Report on Stakeholders' Mapping and Identification

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Executive Summary

Stakeholders are defined as having both an impact and an interest in a project, initiative, result, etc. Focusing on TIGON Key Exploitable Results (KERs) elaborated in D8.2 Business Model development (first report), several stakeholders can have an interest and impact on them, ranging from technology providers, energy players, public and private sector organisations to policy makers, investors, the scientific community, and standardisation bodies. Identifying and mapping all these stakeholder groups provide strategic guidance to the dissemination, engagement, and exploitation activities of the project.

With customers usually buying solutions to their problems, focusing only on technologies makes the mapping exercise not very powerful. As a consequence, the analysis was performed both for the technologies developed in the project and the services (smart grid services and microgrid services) they enable. Moreover, the analysis considered also the (primary) geographical area of stakeholders' operation to screen the most successful communication tools and engagement methods.

Key highlights from the analysis include:

- Technology players tend to have quite a strong interest in technologies. Their impact on the project is linked, though, to the exploitation strategy anticipated for each result.
- Energy players have a more limited interest in the technology per se but a strong interest in the services enabled. Their impact on the project's results will be high.
- Public and private sector organisations (as potential customers of microgrids) have little interest in technologies per se but a strong interest in the services enabled and a strong impact on the project's results.
- Policy makers, investors, and standardisation bodies have different levels of understanding of the technologies and services enabled but a strong potential impact on the project's results. The scientific community is also anticipated to have a potential impact (just slightly lower compared to the former horizontal stakeholders).

Taking into consideration these different stakeholders' profiles, the report maps them against:

- Impact versus geographical area of operation;
- Impact versus Technology Interest;
- Technology Interest versus Technology understanding;
- Impact versus Interest in Services;
- Interest in Services versus Services' understanding.

The results of this mapping exercise will support the project dissemination and engagement activities and provide insights on how to best leverage external organisations and players in planning the exploitation activities of each KER.

Table of contents

List of acronyms, figures and tables

Abreviations and acronyms

AC	Alternating Current
ACER	Agency for the Cooperation of Energy Regulators
AEC	Architecture Engineering & Construction
APPLIA	(Home) Appliance (Europe)
BEUC	Bureau Européen des Unions de Consommateurs
CAGR	Compound Annual Growth Rate
CCRE	Council of European Municipalities and Regions
CEE	Council of European Energy Regulators
CEP	Clean Energy Package
CIGRE	International Council on Large Electric Systems
DC	Direct Current
D&C	Dissemination and Communication
DSO	Distribution System Operator
DSS	Decision Support System
EDSO	European Distribution System Operators
EERA	European Energy Research Alliance
EMS	Energy Management System
EPSMA	European Power Sully Manufacturing Association
ESCO	Energy Service Company
ETSI	European Telecommunications Standard Institute
EU	European Union
EUASE	European Alliance to Save Energy
Eu.bac	European Building Automation and Controls Association
ESMIG	European Smart Metering Industry Group
EURADA	European Association of Development Agencies
EUREC	European Renewable Energy Research Centre
EV	Electric Vehicle
GW	Giga-Watt
JRC	Joint Research Centre

ICT	Information & Communication Technology
IEA	International Energy Agency
IRENA	International Renewable Energy Agency
IoT	Internet of Things
KER	Key Exploitable Result
kW	Kilowatt
M&A	Merger & Acquisition
MVDC	Medium Voltage Direct Current
MW	Megawatt
NGO	Non-Governamental Organisation
PC	Personal Computer
PSMA	Power Source Manufacturing Association
PV	Photovoltaic
R&D	Research & Development
RES	Renewable Energy Source
ROI	Return On Investment
SiC	Silicon Carbide
SCADA	Supervisory Control and Data Acquisition
SME	Small and Medium Enterprise
SST	Solid State Transformer
TSO	Transmission System Operator
VAR	Vaue Added Reseller
WAMPAC	Wide Area Monitoring, Protection, and Control
WBG	Wide Bandgap
WIFI	Wireless Fidelity
WP	Work package

List of Tables

List of Figures

1. Introduction

Stakeholders' mapping is crucial to develop an effective dissemination and engagement strategy and to support a viable exploitation plan. Identifying stakeholders and understanding their needs and priorities allow to effectively plan D&C activities, reach and involve the right external players in the execution of the project and its post-action planning, and maximise the overall project's Return-on-Investment (ROI).

The results of the stakeholders' mapping exercise presented in this report will be a core part of the project's dissemination and engagement strategy (Task 9.1 Development of the dissemination and communication strategy), inform its execution (Tasks 9.2 - Visual identity and channels, and 9.3 - Dissemination and stakeholders' engagement) and provide strategic guidance on the potential targets, partners, channels, enablers, and influencers the project should leverage in its exploitation planning. This will be achieved by:

- Identifying, profiling and prioritising the stakeholders that the project needs to address/engage;
- Supporting the development of tailored messages to their requirements and priorities;
- Defining a strategy for their involvement.

The report is structured in the following chapters>

- ***Chapter 2*** provides an overview of the methodology adopted for identifying and mapping stakeholders.
- ***Chapter 3*** identifies TIGON stakeholders starting from the Key Exploitable Results the project will achieve and the role each stakeholder can have in each of them.
- ***Chapter 4*** profiles the stakeholders identified in chapter 3 with a focus on their market of reference, key trends and examples of organisations/players.
- ***Chapter 5*** maps and prioritises stakeholders based on the analysis developed in chapter 4.
- ***Chapter 6*** provides conclusions and next steps.

The document is public, and targets TIGON partners as well as external organisations and projects that focus on energy innovative projects.

2. Methodology

Stakeholders are individuals and organisations with a vested interest in a project, technology, solution, or business and can either affect or be affected by its outcomes, application, and performance.

Stakeholders' mapping is a process to clarify and categorise different stakeholder groups, their level of interest, and their impact on the evolution of the project and its technology achievements. The methodology implies:

1. Identifying the different stakeholder groups and stakeholders in each group according to their "stake" in the project and its outcomes;
2. Profiling stakeholders according to their requirements and needs;
3. Mapping them using visual tools;
4. Ranking them along a scale of priorities and relevance.

2.1. Step 1. Identifying stakeholders

Considering the definition of "stakeholders" provided above, the process of stakeholders' identification requires understanding which results (technology, advancement in knowledge, models, etc.) the project will deliver. This initial activity was performed in cooperation with WP8 that focuses on exploitation activities and the identification of the project's KERs. For each KER, we then identified all the stakeholder groups (16) and stakeholders in each group (for a total of 26) that have an interest in the result and that can have an impact on it.

Table 2.1: TIGON Stakeholder groups and Stakeholders

Stakeholder group	Stakeholders
Technology Providers: components	Suppliers
	Manufacturers of SSTs and converters
	Manufacturers of DC protection systems and electrical/electronic safety in general;
	Manufacturers of monitoring and control systems
Technology Providers: software and related services	EMS solution providers
	DSS software providers
	Security software and services
	Other software providers to the energy sector
Smart grid integrated technology providers/	Integrated smart grid technology providers
Designers	Engineering services
Technology channels	Distributors/VARs

Energy players	TSOs, DSOs (>100000 customers), utilities (<100000 customers)
	RES providers (including Solar power plants)
	Energy communities, Energy cooperatives
Innovative AEC companies	Architectural, Engineering and construction companies
Private sector	Industrial companies, Real estate and building owners, SMEs
Public sector	Local authorities owning residential public buildings, schools, hospitals, public transport infrastructure
General public	Citizens
Associations	Associations of DSOs, RES providers, industry players, research centres etc.
Consumer associations	Consumer associations
Policy makers	Regional/national/ local governments EU commission and EU public bodies
Investors	ESCOs, financial institutions, business angels, venture capitalists
Scientific community	Universities, Research centres, R&D departments of industry players
Standardisation bodies	Standardisation bodies
Media	Journalists and local/international media

To this aim, it was important to clarify the role each stakeholder has in the development and/or usage of the result. We adopted a value chain approach, whenever possible, to derive this and study the ecosystem. Stakeholders can be customers, users, partners, channels, influencers, enablers, etc. This analysis was also important for the mapping exercise performed in step 3.

The results of this first step are described in *Chapter 3*.

It is important to note that the analysis refers to TIGON results and not in general to an energy project. As such, it is tied to the anticipated exploitation strategy set for each result. As an example, if a commercial result is directly brought to the market by the partners in the consortium, then potential external providers of the same or similar results are mostly competitors. Their impact on the result will be seen after its launch on the market; these stakeholders will have to be monitored but probably not engaged in the project. On the contrary, if no partners in the consortium can bring the result to the market, then the potential external providers can act as partners or customers (through licensing). Their impact on the result will be high as they are needed for its launch on the market and the project will have to engage them as soon as possible to enable a proper exploitation

strategy. Similarly, the report identifies potential stakeholders representing customers. Nonetheless, these customers should be then prioritised according to the capability of consortium partners and the external organisations the project will engage with to reach them (e.g. depending on their customer references, existing contacts, the structure of sale channels, marketing and sales resources, etc.). This report is based on the KERs' preliminary exploitation strategy. If substantial changes will occur during the execution of the project, then the mapping exercise will need to be reviewed accordingly. Similarly, the prioritisation of the stakeholder customers will be part of the business modelling that will be consolidated only at the end of the project.

2.2. Step 2. Stakeholder profile

Once stakeholders were identified, the second step focused on their profile and analysis to understand their market context, drivers, barriers and examples of players to be reached. This analysis was mainly based on desk research of available information and reports, which are all listed in the Bibliography.

To prepare for the mapping exercise, the analysis also focused on:

- *Geographical area of operation:* considering the large prevalence of SMEs in all sectors of the EU economy and considering that SMEs tend to have local or national operations, this item should be read as the "primary" geographical area of operation of the companies/players TIGON results intend to target. The levels considered are:
    - Global (International)
    - Regional (EU level)
    - National (country level)
    - Local (municipality, province, country's region. Note though that countries have different local levels: not all of the EU countries are organised around regions or provinces. With local we refer in any case to strong roots in a limited geographical territory within a country).
- *Technology understanding*, the capability of stakeholders to understand technical features and functions, ranging from None to High
- *Technology interest,* the interest stakeholders have in TIGON technologies, ranging from None to High. Different from understanding (which is mainly related to the technical background of the stakeholders), technology interest was assessed with a focus on TIGON results (rather than technology in general). Technologies considered were all hardware and software results but also the technology consulting and advisory services that can be built on the models and frameworks developed within the projects. The technology layer refers therefore to all TIGON KERs.
- *Services' understanding*, the capability of stakeholders to understand the enhancement in services enabled by the technology (smart grid services and microgrid services), ranging from None to High. With services, we are not referring to technology advisory, consulting or strategy services (which are dealt under technology) but to the enhancement in energy services enabled by DC hybrid grids and microgrids. In other words, we are referring to the benefits of hybrid grids.
- *Interest in Services,* the interest stakeholders have in the enhancement in services enabled by the technology (smart grid services and microgrid services), ranging from None to High
- *Impact* on the project's KERs. To assess impacts we considered the short-medium term as we need to operationalise this mapping during the execution of the project. The impact refers therefore to the *value* that external stakeholders can bring to TIGON results *during the*

execution of the project and immediately after its end (i.e. supporting the launch of the results on the market, influencing and/or enabling uptake and replication of the results). So some stakeholders, which might have a strong impact once the results will be launched on the market (e.g. suppliers, competitors, etc.), have been classified as low or medium impact in our analysis.

