



*Smart system of renewable energy storage based on **IN**tegrated **EV**s and **bA**tteries to empower mobile, **D**istributed and centralised **E**nergy storage in the distribution grid*

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Author:	<b>UPC – Roberto Villafáfila SmartIO – Mari K. Buckholm</b>



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Partner	Reviewer
NTNU	Hossein Farahmand
SIN	Ari Hentunen

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## Executive summary

This document reflects the dissemination and communication actions performed during the second half of the INVADE project. It reviews the measures and actions taken during the second one and a half year of the project for spreading the project objectives and evolution. The main goals of WP2 are to disseminate and communicate the project insights, while capturing and maintaining the attention of potential stakeholders. The channels that have already been created during the first half of the project, have been used and numerous dissemination actions through these channels have been performed to broaden the impact of the project.

Taking into account the large influence that digital media has nowadays, a big effort has been focus on keep updated the webpage of the project and connect it to the social networks. In addition, several events have been organized and other communication channels like conferences, exhibitions or journals have been used to spread INVADE vision, objectives and results. Additionally, a second meeting of the Technical Advisory Group (TAG) has been done, and descriptive videos of the pilots have been released. The project has been very active in the BRIDGE group. Finally, the two INVADE large scale events have been organized, the first one 10/10/2018 in Oslo, and the second one, 20/11/2019 in Barcelona as side event of Smart City Expo World Congress.

Using all these tools, the INVADE's communication and dissemination tasks have achieved the following numbers:

- Tweets: 331
- Twitter followers: 385
- LinkedIn followers: 164
- Publications in Facebook: 166
- Facebook followers: 166
- Research gate reads: 206 reads
- Research gate followers: 17
- Posts in the website: 55
- Videos: 19
- Newsletter: 4
- Contribution to BRIDGE newsletters: 3
- Organization of workshops: 10
- Participations to conferences/local meetings/seminar: around 45
- Trade fairs and exhibitions: 3
- TAG meetings: 2
- Peer-reviewed conference papers: 13
- Peer-reviewed journal papers: 9 + 1 under review



# 1 Introduction

The present report describes the work done in work package (WP) 2. The report includes the performance of the communication and dissemination tools between M18 and M36.

The document is structured as follows. First, the sections 2, 3, 4 and 5 describe the performance of the dissemination tools up from M18 to M36 one by one. Section 6 explains the activity of TAG. Section 7 describes the interactions between the INVADE project and the EU commission initiatives like the BRIDGE projects cluster. Section 8 details additional dissemination tools and the public repository used to make public all possible outputs. Finally, Section 9 checks the key performance indicators (KPIs) included in the DoA and the Dissemination Plan (D2.2).

## 2 Website

The website URL is [www.h2020invade.eu](http://www.h2020invade.eu). It has been used as a hub of the INVADE project during this three years for the dissemination and communication activities providing news and information in order to raise a common understanding of the project and approach the project to different stakeholders in an effective matter.

The website presents challenges and objectives of the project, introduces the project beneficiaries, and presents key outcomes in the form of reports, presentations, articles, films, press reports (media attention) and social media posts and tweets.

### 2.1 Structure and content

The structure of the website has maintained its initial design regards menus, to which it has been added the menu “*Events*”:

- Home
- The project
- Deliverables
- Partners
- Contact
- Event (new)
- News

Next sections detail the content that has been updated from the first year and a half of the project.

### 2.1.1 The project

A brief description of each of the five pilot locations have been included in a frame within this section. From each short description of each pilot – Bulgaria, Germany, Spain, Norway and the Netherlands – clicking on “Read more” a larger description of each pilot is provided.

The INVADE project  
What is it about?

**Our current electrical infrastructure face several challenges in the coming years, one being a greater share of renewable energies, another is aging infrastructure. These challenges should be resolved in a cost-efficient manner.**

Renewable energies set higher demands to system resilience and flexibility, as we deal with intermittent energy resources, and it is oftentimes produced locally in the distribution grid. New system infrastructure is very expensive, urging for better use of existing infrastructure in conjunction with new inexpensive technologies.

**Better energy services**

INVADE seeks to solve these issues by combining already existing technologies into a new framework. At the core is a cloud-based flexibility management system integrated with electric vehicles (EVs) and batteries empowering energy storage to increase the share of renewables in the smart grid. Additionally, smart control of domestic appliances will aid in load-balancing over the course of a day.

