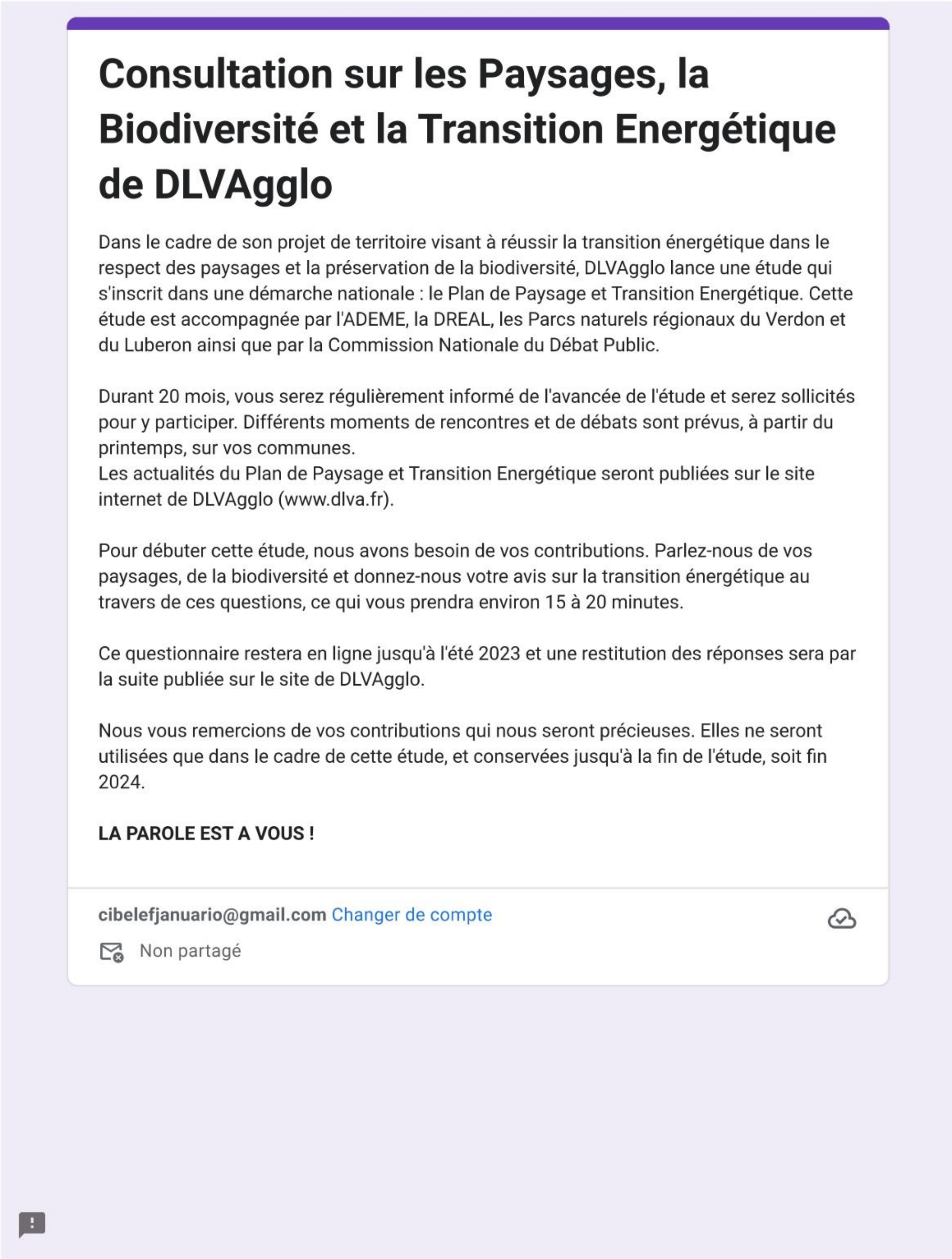
10 APPENDICES

I) DLVAgglo timeline



II) Consultation on Landscapes, Biodiversity, and Energy Transition of DLVAgglo



Consultation sur les Paysages, la Biodiversité et la Transition Energétique de DLVAgglo

Dans le cadre de son projet de territoire visant à réussir la transition énergétique dans le respect des paysages et la préservation de la biodiversité, DLVAgglo lance une étude qui s'inscrit dans une démarche nationale : le Plan de Paysage et Transition Energétique. Cette étude est accompagnée par l'ADEME, la DREAL, les Parcs naturels régionaux du Verdon et du Luberon ainsi que par la Commission Nationale du Débat Public.

Durant 20 mois, vous serez régulièrement informé de l'avancée de l'étude et serez sollicités pour y participer. Différents moments de rencontres et de débats sont prévus, à partir du printemps, sur vos communes.
Les actualités du Plan de Paysage et Transition Energétique seront publiées sur le site internet de DLVAgglo (www.dlva.fr).