The profile of each stakeholder against these 6 items was derived from the:

- Analysis and insights on the market they work in;
- Evaluation of the roles each stakeholder can have in TIGON results (e.g. customers, competitor, partners, etc.);
- Consortium experience in working with different stakeholder groups.

Moreover, we decided to focus both on technologies and enhancement in services. With several stakeholders not having a strong understanding of technology, and considering that in general customers don't buy technologies rather solutions to specific issues, we thought that adding the service component to the analysis would have made the mapping exercise more comprehensive and useful for the project's activities.

The results of this second step are presented in *Chapter 4*.

2.3. Steps 3 and 4. Stakeholder mapping and prioritisation

There are different ways to map stakeholders. The most widely adopted is a simple matrix that leverage impact and interest scores to define 4 quadrants as follows:

- High impact, High interest: Stakeholders to be managed closely
- High impact, Low interest: Stakeholders to keep satisfied
- Low impact, High interest: Stakeholders to keep informed
- Low impact, Low interest: Stakeholders to monitor, with minimum effort

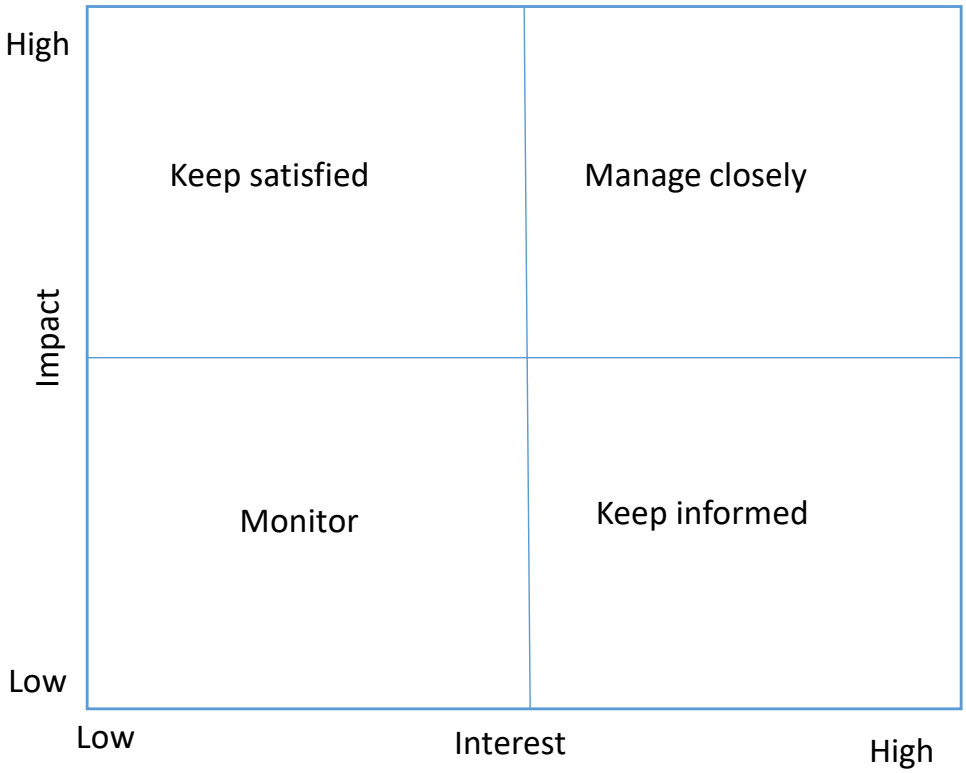


Figure 2.1: Stakeholder map

The approach has been criticised to have several limitations including the fact it doesn't show the stakeholders' attitude towards an initiative and provides just partial views. We tried to smooth these issues by:

- Evaluating the real interest stakeholders can have in the project's KERs, avoiding to position them where we would like them to be, rather assessing their potential interest considering also the maturity of the market and the possible risks.
- Understanding the role stakeholders can have in each result and define their impact starting from that, with a focus on the short to medium term;
- Focusing on technologies and enhancement in grid services alike, considering all project's KERs within the technology pillar (including hardware, software and technology services) and the benefits of hybrid grids as enhancements of grid services;
- Focusing on the capability to understand these technologies and enabled services beyond the interest stakeholders might have;
- Providing a geo assessment of stakeholders' operations;
- Giving a different interpretation to the quadrants.

The stakeholder mapping was therefore based on the profiles developed in the previous step. In particular we converted the 6 items above into numerical representation (on a scale 1 to 5)

- 1 Low
- 2 Low to medium
- 3 Medium
- 4 Medium to High
- 5 High

Only for the general public we considered also None (0).

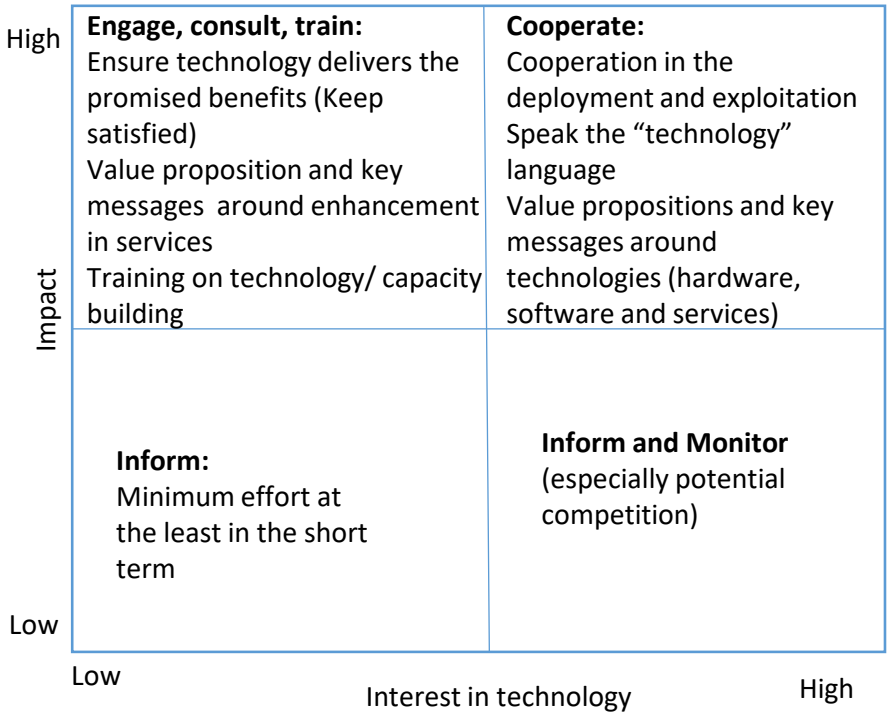
Stakeholders were mapped as follows:

- Interest and understanding of the technology developed by TIGON against impact, to define the related strategy and messages;
- Interest and understanding of the enhanced services and benefits enabled by TIGON against impact, to define the related strategy and messages;
- Geographical area of operation against impact, to assess the most appropriate geo strategy to reach them.

The final prioritisation of stakeholders is the result of the mapping exercise. The maps developed and their interpretation are shown the following figures. The technology map serves to prioritise stakeholders and define a strategy for their involvement (cooperate, engage and consult, inform and monitor, inform). The services map provides additional insights to those stakeholders that, as we will see, have a strong impact on the project but relatively little interest in technology. The geo map drives the geographical dissemination and engagement strategy.

The results of these last steps are presented in *Chapter 5*.

Figure 2.2: Stakeholder technology mapping



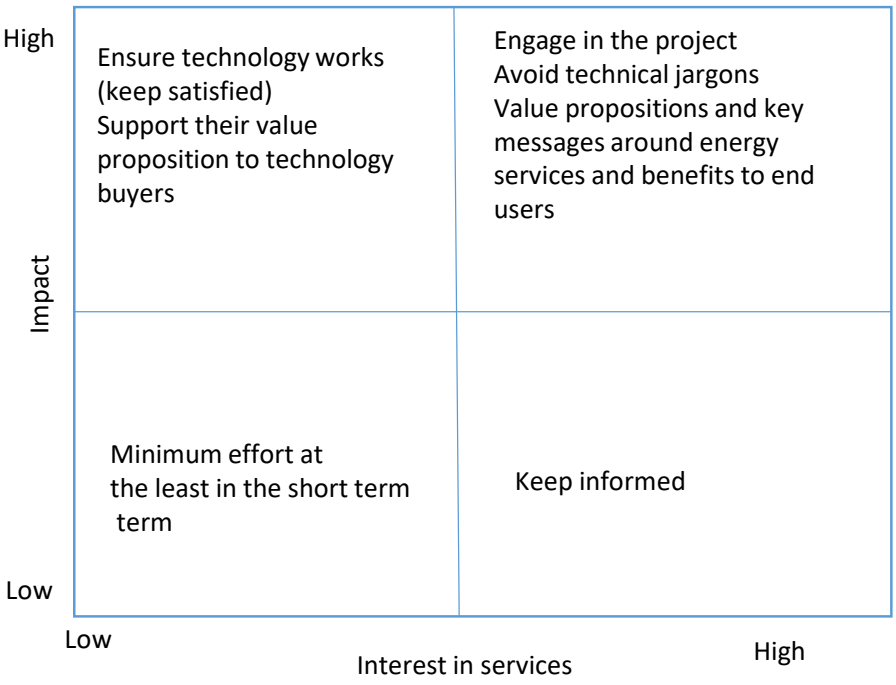


Figure 2.3: Stakeholder services mapping

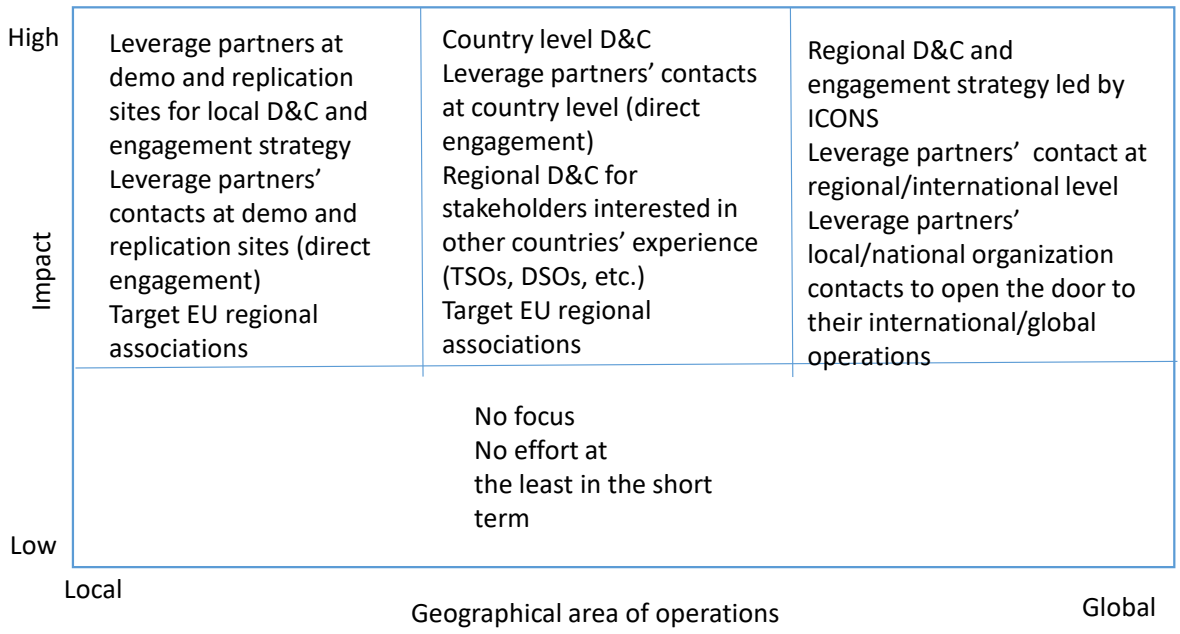


Figure 2.4: Stakeholders geographical mapping

3. KERs and Stakeholders' Identification

As explained in the methodology chapter, the first step of the mapping exercise is the identification of the stakeholders involved in the results that will be generated in the project.