Combining physical batteries with state of the art data technology will open new marketplaces to trade energy and energy services, which in turn will provide the end-users with better services. The electric grid manager will also benefit from this by better being able to manage their resources, and discover patterns in the power consumption, all made possible by the latest technology within big data analytics.

**Large-scale pilots**

The project will integrate the platform with existing infrastructure and systems at pilot sites in Bulgaria, Germany, Spain, Norway and the Netherlands, and validate it through mobile, distributed and centralized use cases in the distribution grid – in large-scale demonstrations.

Novel business models and extensive exploitation activities will be able to tread the fine line between maximizing profits for a full chain of stakeholders and optimizing social welfare, while contributing to the standardization and regulation policies for the European energy market. A meaningful integration of the transport sector is represented by both the Norwegian and the Dutch pilot – the two countries with the highest penetration of EVs worldwide.

**Specific project goals**

1. Design a flexibility management system using batteries that supports the distribution grid and electricity market while coping with grid limitations, uncertainty and variability with high penetration of renewable energy, electric vehicles and an increased number of diverse smart grid actors.
2. Develop a model for batteries including EVs focusing on prediction of batteries lifetime and impact factors contributing to life extension, and prepare a model for optimal sizing, positioning and scheduling of batteries in the distribution grid.
3. Deliver the Integrated INVADE Platform based on Flexibility Cloud enabling flexible management algorithms, functions and monitoring and control dashboards using Internet of Energy Things, Big data analytics and distributed systems to provide real-time information and control to the stakeholders and data.

**The five pilot sites are located in:**

**Norway** (Stavanger)  
Norway has the highest electric vehicle (EV) density in Europe and the economic incentives for end-customers are getting a considerable boost.

[Read more](#)

**Germany** (Freiburg)  
The German pilot focus on both, building up one centralised energy storage device as well as examining new business models for distributed energy storages.

[Read more](#)

**Spain** (Granollers)  
The Spanish use case aims at demonstrating that a storage system shared with other users, is a safe, reliable and emission-free alternative, which will cover a gap of two hours without using a genset and thus no emissions.

[Read more](#)

**The Netherlands** (Noord-Brabant)  
The Dutch pilot will cover three domains and two different approaches to charging electric vehicles on renewable energy.

[Read more](#)

**Bulgaria** (Albens)  
In Bulgaria, centralised electrical energy storage will be installed at a transformer substation that supplies two hotels, including restaurants, a spa centre and swimming pools.

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## Norway

**In Norway, effect based tariffs are emerging and will be implemented during the next 2-3 years. This combined with the highest electric vehicle (EV) density in Europe, makes so-called vehicle-to-home (V2H) relevant, as the economic incentives for end-customers are getting a considerable boost.**

For this to happen, we need solutions to enable bidirectional management of customer loads. The load with the most potential and value is the battery (EV or fixed), as it can enable a two-way flow of electricity and increase the supply security to households. In addition, thermal loads like electrically heated water boilers will also be tested.

In this context, the distribution system operator (DSO) will be able to postpone grid investments, and end users can save money if they can avoid high loads in the high tariff periods, a typical win-win situation. Lyse Elnett has started to implement one of Europe's most advanced four-quadrant automatic meter installations exploiting a generic gateway to collect real-time data. This rollout passed 50.000 installations in 2016 (Q1), including the whole Triangulum large-scale test bed area in Stavanger.

The Integrated INVADE platform will meet existing energy solutions in the European and international market. It will be crucial to demonstrate how existing smart energy solutions can be interoperable with the INVADE architecture and platforms. This represents a significant value increase to the INVADE project, as it is unlikely that early mover DSOs which have already started their smart grid and service rollout are willing to replace these investments.

### Pilot description

We will demonstrate how big data, machine learning and analytics parts of the INVADE platform can be integrated into the existing smart home solutions demonstrated in the Triangulum Smart City solutions in Stavanger with respect to V2H, batteries and boilers. This will provide both the DSO and the end-customers with information, feedback and interaction to promote behavioural change, as well as enable them to use energy efficient solutions and to exploit new opportunities arising in the EV/battery/second-life battery domain.

Equally important are the following three elements in this pilot:

1. The regulatory regime unleashing the effect-based tariffs (expected launched in the 2018-2020 period),
2. The customer behaviour analysis.
3. The deployment of all the above factors into a common business model (ref. close collaboration with WP9)


The stakeholders involved in this pilot are Lyse Elnett (DSO responsible for the distribution network & grid, effect tariffs, large-scale load shifting and customer management), Lyse R&D & Innovation (responsible for customer surveys, prototyping and business plan work), EV vendor with V2H functions, and the end-users.