Pour débuter cette étude, nous avons besoin de vos contributions. Parlez-nous de vos paysages, de la biodiversité et donnez-nous votre avis sur la transition énergétique au travers de ces questions, ce qui vous prendra environ 15 à 20 minutes.

Ce questionnaire restera en ligne jusqu'à l'été 2023 et une restitution des réponses sera par la suite publiée sur le site de DLVAgglo.

Nous vous remercions de vos contributions qui nous seront précieuses. Elles ne seront utilisées que dans le cadre de cette étude, et conservées jusqu'à la fin de l'étude, soit fin 2024.

LA PAROLE EST A VOUS !

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Consultation sur les Paysages, la Biodiversité et la Transition Energétique de DLVAgglo

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« Paysage » désigne une partie de territoire telle que perçue par les populations, dont le caractère résulte de l'action de facteurs naturels et/ou humains et de leurs interrelations.

Définition officielle du Paysage selon la Convention Européenne du Paysage de Florence, 2000

Et pour vous, que représente le Paysage ?

Votre réponse

Quelle importance a le Paysage pour vous ?

De façon générale :

- ○ Forte
- ○ Moyenne
- ○ Faible

Pour le territoire de DLVAgglo :

- ○ Forte
- ○ Moyenne
- ○ Faible

Dans votre quotidien, autour de vous :

- ○ Forte
- ○ Moyenne
- ○ Faible

Quels seraient les 3 éléments positifs de vos Paysages ?
Ce qui les rend appréciables, qui vous plaît plus particulièrement...
Merci de noter un mot à chaque réponse.

Mot 1

Votre réponse

Mot 2

Votre réponse

Mot 3

Votre réponse

Vous pouvez développer...

Votre réponse

Quels seraient les 3 éléments négatifs de vos Paysages ?
Ce qui les abîme, qui les dévalorise...
Merci de noter un mot à chaque réponse.

Mot 1

Votre réponse

Mot 2

Votre réponse

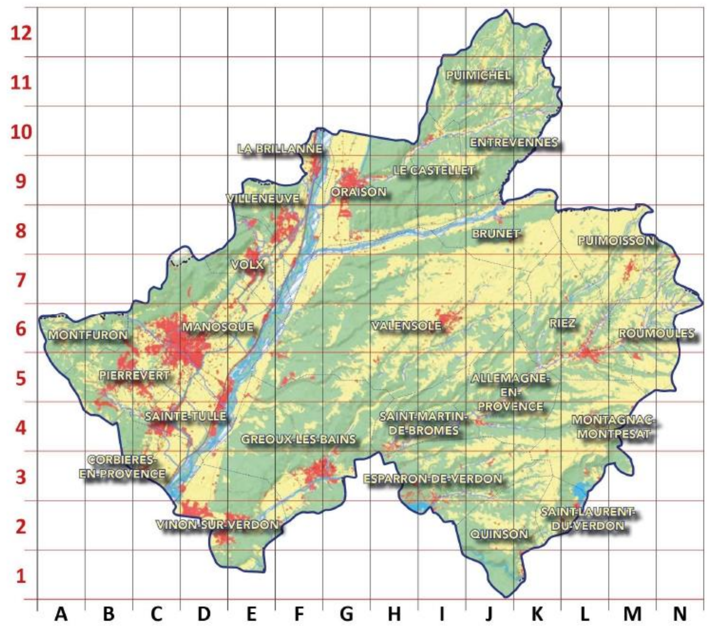
Mot 3

Votre réponse

Vous pouvez développer...

Votre réponse

Pouvez-vous repérer 3 lieux que vous aimez plus particulièrement sur le territoire de DLVAgglo ?
A l'aide de la carte ci-dessous, merci d'indiquer les coordonnées de chaque lieu : une case, un lieu.
Par exemple : B4.
Pour votre information, sont représentées en rouge les espaces "urbains", en jaune agricoles, en vert naturels, en bleu les rivières et étendues d'eau.