The following Table 1 summarises TIGON KERs (Key Exploitable Results), according to the analyse of T8.2 and reflected in its first public deliverable D8.2 Business Model development (first report) and categorise them according to their type.

KERs 1 and 2 are mainly technology hardware, set for commercialisation by the project's partners; KER 3 will provide a new DC protection model that could enhance existing protection systems in the market for the application in a hybrid grid environment; KER 4 refers to the upgrade of solar plants; KER 5 entails both hardware and software for the development of a WAMPAC system; KER 6 refers to software and IT services (consulting/advisory) for an optimised EMS; KER 7 is an advanced DSS software solution; lastly KER 8 is a cybersecurity framework that can be leveraged in consulting services to grid owners and managers.

Table 3.1: TIGON KERs

KERs	Description	Type
KER 1 – Solid State Trasformer (SST)	Multi-level power electronics device used to connect two electric grids with different voltage level and consisting of a medium frequency transformer and AC/DC converters, which are enabled to control terminal voltages and currents and manage active and reactive power flows.	Technology Hardware
KER 2 – SiC DC/DC converters	Innovative SiC WBG DC/DC converters topologies with improved efficiency and power density for a better conversion ratio in DC-based architectures.	Technology Hardware
KER 3 – DC protection schemes	An overall DC protection scheme covering both MV and LV sides of the hybrid grid and optimizing the use of currently available protections in the market.	Advancement in technical knowledge/new DC protection model
KER 4 - MVDC PV plant	Upgrade of solar power plants for production at MVDC directly, thus optimizing their configuration and efficiency of production.	Model for upgrading solar plants/ Technology advisory and consulting services

KER 5 - WAMPAC system	Monitoring and Protection system whose main purpose is to control the stability and safe operation of the whole system thanks to measurements gathered from different points of the micro-grid	Technology: Hardware and software
KER 6 – EMS	Operation modes and strategies integrated into a control software able to manage hybrid grids, optimize their energy flows and maximize the efficiency of the system	Software/Technology Strategy services
KER 7 - DSS tool for DC-based grids	Software tool that will provide with guidelines and simulations facilitating the planning of grid expansions or the development of new hybrid-grids across the EU	Software/Technology Strategy services
KER 8 Cybersecurity Defence System	Cybersecurity defence framework that will enable the protection of digitalised DC-based hybrid grids from potential cyberattacks as well as the identification and remediate vulnerabilities	Framework/model/ technology advisory and consultancy services

The proposal had already identified a broad list of stakeholders involved in these KERs including:

- Main energy actors: DSOs, energy communities, RES players, etc.
- Technology providers
- Technical experts, researchers, scientific community and professional organisations
- Policy makers and public bodies
- General public: consumers, citizen and consumer organisations, NGOs

Their role in each of the results was further investigated and is described in Table 2. Some actors have a specific stake and role just in one or few KERs, while others are involved in all of them.

Table 3.2: Stakeholders' role by KER

Stakeholder group	Stakeholders	Role	KER
Technology Providers: components	Suppliers	*Providers of raw materials* (SiC) for KER 2. TIGON represents a market opportunity.	KER 2
	Manufacturers of SSTs and converters	Considering the aim of TIGON is to commercialise KERs 1 and 2, they represent *competitors* but also a *potential channel* for the new technologies (*coopetition model*).	KERs 1 and 2
	Manufacturers of DC protection systems and electrical/electronic safety in general; Manufacturers of monitoring and control systems	Considering TIGON doesn't aim at the direct commercialisation of DC protection systems and monitoring and control systems, these players represent either a *partner* (for joint go-to-market) or a *customer* of the TIGON solutions (through potential licensing agreements).	KERs 3 and 5
Technology Providers: software and related services	EMS solution providers	They can act as *customers* of the EMS solution developed within TIGON (KER 6) through partners' licensing of the solution, and as a *channel/partner* for some of the other systems (in particular KER 5).	KER 6
	DSS software providers	They can be *customers* of the DSS solution developed within TIGON (KER 7) through partners' licencing of the solution.	KER 7
	Security software and services	They can be *customers* of the cybersecurity framework developed within TIGON (KER 8) and/or a *channel* for the cybersecurity services that will be developed by TIGON partner within the project's exploitation activities.	KER 8
	Other software providers to the energy sector	They represent a *channel*, especially for TIGON software and IT services-based solutions	KERs 5, 6, 7, 8

Smart grid integrated technology providers/ Designers	Integrated smart grid technology providers	They are key *channels* (potential *partners*) to bring the new technologies/services to market. They can be *direct customers* of the consulting services built around KER 4 (solar power plant upgrade), the strategy services that can be built around KERs 6 and 7 and the cybersecurity services of KER 8.	All KERs KERs 4, 6, 7, 8
	Engineering services	They are key *channels* (potential *partners*) to bring the new technologies to market. They can be *direct customers* of the consulting services built around KER 4 (solar power plant upgrade) the strategy services that can be built on KERs 6 and 7 and the cybersecurity services of KER 8.	KERs 1, 2, 3, 4, 5, 6, 7 KERs 4, 6, 7, 8
Technology channels	Distributors/VARs	They represent the *indirect channel* to penetrate EU countries. For KERs 1 and 2 (direct commercialisation), they will be covered in the Business model of the results. For KERs 3 and 5, it will be up to the external company that will commercialise the technologies to design a distribution strategy. New technologies mean new market opportunities for distributors, installers, and the indirect channel in general. Value Added Resellers (VARs) are a key channel for software-based solutions (KERs 5, 6, 7).	KERs 1, 2, 3, 5, 6, 7
Energy players	TSOs, DSOs (>100’000 customers), utilities (<100’000 customers)	*Customers*	All KERs
	RES providers (including Solar power plants)	*Users*. They feed the grid with RES. *Customers* *Customers* (with reference to solar power plants)	All KERs KERs 1, 2, 3, 5, 6, 7, 8 KER 4

	Energy communities, Energy cooperatives	*Customers* (if they operate in generation, sharing and distribution). *Users* of the energy services *Prosumers*	All KERs All KERs All KERs
Innovative AEC companies	Architectural, Engineering and construction companies	They represent a *channel* for TIGON solutions, once, for example, the construction/retrofitting of a district, a campus, an infrastructure, etc. involving energy renovation/optimisation is planned.	All KERs
Private sector	Industrial companies, Real estate and building owners, SMEs	*Prosumers* and *customers* of the solutions *Users* of the solutions (e.g. energy managers, facility managers, etc.) *Consumers*: users of the energy service in the microgrid	All KERs KERs 5, 6, 7, 8 All KERs
Public sector	Local authorities owning residential public buildings, schools, hospitals, public transport infrastructure	*Prosumers* and *customers* of the solutions *Users* of the solutions (e.g. energy managers, facility managers, etc.) *Consumers*: users of the energy service in the microgrid	All KERs KERs 5, 6, 7, 8 All KERs
General public	Citizens	*Consumers*: users of the energy service in the microgrid *Prosumers* (differently from the private and public sector prosumer segments, though, citizens are not expected to be direct customers. Energy communities and cooperatives will be the target customers as well as residential building owners).	All KERs
Associations	Associations of DSOs, RES providers, industry players, research centres etc.	They represent a *channel* to reach their members	All KERS

Consumer associations	Consumer associations	*Influencers*. They can support the upgrade to newer technologies if benefits are well understood.	All KERs
Policy makers	Regional/national/ local governments EU commission and EU public bodies	*Enablers.* They can develop a *favourable regulatory environment* for the deployment of new DC hybrid grid technologies and support the creation of microgrids in the EU.	All KERs
Investors	ESCOs, financial institutions, business angels, venture capitalists	*Enablers*. They can *support the investment* in DC hybrid microgrids	All KERs
Scientific community	Universities, Research centres, R&D departments of industry players	*Supporters*. They can build on top of TIGON results to advance the research in DC hybrid grids and contribute to the EU leadership in this area.	All KERs
Standardisation bodies	Standardisation bodies	*Enablers.* They support market uptake by providing standards to ensure interoperability of the technologies.	All KERs but in particular the WAMPAC system (KER 5) for its integration with EMS (KER 6), safety standards of DC-DC converters (KER 2)
Media	Journalists and local/international media	They represent the “information *multipliers*” of TIGON results for dissemination.	All KERs

4. Stakeholder profile

This chapter provides:

- A short profile for the stakeholders identified, including their market of reference and examples of key players.
- An evaluation of their interest and understanding of the technologies produced in TIGON (all KERs including hardware, software and technology advisory, consulting and strategy services) and the benefits and enhancement of energy services of DC hybrid grids
- An assessment of the impact (i.e. value) they can have on their deployment/adoption;
- The identification of their primary geographical area(s) of operation-

In table 2 we considered associations as a separate stakeholder group as they represent a channel to reach the stakeholders they bring together, which can have then different roles towards TIGON results (e.g. customers, enablers, supporters, influencers, competitors, etc.). In the following paragraphs, we consider associations within each stakeholder group. While the roles of stakeholder groups and their associations are different, from a profile perspective, the key difference is (in some cases) the geography of operations. Some associations group national and local players and act at the EU regional level. In some other cases, associations bring together organisations that already operate at the EU or global level. In all cases, though, their understanding and interest in the technologies, solutions, and enabled services developed within TIGON mirror those of their members.

4.1. Technology providers

4.1.1. Suppliers

Suppliers are the providers of raw materials and/or components for the assembly/manufacture of the technology products in the project (e.g. Transformers, Converters, etc.).