The Stavanger pilot brings added value through the following special features:


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[Read more](#)

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[Read more](#)

 **Bulgaria** (Albena)

## Germany

**The German pilot focuses on both building up a centralised energy storage device as well as examining new business models for distributed energy storages.**

The Green City Freiburg in the south-western corner of Germany has about 200.000 inhabitants. Freiburg is one of the sunniest regions in Germany, experiencing a great penetration of Renewable Energy Sources. Further development and use of renewable energies is not only limited by a lack of resources, but also by the lack of capacity in power lines leading to the outskirts of the city. Due to the relatively high sun radiation in the south-west compared to other regions in Germany, many PV plants are installed. They are mainly connected to the low voltage network. Feed-in peaks during the day require new strategies to cope with congestion management and occurring voltage peaks.


Therefore, it suggests itself to select an application for the centralised energy storage dealing with this problem in a network area operated by the local distribution system operator bn-Netze, which is a subsidiary of badenova. The selected spot is located at an end-feeder in the rural area of Freiburg-Opfingen, which is a community pretty remote from the main city of Freiburg and located at the outer rim of the electricity network. Nevertheless, this region is predestined for PV-systems, because it's settled with many farm houses coming along with barns and extended roofs, perfectly suitable for the configuration with PV-modules.

In the selected case, a farmer's house is located at the end of a feeder, including four PV plants with a total installed power of 30.5 kWp. All four PV plants are connected via one single grid connection point to the low voltage network. The pilot test site is located at the end of a feeder which length amounts to 840 m until the next substation. In some cases on sunny days, voltage limits at the grid connection point are violated by the local generation of electricity. The voltage on the grid connection point rises up nearly 7.5% above the regular level on a day with maximum feed in from the PV-Systems and regular load. 3% are allowed at maximum. Due to the geographical distance of the PV plants to the grid connection point the voltage increases further on the property. It may happen, that at the connection point of the inverters the acceptable voltage tolerance of 10% is exceeded. In this case, the inverters shut down automatically and the PV-systems are no longer able to generate electricity. In consequence the PV-system owner loses the guaranteed feed-in tariff for the not produced energy. A strong interest on the side of the PV-system owner exists, that this case is avoided in any case.


By using a battery storage system, the PV plant shall fully feed-in into the local distribution grid even during peak production periods. The energy is not transported over the weak line but is stored within the battery temporarily. During night time, this energy is transported without causing any problems over the low stressed line. So the battery is foreseen to solely work as a grid-friendly component exclusively operated by the local DSO. Due to regulatory issues, it is not attended to increase the self-sufficiency of the farm house at the same time.

This case is an excellent example illustrating that a battery storage device can help to secure full generation of renewable


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The Dutch pilot will cover three domains and two different approaches to charging electric vehicles on renewable energy.

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## Spain

**The Spanish use case aims at demonstrating that a storage system shared with other users, is a safe, reliable and emission-free alternative, which will cover a gap of two hours without using a genset and thus no emissions.**

The pilot will take place in Granollers since there is a secondary substation which supplies the headquarters of the DSO and a number of private households. The DSO is an example of an entity with critical services needing electricity redundancy. The issue here is that redundancy depends on the HV distribution and transmission network, meaning that in the event of a blackout impacting both, all services will be down. The current alternative is to have generator ready for use, which means storing fuel and an expensive investment.

Consumers such as hospitals, police stations, and utilities among others, which are connected to secondary substations and shared with other consumers, have specific quality of service and endurance needs. Currently most of them have an alternative feeder and generator. The use case consists in providing them with a 2 hour redundancy based on efficiently managed storage.

We consider a 2 hour capacity using batteries to be enough to cover most of incidents. The storage system, combined with the Integrated INVADE platform and Power Electronics will provide the network with a reliable and efficient energy backup, as well as a new business model for daily use by households sharing storage capacity.

### Pilot description

The storage system, with the Integrated INVADE platform and Power Electronics ad-hoc designed, will be installed in an existing secondary substation in Granollers. The pilot will be implemented in a Secondary Substation of the Estabanell network, which supplies 158 users, of which 13 belong to the DSO services.

The neighbours will be invited to participate and share the storage system, which will be fed by the grid and also by existing PV Cells. The neighbours will be motivated to install more PV cells. The storage system will be used to manage flexibility and increase the hosting capacity of the DSO without further grid investments. The pilot will prove that storage systems can provide a business model based on flexibility management.