Lieu apprécié 1

Votre réponse

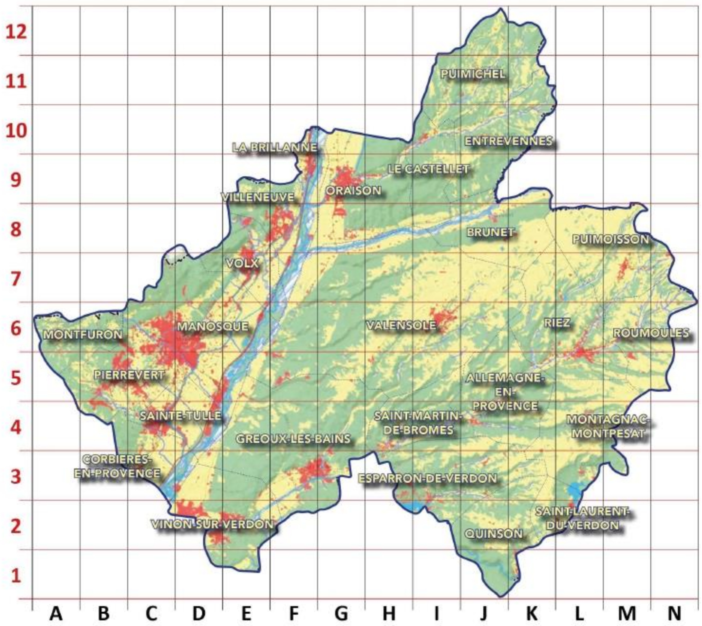
Lieu apprécié 2

Votre réponse

Lieu apprécié 3

Votre réponse

Pouvez-vous repérer 3 lieux que vous n'appréciez pas sur le territoire de DLVAgglo ?
A l'aide de la carte ci-dessous, merci d'indiquer les coordonnées de chaque lieu. Même principe que pour la question précédente.



Lieu peu apprécié 1

Votre réponse

Lieu peu apprécié 2

Votre réponse

Lieu peu apprécié 3

Votre réponse

Les Paysages de DLVAgglo ont-ils selon vous changé ces dernières années ?

- ◯ OUI
- ◯ NON

Si vous avez coché "OUI", trouvez-vous qu'ils ont évolué :

- ◯ Un peu
- ◯ Moyennement
- ◯ Fortement

Ces transformations sont-elles pour vous négatives ou positives ?
(Vous pouvez cocher les deux cases si besoin)

- ☐ Négatives
- ☐ Positives
- ☐ Je ne sais pas

Vous pouvez préciser...

Votre réponse

Pensez-vous que les Paysages de DLVAgglo vont évoluer à l'avenir ?

- ○ OUI
- ○ NON
- ○ Je ne sais pas

Si vous avez coché "OUI", pensez-vous qu'ils vont évoluer :
(Vous pouvez cocher les deux cases si besoin, ou aucune)

- ☐ Sous les effets du changement climatique
- ☐ Sous les effets des actions mises en oeuvre pour lutter contre le changement climatique

Voyez-vous d'autres raisons ? Lesquelles ?

Votre réponse

Pour l'avenir que redoutez-vous pour les Paysages de DLVAgglo ?

Votre réponse

Pour l'avenir de quels Paysages rêvez-vous pour DLVAgglo ?

Votre réponse

Retour

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L'usage du mot Biodiversité, contraction de biologique et diversité, est relativement récent mais la biodiversité est très ancienne. La diversité biologique actuelle vient de la longue et lente évolution du monde vivant sur la planète, depuis les premiers organismes vivants connus il y a 3,5 milliards d'années. La biodiversité, c'est le tissu vivant de notre planète. Cela recouvre l'ensemble des milieux naturels et des formes de vie (plantes, animaux, champignons, bactéries, etc.) et leurs interactions.

Extrait de la présentation de la Biodiversité du Ministère de la Transition Ecologique et de la Cohésion des Territoires

Et pour vous, que représente la Biodiversité ?

Votre réponse

La préserver, est-ce pour vous :
(Vous pouvez cocher plusieurs cases si besoin)

- [ ] Une nécessité
- [ ] Une contrainte
- [ ] Une opportunité
- [ ] Je n'ai pas d'avis

Vous pouvez développer...

Votre réponse

A quelle échelle ?
(Vous pouvez cocher plusieurs cases si besoin)

- [ ] de la Planète
- [ ] de la France
- [ ] de la DLVA
- [ ] de ma commune

Vous sentez-vous personnellement concerné ?
(Vous pouvez cocher plusieurs cases si besoin)

- [ ] NON
- [ ] OUI, C'est important pour moi
- [ ] OUI, Je voudrais participer à sa préservation
- [ ] OUI, Je participe à sa préservation

Vous sentez-vous suffisamment informé sur les caractères, les enjeux et les moyens de préserver la Biodiversité ?

○ OUI

○ NON

De quelles types d'information auriez-vous besoin ?

Votre réponse

Parmi ces types d'actions, lesquelles sont à votre avis importantes à mener ou poursuivre ?
(Vous pouvez cocher plusieurs cases)

- [ ] Préserver les milieux naturels
- [ ] Limiter l'artificialisation des sols
- [ ] Introduire de la nature et de la biodiversité dans les milieux déjà artificialisés
- [ ] Transformer l'agriculture vers des modèles plus écologiques
- [ ] Diminuer les pollutions et nuisances
- [ ] Autres actions

Vous pouvez préciser...