In particular, KER 2 will rely on silicon carbide (SiC), a compound of silicon and carbon, used as deoxidising agent in the steel industry, raw material in refractories production and semiconductor in the electronic industry. Despite an anticipated global growth of over 15% annually to 2027 (7.5% in Europe), competition from other materials (such as gallium nitride in power modules) might hamper stronger demand. Key players in the SiC material market include AGSCO Corporation; Carborundum Universal Limited; Dow Chemical Co.; Entegris, Inc.; ESD-SIC b.v.; ESK-SIC GmbH; Grindwell Norton Ltd; and Saint Gobain Ceramic Materials GmbH. The power electronic segment represented their largest market opportunity in 2019, due to the capability of SiC to reduce energy loss and increase life and the efficiency of power devices.

Increasing market adoption meant SiC wafers became one of the main bottlenecks in the supply chain. The last few years saw different supply agreements and M&As to increase the SiC wafer production capacity. Being vertically integrated, companies tried to secure their supply and be able to leverage wafer quality for their devices. Examples of SiC wafer producers include Cree (Wolfspeed), ROHM (sicrystal), STMicroelectronics (Norstel), Silectra (Infineon),TankeBlue, GT Advanced Technologies (long term agreement with Infineon), etc.

The availability of new products based on SiC (KER 2) represents a new market opportunity for them to forge supply partnerships and a new value chain in the EU. Considering the SiC material suppliers only, they can have therefore an interest in the new technology developed but like in any other solution deploying SiC. Moreover, their understanding of the technology and services remains limited and their overall impact on the TIGON project is very little. Similarly, TIGON represents a further opportunity for producers of silicon carbide wafers. Wafer shortage means that the battle remains open, and strategic long-term agreements and acquisitions characterise this segment. This is an issue affecting technology providers (Transformers, converters) and their business model (procurement) rather than TIGON and its solutions. These vertically integrated companies are considered as separate stakeholders in the following paragraphs. As such the profile of suppliers towards TIGON results can be described as follows:

- Geographical area of operation: Global (at least for key players)
- Technology understanding: Low
- Technology interest: Low Medium
- Services' understanding: Low
- Interest in Services: Low
- Impact: Low

4.1.2. SST transformers and converters

The market for Solid State Transformers (SSTs) is posed for very fast growth (CAGR of around 20-25% to 2027). SSTs are increasingly used in a larger number of applications, including alternative power generation, traction locomotives, Electric Vehicle (EV) charging stations, power grids, and others. Alternative power generation is the dominant application, followed by power grids. Providers of SST transformers largely benefit from the EU move towards RES, the deployment of smart grids, and the introduction of EVs. Europe holds the largest market share globally. Nonetheless, high costs of production (translating into high prices to end customers for installation and maintenance) drag their revenue potential. Key players in this area include SMEs with a focus on transformers and converters and large international companies, with a portfolio covering other technical components of the smart grid. The latter include ABB Ltd., Schneider Electric SE, General Electric Co., Siemens AG, Alstom SA, Mitsubishi Electric Corporation, Eaton Corporation plc (Cooper Power Systems), Gridbridge, Inc., Varentec, Inc. and Maschinenfabrik Reinhausen (MR). Competition is rather high, considering also competition with alternative systems (substitute technologies and equipment).

The DC-DC converter market is experiencing a more limited growth, still double digit (CAGR over 10% to 2027). Players include large international companies like Ericsson, Texas Instruments, Murata Manufacturing Co. Ltd., General Electric (GE), Delta Electronics Inc., Vicor Corporation, TDK-Lambda Corporation, Fujitsu, ST Microelectronics, ON Semiconductor, Traco Electronic AG, RECOM Power GmbH, Infineon, etc. They benefit from the increasing demand for EVs, railway applications, IoT, high-performance power electronics and process control and automation applications. Competition is rather high also in this segment, and regulation and safety standards are other barriers affecting the players' performance.

Manufacturers of both SST and DC-DC converters have a very good understanding of the technologies they produce, a strong interest in new technologies (KERs 1 and 2) with regards to potential new competition or partnerships, a lower understanding and interest in the services enabled (which can be mainly used as marketing messages) and an overall low to medium impact on the project's results. Indeed, considering TIGON will directly commercialise these results, the impact

(challenge) is mainly connected to potential competition, which is an issue we need to face in the business modelling activities by building value propositions stressing our competitive advantage. As anticipated coopetition models are also possible (that is forging partnerships with these companies, especially those with a broad portfolio of solutions and use them as a channel to reach customers)

- Geographical area of operation: Global/Regional (for smaller players)
- Technology understanding: High
- Technology interest: High
- Services' understanding: Medium
- Interest in Services: Low
- Impact: Low to Medium

4.1.3. Manufacturers of DC protection systems and monitoring and control systems

The market for protection systems is growing at a moderate pace. Players in this segment benefit from the increase in power consumption, the rise of renewable sources in the energy mix, and the emergence of electric vehicles. Major companies operating in this segment include ABB Ltd, Siemens AG, Rockwell, Secheron, ETA, etc. They focus on a full range of solutions to connect, protect, control, and measure a wide range of electrical installations, enclosures, switchboards, electronics, and electromechanical devices in the energy and other sectors.

The proliferation of sensors driven by continuous IoT projects is a key driver of demand for monitoring and control systems. The market is experiencing double digit growth albeit the covid pandemic. The energy sector is the stronger revenue generator due to the increasing importance of controlling the stability and safe operations of the entire infrastructure. Key players include Honeywell International, Emerson Electric, Schneider Electric, ABB Ltd., Rockwell Automation, General Electric Co., Yokogawa Electric Corporation, Endress+Hauser AG, Fuji Electric Co. Ltd., Siemens, Robert Bosch, KROHNE Ltd., Sierra Instruments, Inc., VEGA Grieshaber KG, WIKA Alexander Wiegand SE & Co. KG, Hitachi Ltd.

Like other technology providers, these players tend to compete on the global market, they have a very strong understanding of technologies, medium to high interest in TIGON results (considering the immaturity of hybrid grids) and medium interest in the benefits and enhanced services (to be leveraged as marketing messages to end customers). Some of these players have been already contacted at the proposal stage to discuss a potential joint exploitation. Considering that TIGON will not commercialise directly KERs 3 and 5, the impact of these players on the project is set to be medium to high (depending on how the discussions with the players contacted will evolve).

- Geographical area of operation: Global
- Technology understanding: High
- Technology interest: Medium to High
- Services' understanding: Medium
- Interest in Services: Low to Medium
- Impact: Medium to High

4.1.4. EMS solution providers

Energy Management Systems (EMS) are solutions able to collect real-time information on energy consumption by monitoring, controlling, assessing, and visualising energy consumption, also for small scale systems such as microgrids. The market for energy management systems is poised for solid growth (9.9% globally to 2027). Government policies, the need to optimise RES usage, issues over energy and cost efficiencies, development in smart grids are key trends benefitting providers in this segment. They include large international companies such as General Electric, IBM, Honeywell, Rockwell, Schneider, Mitsubishi, Eaton, Enel X, etc. They have all an established presence and experience with EMS, so a very good understanding of the technology and a relatively high interest in it. The understanding of the services is also high, while the interest might be limited (as hybrid grids are not yet highly deployed and demand for EMS is spanning different industries) and the overall impact on the project medium to high.

- Geographical area of operation: Global
- Technology understanding: High
- Technology interest: Medium to High
- Services' understanding: Medium to High
- Interest in Services: Low to Medium
- Impact: Medium to High

4.1.5. DSS software providers

A decision support system (DSS) is a software system used to support decision-making. A DSS allows to analyse a huge amount of data in real time, and compile information that can be leveraged to solve problems and make informed, fact-based decisions. The increasing reliance on Analytics, Big Data and IoT has increased the focus of traditional software and solution providers on how to support the energy sector with advanced use of systems leveraging data and simulations. These players include providers of energy solutions (hardware and software) such as ABB and Schneider, and traditional software players such as Oracle, SAP or Qlick. These providers represent the potential customers of TIGON KER 7. They usually have a strong understanding of data-based solutions and the services they enabled, a medium interest in the technologies and services (they need to be introduced to TIGON innovations: their portfolio is already very rich and growing) and overall a medium impact on the project's result as licensing is a currently considered option, but partners expect also potential direct launch of the services based on the new DSS.

- Geographical area of operation: Global
- Technology understanding: High
- Technology interest: Medium
- Services understanding: Medium to High
- Interest in Services: Low
- Impact: Medium

4.1.6. Security software and services

Cybersecurity is a major concern in smart grid management and operations. Different smart grid components can be a source of vulnerabilities linked to technology or human factors. These components include operational systems (e.g. generators, transformers, SCADA, EMS, etc.), classic IT systems (e.g. PCs, servers, databases, websites, etc.), communication networks and protocols (e.g. Ethernet, WIFI, 5g, etc.), and end points (e.g. smart meters, EVs, smart phones, etc.). Several vendors have developed a portfolio to protect selected or all these components. They include BAE Systems, IBM Corporation, Cisco Systems, Siemens AG (Germany), Symantec Corporation, Thales, Lockeed Martin, Verisign, McAfee, etc. These large international corporations have a very high understanding of the cybersecurity challenges of smart grids, the related technologies and services, an anticipated medium interest in TIGON results (and in particular in KER 8), and an anticipated medium impact on the project's result as TIGON anticipates the possibility to offer cybersecurity services also directly to end-customers.

- Geographical area of operation: Global
- Understanding: High
- Technology interest: Medium
- Services understanding: Medium to High
- Interest in Services: Medium
- Impact: Medium

4.1.7. Other software providers to the energy sector

The energy sector is a heavy user of ICT systems. Several ICT vendors have an offer dedicated to the energy sector. In the software area, top players include Oracle, SAP, Microsoft, Itron Inc., and Salesforce, with a focus on Customer care, billing, smart meter infrastructure, Energy Trading Risk Management, SCADA, Financials, HR, Procurement. These players have strong direct connections with DSOs and utilities, so they can be very good channels. Nonetheless, their interest in TIGON could be not significant, and their overall impact on our project low to medium

- Geographical area of operation: Global/regional (for smaller players)
- Understanding: High (with reference to software results)
- Technology interest: Low to Medium
- Services understanding: Medium
- Interest in Services: Low to Medium
- Impact: Low to Medium

4.1.8. Smart grid integrated technology providers/Designers

As already evident from the examples provided for the stakeholders' groups presented so far, some companies have developed a portfolio covering different smart grid areas. They include ABB, Siemens, Schneider (on the automation and control side), or IBM (on the software side). They represent good channels of TIGON go-to-market either as partners or direct customers of the developed solutions (through licensing).

For the sake of simplicity, we consider in this stakeholder group the different associations of industry players that work on one or more smart grid technology and solutions. Grouping together technology players with different backgrounds and portfolios, they can be seen as a channel for end-to-end solutions. Examples of such associations include eu.bac (European Building Automation and Controls Association) ESMIG (European Smart Energy Solution providers), APPLIA (Home appliance Europe), EUASE (European alliance to save energy), PSMA (Power Source manufacturing Association), EPSMA (European Power Sully Manufacturing Association), Energy Security Council.