Stakeholders involved are the headquarter of the DSO and their neighbours. The municipality will be invited to learn about the pilot and asked to support it.

The goals are CO2 reduction, increased grid resilience without the need of further investments in networks, demand response activities and management of flexibility.

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[Read more](#)



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The Dutch pilot will cover three domains and two different approaches to charging electric vehicles on renewable energy.

[Read more](#)

## The Netherlands

**In the Netherlands, GreenFlux and ElaadNL strive to accommodate as much renewable energy in the energy system as possible and will explore the possibilities of matching demand to sustainable generation.**

The Dutch pilot will cover three domains and two different approaches to charging electric vehicles on renewable energy.

The first domain explores a charge point at home in own driveway or carport. Usually there is only one charge point and the available maximum power for charging is low. If there is renewable energy available, it is almost always from roof solar panels. The charge point is connected to the grid connection of the house

The second domain explores a group of charge points at an office building, a shopping centre, a football stadium, etc. The charge points are all connected to the same network connection and often have to divide the available capacity to prevent overloading this connection. The charge points are sometimes publicly accessible but not 24/7. Local renewable energy production can come from solar panels, but also from windmills or other sources

The third domain explores a charge point in the public domain. The charge point has its own connection to the electricity grid and its own energy contract. It is completely interoperable (everybody can charge there) and it is available 24/7. Connection to renewable energy sources is via the energy contract, this might be reflected in dynamic energy prices.

The two approaches are:

1. The 'grid approach': Where you are able to use renewable energy at the location that it is produced, and where electricity does not need to be transported over large distances which reduces energy transport losses significantly. Also, it diminishes the load on high power transmission cables, which reduces network costs in general.
2. The 'system approach': Supply and demand always need to be in balance. This effectively means that electric vehicles are charged when (renewable) energy is available and are not charged (or discharged) when there is none. This does not need to be locally produced energy (since electricity travels at one third of the speed of light through a cable), it is really the system balance of a country or large region that is considered here. The (im)balance of the energy system is reflected in the (dynamic) price of energy.

Each of the three domains tested in this pilot requires a different approach and a different business case. In the first two domains calculations on Business Case possibilities will be performed, assuming a fixed energy-system. In the third domain the flexibility possibilities to be entered in the energy system are considered. Besides practical implementations, also data-extraction and data-analyses will be performed, and methodological user (impact) research will be done.

The biggest challenge for the future is to maintain system balance when renewable energy sources become dominant in the energy system. However, in the next 5 to 10 years, there will be a very strong desire among consumers to charge vehicles with

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## Bulgaria

**In Albena, Bulgaria, centralised electrical energy storage will be installed at a transformer substation that supplies two hotels, including restaurants, a spa centre and swimming pools.**

Furthermore, on the hotel rooftop a PV system will be installed in order to cover the daily peak electricity consumption. Full energy monitoring structure is already installed at the site. The hotel has its own solar thermal station installed.

- The PV system will cover most of the daily electricity demand. As the daily electricity load curve is quite similar to the power generation profile, a PV system gives the opportunity to reduce the used grid peak power and increase the percentage of used renewable energy.
- Electricity energy storage will be installed in order to balance the power generation of the PV system, as well as to store surplus energy for evening peak power demand ensuring constant grid load.
  - With energy storage, local peak power loads at the transformer station will be avoided, and the power quality and system reliability will be improved.
  - A local energy power balance between bought energy and actual consumed energy will be available. In that case costs for imbalance will be avoided.

The Integrated INVADE platform will enable the combination of a PV System, Solar thermal system and battery storage that will essentially increase the share of renewable energy in the hotel sector. This will utilise the enormous potential of solar energy for summer resorts. The energy consumption and CO2 emissions will be reduced.

### Pilot description

A new Photovoltaic system will be installed, protection and cables leading to the main transformer board. The battery storage system with suitable inverters, protection and battery management system will be situated at the transformer substation site. Full energy monitoring system consisting of power meters and software produced by Schneider Electric is already functioning on site.

Stakeholders involved are the hotel owners. After the successful implementation of the project, the pilot model will be rolled out to the other hotels in Albena. The model will also be presented to other tourist resorts as an example of energy and financial efficiency.