Votre réponse

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Non partagé

La Transition Energétique se définit par l'ensemble des changements à réaliser sur les modèles de production, de distribution et de consommation d'énergie afin de rendre ces derniers plus écologiques. Elle s'inscrit plus globalement dans la transition écologique, dont elle constitue l'un des volets parmi de nombreux autres. L'objectif commun est de lutter contre le réchauffement climatique, et limiter les émissions de CO2 dans l'atmosphère. La transition énergétique implique donc une optimisation de la consommation d'énergie et une diminution drastique du recours aux combustibles fossiles au profit des énergies renouvelables.

La Transition Energétique, est-ce pour vous :
(Vous pouvez cocher plusieurs cases si besoin)

- ☐ Une nécessité
- ☐ Une contrainte
- ☐ Une opportunité
- ☐ Je n'ai pas d'avis

Vous pouvez développer...

Votre réponse

Comment vous sentez-vous concerné ?
(Vous pouvez cocher plusieurs cases si besoin)

- [ ] Je ne me sens pas concerné
- [ ] C'est important pour moi
- [ ] Je souhaiterais la mettre en oeuvre personnellement
- [ ] J'y contribue déjà personnellement
- [ ] Je souhaite que mon territoire, ma commune et DLVAgglo, la mette en oeuvre

Vous pouvez préciser...

Votre réponse

Pensez-vous que la Transition Energétique puisse améliorer votre quotidien ?

- ○ OUI
- ○ NON

De quelle façon ?
(Vous pouvez cocher plusieurs cases)

- [ ] Finances
- [ ] Santé
- [ ] Cadre de vie
- [ ] Praticité
- [ ] Autres
- [ ] Je ne sais pas

Vous pouvez préciser...

Votre réponse

Parmi les types d'actions que l'on peut mettre en oeuvre, lesquelles vous paraissent importantes ?
(Vous pouvez cocher plusieurs cases)

- [ ] Diminuer la consommation d'énergie des bâtiments et dans l'espace public
- [ ] Développer les modes actifs de déplacement, le covoiturage, les transports en commun
- [ ] Développer les énergies renouvelables

Voyez-vous d'autres types d'actions à mettre en oeuvre ?

Votre réponse

Vous sentez-vous suffisamment informés sur les actions que met en oeuvre votre commune ?

- ○ OUI
- ○ NON

Vous sentez-vous suffisamment informés sur les actions que met en oeuvre DLVAgglo ?

- ○ OUI
- ○ NON

Souhaiteriez-vous participer à la réflexion pour réussir la Transition Energétique de DLVAgglo, dans le respect de la Biodiversité et en préservant la qualité des Paysages ?

- ◯ OUI
- ◯ NON

Une série de rencontres va être menée dans le cadre de ce Plan de paysage et Transition énergétique à partir du printemps 2023. Les actualités de la démarche, qui va durer jusqu'en 2024, seront publiées régulièrement sur www.dlva.fr

Vous pouvez à tout moment nous contacter à cette adresse :

paysages-energie@dlva.fr

Et si vous souhaitez être directement informés des dates de rencontre, merci de nous laisser votre adresse mail ici :

Votre réponse

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A propos de vous

Pour nous aider à mieux analyser cette enquête, nous vous invitons à répondre à ces quelques dernières questions.

Résidez-vous sur le territoire de la DLVA ?

- Oui, de façon permanente, depuis toujours
- Oui, de façon permanente, depuis plus de 10 ans
- Oui, de façon permanente, depuis moins de 10 ans
- Oui, mais en résidence secondaire
- Non, mais j'y travaille
- Non, mais je rends régulièrement visite à ma famille qui y réside
- Non, mais je m'y rends pour les loisirs, les vacances...
- Non, mais je suis intéressé par cette étude et ce territoire

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Si vous habitez sur le territoire de DLVAgglo, dans quelle commune ?

Sélectionner ▾

Si vous habitez sur le territoire de DLVAgglo, dans quel environnement ?

- ◯ En centre-ville
- ◯ En périphérie de ville
- ◯ Dans un village, dans le centre
- ◯ A la campagne

Si vous travaillez sur le territoire de DLVAgglo, dans quel secteur ?

Sélectionner ▾

Si vous le souhaitez, vous pouvez nous indiquer votre tranche d'âge :

- ◯ Moins de 18 ans
- ◯ 18-24 ans
- ◯ 25-49 ans
- ◯ 50-64 ans
- ◯ 65-79 ans
- ◯ 80 ans ou plus

Vous pouvez nous laisser votre adresse mail si vous le souhaitez :

Votre réponse

Vous pouvez également nous transmettre des informations, images de paysages, de nature, des expériences de la transition énergétique... à cette adresse : paysages.energie@dlva.fr

MERCI DE VOTRE CONTRIBUTION !

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