Moreover, smart grid designers, developers and engineering companies can be also leveraged as a channel of the project's solution, as they directly influence how a grid will be developed, using which technology and brand. Examples of companies developing RES and smart grid projects include European Energy, Merit SI, Naveco Power, Terra.Gen Renewable energy, ECO2, Meeco services.

While the first integrated companies tend to have an international presence, these developers are smaller in size and usually have a national presence.

- Geographical area of operation: Global/Regional/National
- Technology understanding: High
- Technology interest: Medium to High (designers) to High (smartgrid integrated technology companies)
- Services understanding: High
- Interest in Services: Medium
- Impact: High

4.1.9. Technology channels

The large majority of providers leverage both a direct sale and an indirect sales strategy. Resellers, distributors, VARs (for software) are all indirect sales channels. They are key to bring technologies to market, especially on a local level. A good distribution strategy is vital for the success and profitability of a product. Moreover, indirect sales channels can influence the purchase of a technology (versus a substitute technology) or a brand (versus a competing brand). The indirect sales strategy, though, is part of the business modelling of the partners that will bring TIGON to market. As such, their understanding of the technology is medium to high, while their interest in new potential products to distribute (new business) is high but there is not a specific interest in TIGON technologies. Moreover, their interest in the final enabled services is generally little and their impact on the success of TIGON results is limited (at the least in the short term, during and just after the end of the project). It will become more relevant in the long term for technology providers to enhance their distribution channels to make TIGON related products and services available throughout the EU or even internationally.

- Geographical area of operation: National, Local
- Technology understanding: Medium to High
- Technology interest: Low to Medium
- Services' understanding: Low
- Interest in Services: Low
- Impact: Low

4.2. Energy providers

4.2.1. TSOs, DSOs, Utilities

TSOs operate the transmission network (i.e. High Voltage) and are responsible for the infrastructure at the national and regional levels. It is a very concentrated market, with just one or few players per country. Examples include Terna (Italy), RTE (France), REE (Spain), REN (Portugal), TransnetBW, TenneT, Amprion, 50Hertz Transmission (Germany). Considering the high concentration of the market, analysing TSOs is a simpler exercise than with DSOs. Targeting TSOs, though, poses all those challenges of account-based marketing with very large organisations (e.g. qualifying the right people inside the organisation, getting attention, etc). DSOs are responsible for energy distribution (>100'000 customers. Utilities are small DSOs <100'000 customers) and manage Medium to Low Voltage down to the consumers' meters. There are several DSOs in Europe (2556 in 2020). The recent EU Clean Energy Package (CEP) includes many provisions targeted at DSOs. They are expected to develop multiannual grid investment plans, ensure flexibility to face peak loads, allow network neutrality and appropriate data management. At the same time, they need to ensure the stability of the grid in a market that is set for increased electrification as decarbonisation targets will be partly achieved through electrification (EVs, heat pumps in buildings, etc). So DSOs face several challenges but also opportunities to grow. Examples of DSOs include E-distribuzione (Italy), Iberdrola and Endesa (Spain), Enedis (France), EDP Distribuição (Portugal), RWE (Germany), etc. They operate on a national and local level. They usually have a medium understanding of technologies and a low to medium interest in new technologies (as there are risks associated to the deployment of innovations, while the investment needed can be high. ROI issues are critical to them). On the contrary, they have a very strong interest in the enhancement of energy services. Considering they are key target customers of TIGON, their impact on the project is anticipated to be high.

- Geographical area of operation: National, Local
- Technology understanding: Medium
- Technology interest: Low to Medium
- Services' understanding: High
- Interest in Services: High
- Impact: High

It is worth noting that energy players have forged several associations, which represent a key channel for TIGON to reach its members. These associations include, as examples, EDSO, CEDEC, EULECTRIC and GEODE. A new DSO association (i.e. EU DSO entity) started its operations in 2021 with the aim of ensuring coordination of its member DSOs. At the moment of writing, 898 DSOs have already registered to the new association. The full list by country is available at https://www.eudsoentity.eu/registered-organisations/.

Differently from energy providers, these associations operate internationally but their understanding and interest in the technology and services, and overall impact on the project mirror the ones of its members.

4.2.2. Energy communities/ Energy cooperatives

According to JRC, "*community energy refers to a wide range of collective energy actions that involve citizens' participation in the energy system*". These communities are more widespread in Denmark,

Germany, and in general North-Western Europe. There are various forms of communities but the prevailing one is energy cooperatives (around 3500 in the EU). Other types include limited partnerships, development trusts, and foundations. They are mostly involved in energy generation (mostly solar, wind, hydro) but can operate also in other areas including supply, consumption and sharing, distribution, electro mobility, energy and other services. The social, cultural, political setting of a country and a favourable policy environment are major factors driving the development of energy communities. Examples include Bauvent (Belgium), Courant d'Air (Belgium), Marstal Fjernvarme (Denmark), Svalin co-housing complex (Denmark), Enercoop (France), SAS Segala Agriculture et Energie Solaire, Bioenergiedorf Juhnde (Gemany), Sprakebull Village (Germany), Amelander Energie Cooperatie (The Netherlands), etc.

In general, these communities have a relatively small size, low to medium understanding of the technology and a relatively little interest in the technology per se (including TIGON KERs), as their focus is on the benefits they can gain from the community energy services. As target customers (including existing and potential new communities), their impact can be high.

- Geographical area of operation: Local
- Technology understanding: Low to Medium
- Technology interest: Low
- Services understanding: High
- Interest in Services: High
- Impact: High

4.2.3. RES providers and Solar Power Plants

RES providers include different types of players. Large DSOs and utility companies have turned to RES. Italian Enel, for example, claims its 43-gigawatt fleet of renewable generation is the largest in the world. Iberdrola has recently completed a new solar plant in Bilbao (see below). A major asset swap between German RWE and Eon was recently completed, with RWE Renewables now set to become one of the largest renewable players in the EU. Oster in Denmark is also a very active player, especially in the wind segment. In other countries, like France, where EDF is still largely dependent on nuclear, alternatively players have emerged, including Direct Energie, Planet Oui, Poweo. Moreover, private non-energy companies have entered this market (see below 4.4. They have not been included in this group). These players operate on a national or local level and can have a strong impact on the project driven by the enhancement in RES services it can enable.

- Geographical area of operation: National/Local
- Technology understanding: Medium
- Technology interest: Medium
- Services understanding: Medium to High
- Interest in Services: High
- Impact: High

A specific focus needs to be put on solar power plants as key targets of KER 4. Solar power attracts the largest share of RES investments (more than 40%). Solar cell production has increased dramatically since 2000 (growing at a 40% CAGR), driven by Chinese players, which dominate PV production. Overcapacity in the supply chain has caused a sharp decrease in prices in the last few years. Lower prices and large-scale deployments have sustained global market demand. Looking at

installations, the EU held around 23% of global PV generation capacity (2018), able to meet only 4.8% of energy demand. Stronger investments would be needed to meet the EU decarbonisation goals (from 14 GW in 2019 to 70+ GW in 2030). Despite the Covid pandemic, the number of installations grew fast in 2020 (+11% in power installed to 18.2 GW in 2020). The majority of EU installations are in Germany, Italy, France, Spain and Belgium. The largest PV power stations are located in Asia (China and India). Spanish Iberdrola has recently completed the largest PV EU plant (Núñez de Balboa). The plant has installed more than 1.4 million solar panels and will be able to supply energy to 250,000 people per year. Other examples of large plants in the EU include Cestas Solar Park (France), Troia Solar Park (Italy), Krista Solar Park (Belgium), Solar Park Meuro (Germany). Nonetheless, beyond these utility scale examples (often led by large energy operators), the segment is very fragmented. As an example, there were 732,053 solar power plants operating in Italy in 2016. Small sized plants (<3 kW) were 245,293, with an installed power equal to 670 MW. The average sized plants, from 20 kW and 1 MW, reached 10,638 units, for a total installed capacity amounted to 7,296 MW, while the large plants, with power over 1 MW, reached 1,142 units, for a total installed capacity amounted to 4,177 MW. Considering this high fragmentation and the large presence of small installations, the understanding of the technology and the active interest in TIGON results is expected to be rather low (for smaller installations). Nonetheless, the interest in the services is generally high. As a customer, the impact is also expected to be also high.

- Geographical area of operation: Local
- Technology understanding: Low to Medium depending on the size of the plant
- Technology interest: Low to Medium depending on the size of the plant
- Services understanding: Medium to High depending on the size of the plant
- Interest in Services: High
- Impact: High

4.3. Innovative AEC companies

Civil engineering and large construction companies can play a role within TIGON. These companies have usually a focus on the development of critical infrastructure, are large in size and operate on a multinational level. They include Vinci, ACS, Bouygues Construction Divisions. Saipem**,** TechnipFMC, Strabag**,** Eiffage**,** Hochtief, Skanka. Since their focus is on critical infrastructure, they can support large-scale grid developments (DSOs, TSOs).

Considering the local dimension of microgrids, with energy renovation projects often associated with retrofitting/expansion of districts and buildings, smaller architectural, engineering and construction companies can also play a role in influencing the decisions connected to the deployment of PVs and the establishments of local microgrids. The construction market is strongly fragmented. The large majority of companies in the EU have less than 10 employees. These micro-companies have in many cases limited technical understanding. Moreover, acting as a pure channel to market, they have also a limited interest in the services enabled. As such, their impact on the project is expected to be limited (especially with regards to small companies) but can be medium when considering large companies developing critical infrastructure.

- Geographical area of operation: Global, National, Local
- Technology understanding: Low to Medium depending on the size
- Technology interest: Low
- Services understanding: Low to medium

- Interest in Services: Low
- Impact: Low to Medium

4.4. Private and public sector organisations

Private and public sector organisations have been grouped as users of some solutions (e.g. energy managers, facility managers), customers (developers of microgrids) and prosumers of the energy services. Examples of microgrids can be found in:

Private sector:

- Mall/shopping centres
- Office districts
- Industrial parks
- Sport facilities
- Other commercial properties
- Data centres
- Research centres
- Airports, ports
- Etc.

Public sector:

- Schools
- University campuses
- Hospitals
- Public infrastructure (e.g. public lighting, public transport infrastructure, etc.)
- Etc.

In general, their understanding and interest in the technology per se is little but they have a strong impact on the project being target customers with current medium interest in the potential enhancement of energy services.

- Geographical area of operation: Local
- Technology understanding: Low
- Technology interest: Low
- Services understanding: Low to Medium
- Interest in Services: Low to Medium
- Impact: High

4.5. General public

The general public (citizens) is not a direct target of the solutions as we considered building owners as part of the public sector (see 4.4) and energy communities that aggregate citizen's demand in a separate stakeholder group (see 4.2.2). With this in mind, we expect the impact of the general public on the project to be rather limited. Moreover, the general public hasn't got any understanding of

technologies, and a low understanding of potential new services, even though they could be interested.