The added value can be expressed by:

- Increased share of renewable energy for self-consumption reducing energy costs for the owner, reducing CO2 emissions, and reducing grid costs for the local DSO.
- A working model for utilising the domestic potential of solar energy in tourist services by combining solar electrical and solar thermal power generation.
- Experience in modern energy management: Fully functioning demand side management on consumer site will be available. This will lead to better exploitation of energy infrastructures and reduce power peak consumption. Better reliability of the grid as well as reduced voltage drop will decrease energy network losses.

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[Read more](#)

## 2.1.2 Deliverables

The public deliverables of each work package are published once they are approved and accepted in order to interested people can download them. Until 17/12/19, the published deliverables for each work package has been:

- WP1: Project Management
  - D1.1 Project Management Plan
  - D1.2 Project Periodic Report n°1
- WP2: Communication and Dissemination
  - D2.1 Project website and social network profiles
  - D2.2 Dissemination plan
  - D2.3 Data management Plan
  - D2.4 Dissemination and communication intermediate report
- WP3: Exploitation
  - D3.1 Stakeholders Engagement Plan
  - D3.2 Stakeholders analysis

- D3.4 Draft Life Cycle Analysis
- WP4: Overall INVADE architecture
  - D4.1 Overall INVADE architecture
  - D4.2 INVADE architecture of pilots
  - D4.3 Overall INVADE architecture final
- WP5: Flexibility management system
  - D5.1 Report on challenges in distribution grid with high penetration of renewables
  - D5.2 Assessment of the potential value of alternatives in the future with demand growth from EVs, renewables integration and distributed storage units
  - D5.3 Simplified Battery operation and control algorithm
  - D5.4 Advanced Optimal Battery operation and control algorithm
- WP6: Energy storage technologies
  - D6.1 Storage system dimensioning and design tool
  - D6.2 Battery techno-economics tool
  - D6.3 Simplified State of health diagnostics tool
  - D6.4 Advanced State of health diagnostics tool
  - D6.5 Advanced Battery techno-economics tool
- WP7: Communication platform
  - D7.1 Communications Specification Plan
  - D7.2 Specification of the CP-API-functions
  - D7.3 Feasibility analysis and reports of BPL and field devices integration
  - D7.4 Communications Test Plan and test reports
- WP8: Integrated INVADE platform
  - D8.1 Cloud based flexibility management system: Flexibility Cloud, phase 1
  - D8.2 Cloud based flexibility management system: Flexibility Cloud, phase 2
  - D8.3 End-user mobile apps and management dashboards, phase 1
  - D8.4 Cloud based flexibility management system: Flexibility Cloud, phase 3
  - D8.5 End-user mobile apps and management dashboards, phase 2
- WP9: Business models and energy market structures
  - D9.1 Review of existing business models and storage technology database



- D9.2 Input on user behaviour and technology domestication amongst users to the business model development
- D9.3 Report on legal policy implications
- D9.4 Set of INVADE business models including classification framework simplified
- WP10: Pilots
  - D10.1 Pilot Specifications
  - D10.2 Pilots methodology
  - D10.3 Data collection and management
  - D10.4 First results from Pilots
  - D10.5 Final Pilots Methodology

The screenshot displays the INVADE project website. The top navigation bar includes 'The project', 'Deliverables', 'Partners', 'Contact', 'Events', 'News', 'Videos', and a search bar. The main content is divided into two sections: 'Work Packages and Deliverables' and 'Timeline'.

**Work Packages and Deliverables:** A list of work packages (WP 1 to WP 10) is shown. WP 10: PILOTS is highlighted. Below it, a list of deliverables (D10.1 to D10.7) is provided, each with a 'Download' link.

**Timeline:** A vertical timeline shows three milestones:
 

- Fourth milestone (MS4):** 1. February 2019. Preliminary analyses and results from the pilots are available. The integrated ICT platform is updated and fine-tuned based on initial feedback for full-fledged pilot... (Read more)
- Fifth milestone (MS5):** 1. October 2019. Project is nearing completing with pilot results and reports getting shape. The finalized INVADE platform is ready to be delivered to the market. Another... (Read more)
- Sixth milestone (MS6):** 1. January 2020. Implies the formal completion of INVADE after having the pilots certified and validated. All communication and dissemination activities have been accomplished and reached the... (Read more)

 A 'Scroll down to see more' button is located at the bottom of the timeline.