- Geographical area of operation: Local
- Technology understanding: None
- Technology interest: None
- Services understanding: Low
- Interest in Services: Low to Medium
- Impact: Low

Consumer associations and NGOs can act as information channels and influencers of citizens/consumers' behaviours/opinions. Considering, though, the focus on TIGON we believe that they would have a lower impact compared to energy communities. Still consumer associations could push the development of new citizens' led energy communities in EU countries, even though this is not a core mission for them being focused on defending consumers' rights.

- Geographical area of operation: National
- Technology understanding: None
- Technology interest: Low
- Services understanding: Low
- Interest in Services: Medium
- Impact: Low to Medium

Like other stakeholder groups, the EU association (BEUC) can be a good channel to reach national consumer associations. BEUC represents 45 independent consumer organisations from 32 countries. The full list is presented at the following link: https://www.beuc.eu/our-members.

4.6. Policy makers

Policy makers have a key role in driving the EU decarbonisation. They can operate in different areas including:

- Setting favourable regulatory environments for the development of microgrids, renewable energy investments, etc.;
- Providing incentives to the deployment of green energy projects;
- Financing R&D spending in energy areas;
- Being active customers of new technologies/solutions to move their buildings and infrastructure to green energy (driving by example). This instance is already covered in paragraph 4.4.

As such, they can have a strong impact on the success of TIGON. Policy makers include EU member state governments, which by definition operate at local (and provincial and regional level in countries where provinces/regions are present) and national level, and supranational institutions including the European Commission and the European Parliament. We consider in this stakeholder group also public bodies and agencies operating at the supranational level that are not policy makers (they don't develop policies) but, as assessors, contribute to policy making with analyses and recommendations. They include IEA (International Energy Agency) and IRENA (International Renewable Energy Agency). Moreover, related associations are included in this group and can represent viable channels to reach them. They include ACER (European Union Agency for the

Cooperation of Energy Regulators), CEE (Council of European Energy Regulators), CCRE (Council of European Municipalities and Regions), EURADA (European Association of Development Agencies) and the Covenant of Mayors.

- Geographical area of operation: Local/National/Supranational
- Technology understanding: Low
- Technology interest: Low (low to medium for supranational organisations)
- Services understanding: Medium
- Interest in Services: High
- Impact: High

4.7. Scientific community

Energy has become a key topic driving debates and research investments in the EU scientific community. In 2019, government led R&D spending on energy grew by 3%, with around 80% of all spending on low-carbon technologies including energy efficiency, renewables, nuclear, hydrogen, energy storage and smart grids. Corporate R&D spending also continues to grow. According to IEA, corporate R&D spending on energy grew by around 40% since 2010 (74% considering only renewable energy technologies). Of course, the Covid pandemic represents a risk. R&D practitioners may find it difficult to execute funded projects in 2020, and public and corporate budgets are expected to be under pressure.

There are different actors in the scientific community, including universities, research centres as well as experts and researchers working in corporate R&D departments.

According to USnews, the top universities in Europe covering “energy and fuel” include 66 technical institutes, ranked according to their global and regional research reputation, publications, books, conferences, citations and collaborations. Examples of institutes included in the list are: École Polytechnique Fédérale of Lausanne, University of Oxford, Imperial College London, University of Cambridge, Technical University of Denmark, Aalborg University, Polytechnic University of Milan, Swiss Federal Institute of Technology Zurich, Royal Institute of Technology, Delft University of Technology, RWTH Aachen University, Catholic University of Leuven, Eindhoven University of Technology, Karlsruhe Institute of Technology, Chalmers University of Technology, University of Lisbon, Lund University, Technical University of Berlin, etc.

There are also several research centres active in the energy domain. They include CIRCE, Foss, Eurac, RISE, WIP, AIT. Many of them have adhered to EUREC, which is the association of European renewable energy research centres and is a good channel to reach all its members (some 35 research centres in the EU). Other associations include EERA (European Energy Research Alliance) and CIGRE (International Council on Large Electric Systems)

Both universities and research centres work mainly on a regional and international level. Even universities, which tend to have a local presence, aim to attract international students and research skills and increase their reputation and visibility internationally. The scientific community has in general a very solid understanding and interest in emerging technologies and services (i.e. their areas of focus). Their impact on our project can be medium; they have an indirect impact on replication by sharing knowledge and build upon the results of the project. They have a more limited direct influence on the adoption by the target customers compared to business and other stakeholders.

- Geographical area of operation: Global, regional
- Technology understanding: High
- Technology interest: High
- Services understanding: High
- Interest in Services: High
- Impact: Medium

4.8. Investors

The role of investors can be considered from different perspectives:

1. The development of technologies, solutions and start-ups

Investors are investing heavily in renewable energy projects. As of December 2020, renewable energy investors had backed 529 deals, a 14% increase from 2019, with focus on infrastructure, power generation, storage, and energy management software. Key players include Shell Ventures, EIT InnoEnergy, Energy Impact Partners, and Total Carbon Neutrality Ventures are the most active investors in the renewable energy ecosystem. In particular, EIT InnoEnergy, the EU's energy-focused innovation fund, keeps on helping start-ups that will strengthen the EU renewable energy ecosystem. The financial support in this area could support TIGON technologies and solutions to scale to TRL 9. This is a key focus area of the project's exploitation activities. The exploitation plan will investigate financial mechanisms and resources that partners can adopt in this area. Nonetheless, a preliminary strategy is already set and no major issues are expected in this area.

2. The development of DC hybrid smart grids and microgrids implementing the technologies and solutions developed by TIGON and enabling strong replication across the EU

Considering that private investment is the most important source of financing of smart grid projects (with DSOs leading the effort), the role of investors becomes very relevant when considering microgrids developed by citizens' communities, and small public and private sector organisations. Key players in this area include financial institutions (e.g. banks, private equity, venture capitalists, etc.) and ESCOs.

ESCOs provide energy services to final end-users but can also finance or arrange financing for their operation. Their remuneration is then tied to the energy savings achieved. Belgium, Croatia, Denmark, Slovenia and Italy are showing the strongest ESCO market growth, while other EU countries are progressing slowly (and at a slower pace compared to countries/regions outside the EU). Different barriers are still affecting EU ESCO players, including mistrust from potential customers, their ability to inform and raise awareness on their activities and benefits, their inexperience, ambiguities in the legislative framework and small size projects. A recent trend in this area sees the financial bundling of multiple projects into a portfolio. This attracts more investment because of the increased portfolio size and contributes to de-risk it. A list of ESCOs operating in the EU is provided in the JRC ESCO library, available at https://e3p.jrc.ec.europa.eu/esco-library. Nonetheless, there are different ESCOs not listed in the JRC library. As an example, the list in Italy (which is one of the largest ESCO markets in the EU in Euro terms) covers more players (and can be found at the following link https://fire-italia.org/elenco-esco-certificate-11352/). Many ESCOs have strong roots in their countries of operations and tend to operate at the national level. There are some ESCOs that have an international presence. They are often spin offs or parts of large groups,

including manufacturers with a stake in renewable energies. Examples include Honeywell technologies, Siemens building technologies, Schneider electric building, etc.

Financial institutions and ESCOs show differences in the understanding and interest in services and technologies. Focusing on ESCOs, this is the anticipated behaviour towards TIGON:

- Geographical area of operation: National (with selected large players operating also internationally)
- Technology understanding: Low to medium (depending on ESCO, it can be medium)
- Technology interest: Low to Medium
- Services understanding: High
- Interest in Services: High
- Impact: High

Like other types of stakeholders, also ESCOs have their associations operating at the EU level. They include eu.ESCO and RESCoop. They have a similar profile to their members but operate at the EU regional level.

Focusing on traditional financial institutions:

- Geographical area of operation: National
- Technology understanding: Low
- Technology interest: Low
- Services understanding: Low to medium
- Interest in Services: Low
- Impact: Medium

4.9. Standardisation bodies

Standardisation and interoperability are always key issues when dealing with technology and especially new technologies. Standardisation bodies can therefore have an important impact on the deployment of TIGON results. Key standardization bodies in the EU include:

- CEN: European Committee for Standardisation (www.cen.eu), active in energy and environment among other sectors and bringing together 34 national standardisation bodies. The full list is available at the following link: https://standards.cen.eu/dyn/www/f?p=CENWEB:5

- CENELEC: European Committee for Electrotechnical Standardisation (www.cenelec.eu), operating in the electrotechnical engineering and bringing together 34 national committees. The full list is available at the following link: https://www.cenelec.eu/dyn/www/f?p=104:5:1029070987276501:::::

- ETSI: European Telecommunications Standard Institute (www.etsi.org), operating in the ICT (including hardware, software, networking and telecommunications) sector and bringing together 740 member companies and organisations, drawn from 62 countries across 5 continents worldwide. The full list of ETSI members is available at the following link: https://www.etsi.org/membership

These bodies have a strong understanding and interest in new technologies, including the areas of development of TIGON results. They have a solid understanding also of the services they enable but not such a strong interest in them. As stated above, though, with standardisation and interoperability acting as key barriers, their impact is high.

- Geographical area of operation: Global, Regional
- Technology understanding: High
- Technology interest: High
- Services understanding: Medium to High
- Interest in Services: Low
- Impact: High

4.10. Media

There is a long-standing debate about the role of media as a target or multiplier of information. We believe in the latter and consider media as a platform to reach the targeted stakeholders profiled in this report (rather than a target itself).

5. Stakeholders' mapping and prioritization

In the previous chapter we analysed the profile of the key stakeholders in the TIGON ecosystem. In this chapter we leverage this analysis to map and prioritise them.

The focus is:

- Interest and understanding of the technology developed by TIGON against impact, to define the related strategy and messages;
- Interest and understanding of the enhanced services and benefits enabled by TIGON against impact, to define the related strategy and messages;
- Geographical area of operation against impact, to assess the most appropriate geo strategy to reach them.

For the sake of simplicity and readability, the following labels have been used in the figures mapping the stakeholders we identified.

Table 5.1: Stakeholders' labels

SH LABELS	Stakeholders
Supp	Suppliers
STT/DC-DC	Manufacturers of SST transformers and DC-DC converters
DC pro_ MCS	Manufacturers of DC protection systems and monitoring and control systems
EMS	EMS solution providers
DSS	DSS software providers
SS	Security software and services
Other	Other software providers to the energy sector
Smart pro	Smart grid integrated technology providers
Smart de	Smart grid designers
Tech ch	Technology channels
TSOs/DSOs	TSOs, DSOs, Utilities
E comm	Energy communities/ Energy cooperatives
RES	RES providers
SPP	Solar power plants
L AEC	Large AEC companies
SM AEC	Small & Mid AEC companies
PP org	Public and private sector organisations
Gen pub	General public
Cons ass	Consumer associations
PM loc	Policy makers: local

PM nat	Policy makers: national
PM sup	Policy makers: supranational
SC	Scientific community
ESCOs	ESCOs
Inv	Traditional investors
Stand	Standardisation bodies

5.1. TIGON Stakeholder technology mapping

The first mapping scatters stakeholders according to their impact on TIGON results (i.e. the value they can bring) and the interest they have in the technologies developed in the project. As already said, we consider within technologies all hardware, software and technology consulting, advisory and strategy services that will be developed in the project.

The map presents a series of stakeholders showing high impact and high interest with different levels of priority:

- Priority 1: Standardisation bodies, smart grid integrated technology providers
- Priority 2: Smart grid designers, energy management system providers and DC protection system and monitoring control system providers
- Priority 3: DSS providers, Cypersecurity software and services providers, and the scientific community

These would represent the stakeholders we need to manage closely with a cooperation approach that is involving them in direct discussions on the development of the result and/or planning together the potential exploitation routes. Considering the relative high interest they have in the technology, the value proposition and key messages can be built on the technical feature and functions of TIGON results. It should be noted though that we evaluated their interest in TIGON technologies either medium or medium to high (rather than high), owing to the innovations but also the risks they bring. The focus of such cooperation should be also to increase their interest in the results we will produce.

Given the anticipated strategy of TIGON KERS 1 and 2, manufacturers of SST transformers and DC-DC converters, which can have a strong interest in TIGON KERs, are set to have just a low to medium impact on the project. At the moment, we need to monitor these stakeholders and understand the evolution of their portfolio in the TIGON related areas.

A series of stakeholders have a low to medium impact and interest in the technologies developed in our project. They will not represent primary targets in the short term and the activities of TIGON will be limited (i.e. informing them through communication and dissemination rather than cooperating and/or engaging with them).

Nonetheless, there are several other stakeholders that have little or medium interest in the technologies developed by TIGON but quite a strong impact on its results. They mainly include TIGON demand-side stakeholders (potential end-customers developing grids and smart grids), policy makers and ESCOs.

Also, in this group it is possible to prioritise them as follows:

- Priority 1: RES providers, Solar power plants, TSOs/DSOs, ESCOs and policy makers (supranational level)
- Priority 2: policy makers (national and local level), Energy communities, public and private sector organisations

According to the traditional stakeholder mapping scheme, they would be the stakeholders to keep satisfied. Within TIGON we believe that this is the area where we need to make sure that the technology delivers the benefits it promises. We also believe that these stakeholders need to be engaged and consulted in order to make sure the development of TIGON meets their needs and requirements. Moreover, considering the medium and in some cases little potential understanding of technologies, stakeholders in this group may also be targets of training and capacity building initiatives.

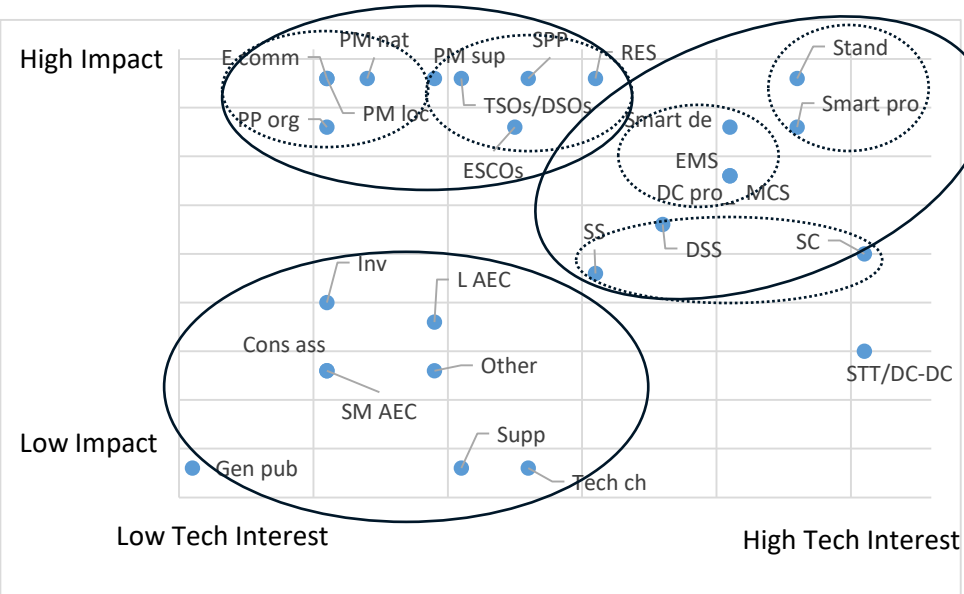


Figure 5.1: TIGON Stakeholders' technology mapping

Indeed, we also tried to understand if there was a positive correlation between the level of understanding of technology and the interest in the technology. As shown in the figure below, we believe the correlation is rather high, with some exceptions though. In principle, all technology providers have the capability to understand the technology features and functions we could present them. Nonetheless, we believe that their interest in TIGON results is probably lower than their capability to understand them. Moreover:

- The level of understanding of other software and services providers and technology channels is rather high, but their interest in our specific technologies remain limited (other software and service providers have a portfolio covering other areas; technology channels are interested in technologies ready for market distribution).
- The level of understanding of TSOs and DSOs is the highest among potential customers, not as high as manufacturers', whose main focus is technology but still pretty high. It should be noted, though, that the decision of implementing innovative grid solutions may rely on people with a non-technical background, which of course represents another challenge. The interest

is only medium (due to the potential risks tied to the development of very innovative technologies such as those produced by TIGON).

- Security software and service providers and decision support system providers have a high capability to understand software functionalities, but their portfolio spans several industries and their specific interest in TIGON might be more limited compared to players with a specific offer in the energy sector. hardware and software providers
- In all other cases, the correlation between interest and understanding tends to be quite high.

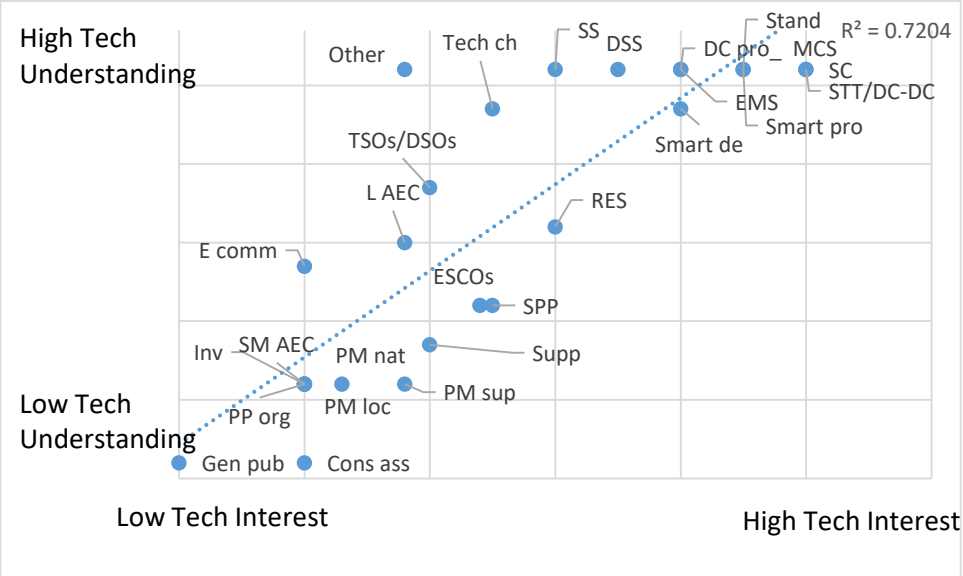


Figure 5.2: TIGON Stakeholder mapping: technology interest versus technology understanding

5.2. TIGON Stakeholder services' mapping

With so many stakeholders falling in the quadrant "high impact/low interest in the technology", we believed it was necessary to investigate them further and worked on a mapping focused on the end user energy services delivered by smart hybrid grids and microgrids and their expected benefits. As already stated above, technology services (consulting, strategy, advisory, etc.) are considered in the technology mapping. We are focusing here on energy services and related benefits in terms of stability, performance, etc.

The results of the analysis show quite a different picture compared to the technology mapping

In the quadrant high impact/high interest in services, we can see all energy service providers (including RES providers, Solar power plants, TSOs/DSOs), ESCOs (as service providers as well as potential investors), policy makers (local, national, supranational) and energy communities (as service providers and consumers of energy services).

As said, this the area of stakeholders' engagement and consultation to ensure the project delivers all benefits it promises. Clearly value propositions and key messages need to be centred on these benefits rather than the technology per se.

The quadrant low impact and low interest shows the same stakeholders than in the technology mapping. These stakeholders don't represent a priority at least in the short term.

In the quadrant high impact/low interest, we have mainly manufacturers and technology providers whose interest in the services is mainly connected to their marketing messages and go-to-market strategy. Delivering energy services is not their core business, and considering this initial phase of product development, their attention could be more on the technical features and functions rather than the value proposition to the end customer. Nonetheless, with reference to this analysis on enhanced services, we believe that the role of TIGON would be support them in building solid value propositions to the end users, centred around energy services and benefits as proven and demonstrated in our project (fact-based value propositions to their end customers). There is an exception, that is public and private sector organisations. As potential customers of the solutions in TIGON, we need to increase their interest in the benefits TIGON can bring. This will have to be done mainly locally, as it will be described in the following paragraph.

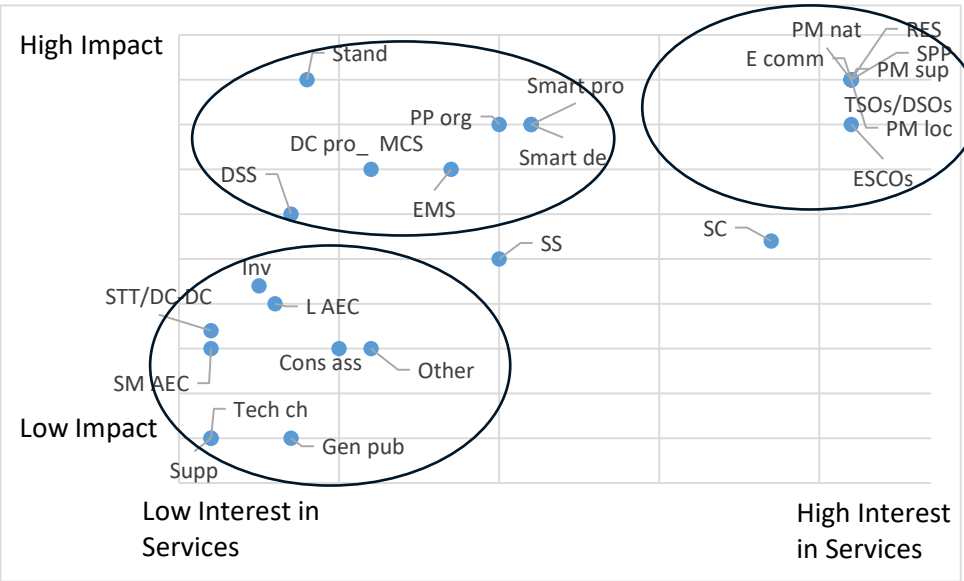


Figure 5.3: TIGON Stakeholders' Services mapping

Lastly, we also mapped the potential interest in services versus their understanding. Also in this case, there is a positive correlation, but rather limited (R2 at 0.3565 versus R2 at 0.7204 for technology). There are indeed a series of stakeholders that despite being able to understand the benefits delivered are less interested in them compared to the technology per se, at least in this initial phase of technology development. We are mainly talking about technology manufacturers and providers.