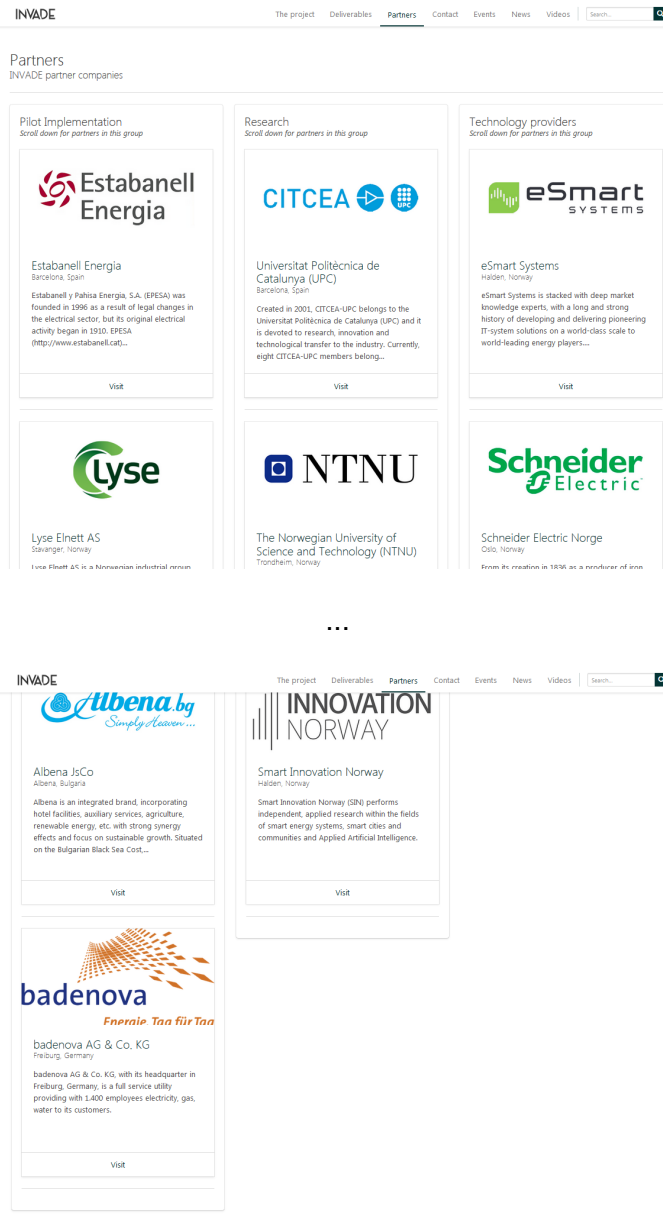
### 2.1.3 Partners

INVADE partners has been the same during the whole project less the responsible for the German pilot implementation. Badenova has substituted NewEn.

**badenova AG & Co. KG**

Freiburg, Germany

badenova AG & Co. KG, with its headquarter in Freiburg, Germany, is a full service utility providing with 1.400 employees electricity, gas, water to its customers.



### 2.1.4 Contact

Roberto Villafáfila-Robles replaced Pol Olivella as a member of the INVADE team for the last year of the project.

#### Roberto Villafáfila-Robles

*Dr. Electrical Engineering*

Roberto is Associate Professor at Universitat Politècnica de Catalunya and Directive Board at CITCEA-UPC. He is responsible for the INVADE communication and dissemination.




INVADE
The project Deliverables Partners **Contact** Events News Videos

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## Contact


Meet our INVADE team



**Dieter Hirdes**  
Head of Research & Innovation

Dieter is Head of Research & Innovation at Smart Innovation Norway and project coordinator for INVADE.


☎ Telephone
✉ Email



**Mette M. Magnussen**  
Head of Communication & Visualization

Mette is Head of Communication & Visualization at Smart Innovation Norway and oversees the INVADE communication and digital media.


☎ Telephone
✉ Email



**Mari Kristine Buckholm**  
Journalist / Communications Specialist

Mari is a journalist at Smart Innovation Norway and is in charge of the INVADE communication and digital media content.

☎ Telephone
✉ Email



**Roberto Villafáfila-Robles**  
Dr. Electrical Engineering

Roberto is Associate Professor at Universitat Politècnica de Catalunya and Directive Board at CITCEA-UPC. He is responsible for the INVADE communication and dissemination.

☎ Telephone
✉ Email

**INVADE**

The project - Deliverables - Partners - Contact - News

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 731148.