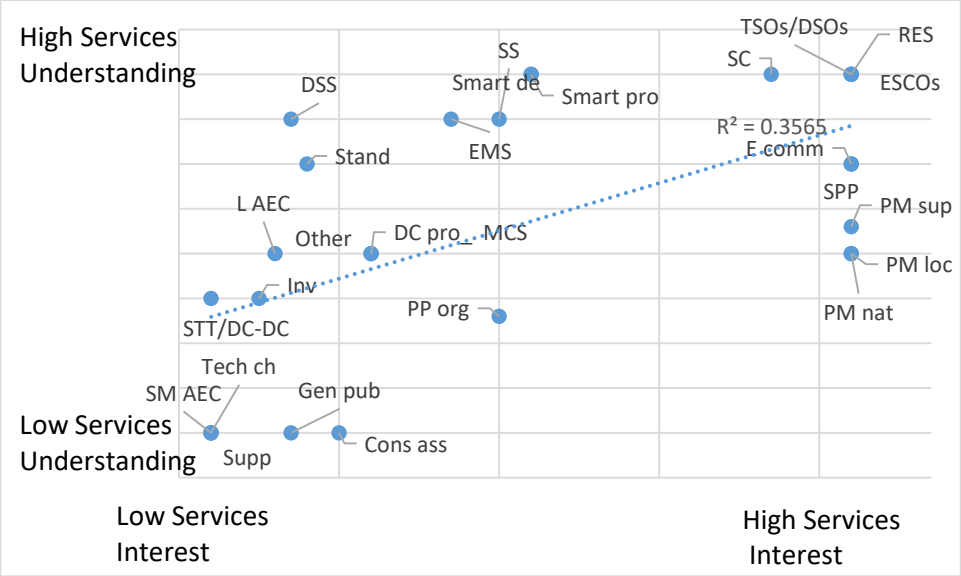


Figure 5.4: TIGON Stakeholder mapping: interest in services versus understanding

5.3. TIGON Stakeholders' geographical area of operation

The mapping of stakeholders by geographical area of operations shows the following needs:

- Reaching locally energy communities, local policy makers, solar power plants, RES providers and public and private sector organisations. This calls for
  - Developing a local dissemination and communication strategy that can be led by the partners in the demo sites;
  - Leveraging a local engagement strategy through direct contacts by the partners in the demo sites;
  - Fine tuning the regional dissemination, communication and engagement strategy targeting the associations representing these stakeholders;
  - Developing different value propositions and messages, depending on their interest in the technology or enhanced services/benefits as described in the previous maps.
- Reaching nationally TSOs/DSOs, Policy makers, ESCOs and smart grid designers. This calls for:
  - Reaching out to country's media for a country specific D&C strategy;
  - Leveraging all project's partners contacts in their countries for an effective direct engagement strategy;
  - Keeping on leveraging international media and dissemination channels as per the project D&C plan developed by ICONS (as especially TSOs, DSOs, smart grid designers and national governments are usually very interested in the developments in other countries);
  - Fine tuning the regional dissemination, communication and engagement strategy targeting the associations representing these stakeholders.
- Reaching out to supranational policy makers, standardization bodies and regional/global technology players, starting from smart grid integrated technology providers, manufacturers of DC protection and monitoring and control systems and energy management system providers (as having a potential stronger impact on the project's results in the short term) and

extending to decision support system providers, the scientific community and cybersecurtity software providers as having a medium to high or medium impact on the project. This will be achieved through the:

- Regional D&C and engagement strategy already developed for the project;
- Leverage of partners' contacts at the supranational level (e.g. European commission, public bodies and agencies) and with regional associations;
- Leverage of partners' contacts in country to open the doors to the international headquarters of manufacturers (in case local subsidiaries haven't got decision power).

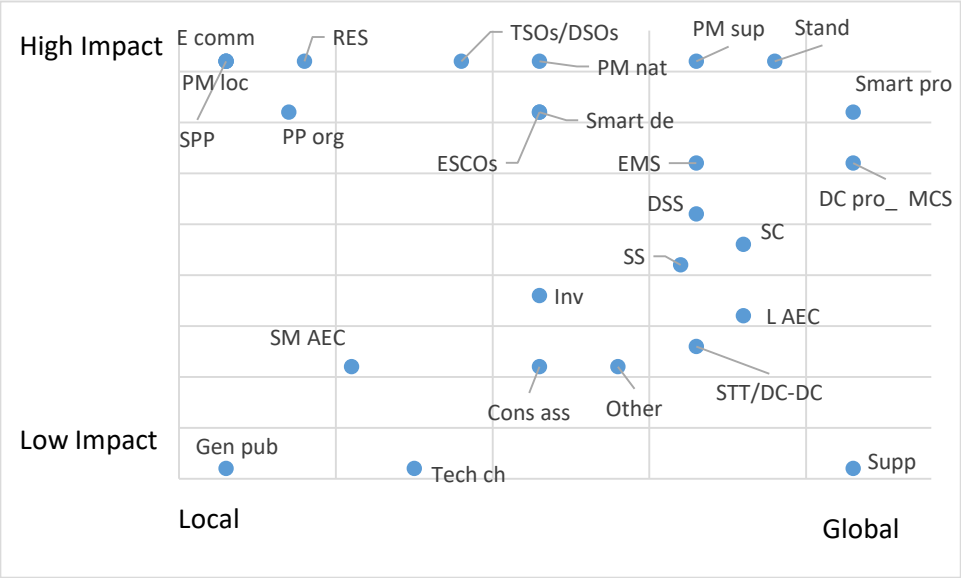


Figure 5.5: TIGON Stakeholders' geo mapping

6. Conclusions and next steps

The stakeholder mapping presented in this document prioritises a series of stakeholders, mainly those in the high impact/high technology interest quadrant (cooperation approach) and high impact/ low technology interest quadrant (engage, train and consult). These latter are the key stakeholders when considering their interest in enhanced energy services (quadrant high impact/ high interest in services in the services mapping).

This mapping and prioritisation represent our best interpretation of the situation as of today. Several factors can influence and change the current distribution of the stakeholders in the maps, including:

- External factors affecting the stakeholders' interest and/or role in the ecosystem (e.g. stakeholders turning into TIGON direct competitors, emergence of alternative technologies, policies favouring DC hybrid grids, new R&D results from the scientific community in the same or correlated areas, etc. They can enhance/decrease the interest in TIGON results and/or change the role of stakeholders in the TIGON ecosystem);
- Final consortium partners' exploitation intentions (e.g. licensing a product rather than directly commercialising it moves selected stakeholders from competitors to potential customers or the other way round; partners' new customers/connections may lead to prioritise certain stakeholders, at least in the short term, etc. This has obvious implications on the impact a stakeholder group can have on the project);
- The project overall capability to reach these stakeholders, considering the aim of the D&C and engagement strategy is also to increase the understanding of TIGON technologies, services and benefits and generate interest in its community of stakeholders.

Keeping this in mind and considering potential updates throughout the execution of the project (whenever needed), the insights from this report will be leveraged to:

- Fine tune the project communication and dissemination plan (next release at M20);
- Shape the project's engagement strategy at the local, national, and regional level;
- Support the assessment of the KERs' business model by developing a strategy to cooperate and engage with the key stakeholders identified.

To these aims, the mapping will have to be "operationalised". Each partner will create a list of stakeholders they have contact with starting with those with the strongest potential interest and impact on both technologies and enhancement in services. For each stakeholder, an assessment will be made around:

- The best engagement method (e.g. TIGON events, webinars, showcases, international networking through associations, other events –not managed by the project, etc.);
- The frequency of direct contacts with these stakeholders;
- Other initiatives to cooperate and engage with them.

7. Bibliography / References

- http://cleenet.org/index.php/en/online-courses/24-online-courses/module-1/90-stakeholder-mapping
- Markets and markets, https://www.marketsandmarkets.com/Market-Reports/silicon-carbide-electronics-market-439.html
- Grand View Research, https://www.grandviewresearch.com/industry-analysis/silicon-carbide-market
- Fior Markets, https://www.fiormarkets.com/report/global-sic-substrates-market-2019-by-manufacturers-regions-385631.html
- https://www.i-micronews.com/silicon-carbide-on-the-road-not-just-on-trial/
- Allied Market Research, https://www.alliedmarketresearch.com/solid-state-transformer-market
- Research Dive, https://www.researchdive.com/350/solid-state-transformer-sst-market
- Allied Market Research, https://www.alliedmarketresearch.com/dc-dc-converter-market
- Markets and Markets, https://www.marketsandmarkets.com/Market-Reports/global-dc-dc-converter-market-17565254.html
- Modor Intelligence, https://www.mordorintelligence.com/industry-reports/low-voltage-protection-control-market
- https://www.prnewswire.com/news-releases/covid-19---update-remote-monitoring-and-control-system-market-was-estimated-to-be-us-74-897-4-mn-in-2018-and-is-growing-at-a-cagr-of-10-3-over-the-forecast-period-says-absolute-markets-insights-301043430.html
- Fortune Business Insights, https://www.fortunebusinessinsights.com/industry-reports/energy-management-system-market-101167
- ENISA, Security aspects of the smart grid, 2012
- Markets and Markets, https://www.marketsandmarkets.com/Market-Reports/smart-grid-security-market-112912959.html
- Apps run the world, https://www.appsruntheworld.com/top-10-utility-software-vendors-and-market-forecast/
- Prettico, Marinopoulus, Vittiello, JRC science for policy report, Distribution System Operators Observatory, 2020
- https://www.eudsoentity.eu/
- Aura Caramizaru, Andreas Uihlein, JRC science for policy report, Energy communities: an overview of energy and social innovation 2020, 2021

- https://www.frenchentree.com/french-property/eco-homes/renewable-energy-suppliers-in-france/
- https://www.startmag.it/energia/grandi-aziende-energie-rinnovabili/
- JRC, PV Status report 2019
- https://www.solarpowereurope.org/european-market-outlook-for-solar-power-2020-2024/
- https://www.energylivenews.com/2020/01/20/iberdrola-completes-largest-solar-power-plant-in-europe/
- Wikipedia, https://en.wikipedia.org/wiki/List_of_photovoltaic_power_stations
- http://www.eniscuola.net/en/argomento/solar/solar-knowledge/some-more-numbers-in-italy/
- https://www.construction-europe.com/news/Top-10-European-construction-companies-2019/1139997.article
- IEA, World energy investment 2020, https://www.iea.org/reports/world-energy-investment-2020/rd-and-technology-innovation
- https://www.usnews.com/education/best-global-universities/energy-fuels?region=europe
- https://eurec.be/membership/
- CB Insights https://www.cbinsights.com/research/renewable-energy-tech-ecosystem-top-investors
- Boza-Kiss, B., Toleikyté, A., Bertoldi, P., JRC Science for policy report, Energy service market in the EU, Status review and recommendations 2019, 2019
- https://e3p.jrc.ec.europa.eu/esco-library.
- https://fire-italia.org/elenco-esco-certificate-11352/)
- https:/www.cen.eu
- https:/www.cenelec.eu
- https:/www.etsi.org