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## 2.1.5 Events

From M18 to month M36 different events have been organized or co-organized. The mid-term large event and the final large event, plus some workshops are available:

- INVADE Black Sea Workshop: “Smart Energy Research – Innovation & Business”, Varna – Bulgaria (13/09/2018)
- Mid-term conference “Smart Business of Batteries – Trends & Opportunities”, Oslo – Norway (10/10/2018)
- XI International Conference on Energy Innovation, "Integration of batteries and electrical vehicles: towards a more flexible power system", Barcelona – Spain (16/11/2018)

Presentations are available by clicking on it.

- Exploitation workshop, Copenhagen – Denmark (06/03/2019)  
Presentations are available by clicking on it.
- Final INVADE conference, Barcelona – Spain (20/11/2019)  
Presentations are available by clicking on it.
- Exploitation workshop “Battery storage and flexibility”, Barcelona – Spain (20/11/2019)

As it coincides with the final INVADE conference and TAG meeting, a visit to EPESA’s pilot site was done with the participants.

**Past events**

**JOIN THE CONFERENCE: INVADE Barcelona 2019**  
 November 20, 2019  
 Fira Barcelona Gran Via  
 The Horizon 2020 EU project INVADE is arriving at its end and the partners aim to share their findings regarding efficient use of centralised and distributed storage – for the benefit of consumers and grid operators.  
[View more info](#)

**JOIN THE WORKSHOP: Battery storage and flexibility**  
 November 20, 2019  
 Fira Barcelona Gran Via  
 Welcome to the third INVADE Exploitation User Group (EUG) workshop!  
[View more info](#)

**INVADE Exploitation Workshop in Copenhagen**  
 March 6, 2019  
 Copenhagen, Denmark  
 Last year, we invited speakers to harvest input on business opportunities for the work that we have undertaken in INVADE. This time we will present preliminary results and how ongoing work is positioned for use after the project.  
[View more info](#)


**INVADE local event in Barcelona**  
 November 16, 2018 (08:00-14:00)  
 Escala Tècnica Superior d'Enginyeria Industrial de Barcelona, Universitat Politècnica de Catalunya  
 The conference will explain the technological developments that are enabling the exploitation of flexibility through the connection of batteries and electric vehicles.  
[View more info](#)

**JOIN THE CONFERENCE: Smart Business of Batteries – Trends & Opportunities**  
 October 10, 2018  
 Park Inn by Radisson Oslo Airport, Gardermoen Hotel, Henrik Ibsens veg, Gardermoen  
 Join the conference and explore how INVADE will change the way energy is used, stored and generated!  
[View more info](#)

**JOIN THE WORKSHOP: Smart Energy Research – Innovation & Business**  
 September 13, 2018  
 Varna, Bulgaria  
 The INVADE Black Sea 2018 workshop gives insight in results from INVADE and several other European research and innovation projects.  
[View more info](#)

### 2.1.6 News

News from INVADE project have been included as they have taken place.




[The project](#)
[Deliverables](#)
[Partners](#)
[Contact](#)
[Events](#)
[News](#)
[Videos](#)

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### News

Our latest from INVADE




**MSc student won the INVADE contest at EUW19: "I found the INVADE pilots incredibly interesting"**  
*By Mari Kristine Buckholm, Smart Innovation Norway* 29 November 2019

During the European Utility Week in Paris in November 2019, the INVADE project presented itself in a unique way in the EU Projects Zone. Using videos and an informative quiz, the INVADE stand was always busy.

Read more

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**Conference participants: "Solutions like INVADE are necessary"**  
*By Sanket Puranik and Mari K. Buckholm, Smart Innovation Norway* 25 November 2019

The Horizon 2020 INVADE project is coming to an end this year. Last week, a conference and a workshop were organized on behalf of the project and parallel to event Smart City Expo World Congress in Barcelona.

Read more

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**Watch INVADE pilot films**  
*By Mari Kristine Buckholm, Smart Innovation Norway* 21 September 2019

The INVADE project has resulted in five successful pilot stories and professional films have been made from each pilot site. You can watch them all here.


### Social media

INVADE updates




@INVADEH2020 : During the #EUW19 (European Utility Week 2019) in Paris, the @EU\_H2020 INVADE project presented itself in a unique... <https://t.co/fhwY35b02> - 2 weeks ago

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@INVADEH2020 : The Horizon 2020 INVADE project is coming to an end this year. Last week, a conference and a workshop were organize... <https://t.co/zjAJEjx0tW> - 3 weeks ago

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@rgallartf : RT @rgallartf: The catalonian pilot did share its results during the visit of the Technical Advisory group in its Granollers headquarter de... - 3 weeks ago

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@RVillafafilaR : RT @RVillafafilaR: @INVADEH2020 pilots have shown their experiences. @LyseAS @badenovaAG @Estabanel @Greenfluxinfo @elaadNL @AlbenasResort... - 3 weeks ago

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@INVADEH2020 : The @EU\_H2020 project INVADE is arriving at its end and today, as a side event of @SmartCityexpo in Barcelona, the... <https://t.co/TBRhA9dpCT> - 3 weeks ago

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@RVillafafilaR : RT @RVillafafilaR: We have started @INVADEH2020 conference at @SmartCityexpo. Join us and complete the quiz: <https://t.co/8TnkWj6W5A> #Iexl... - 3 weeks ago

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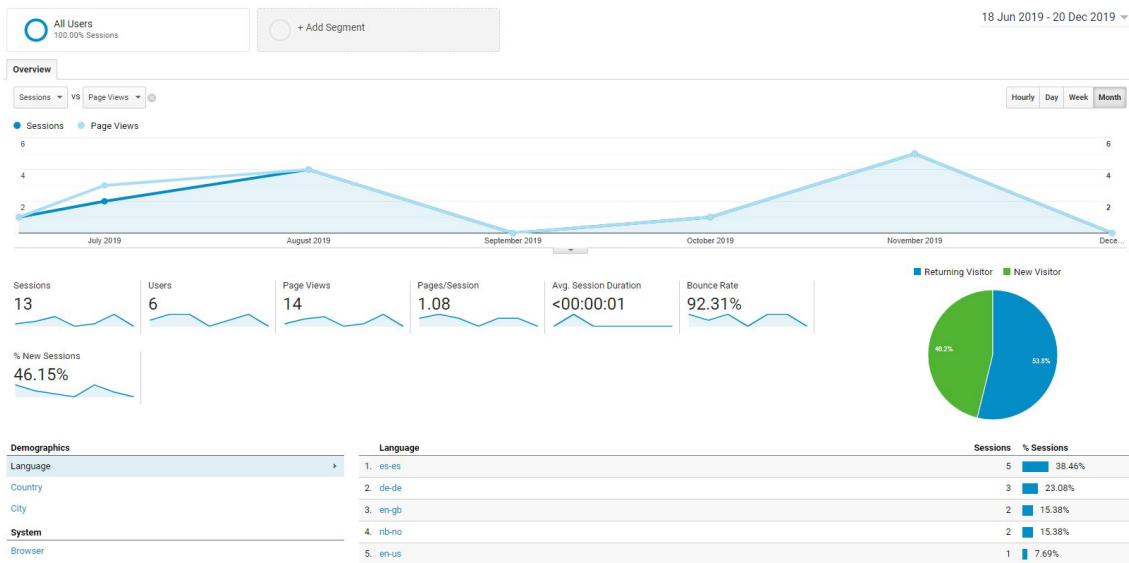


@RVillafafilaR : RT @RVillafafilaR: Main outcomes from @INVADEH2020 #technology workpackages are being presented @VTTFinland @CITCEA @NTNU @eSmart Systems... - 3 weeks ago

## 2.2 Monitoring

As the webpage and social media have an important role for achieving a successful communication and dissemination, all channels have been monitored, and new and statistics have been documented every month. This has allowed getting statistics of their use and helped taking decisions for reinforcing those channels that are not being so consulted and to strengthen the most successful ones.

We have used Google Analytics to monitor the webpage, the following figure shows an overview of page views, sessions, users (and where the users are from) from M30 to M36:



### 3 Social media profiles

INVADE is available in different social networks: Twitter, LinkedIn, Facebook and Youtube. The key objective has been to outreach citizens as well as different stakeholder groups about the INVADE platform and its potential. Social networks have also been used to collect feedback and extract information from vital stakeholders, to utilize and improve the project's platform and its business and exploitation plan.

The accounts have slightly different purposes and their use has varied according to project activity and relevance:

- **Twitter** account, @INVADEH2020, has been used to cover ongoing news and updates from the consortium partners, and for collecting input and information. Consortium members were encourage to tweet about their everyday work with the project.
- **Youtube** has been used for uploading interviews and relevant videos explaining the project. We have published 19 videos from interviews at workshops and conferences, description of pilot sites and one explaining the project.
- **LinkedIn** profile has been used to target stakeholders of the European industry, initiatives and associations focusing on renewable energy storage, the smart grid, and novel ICT solutions for the energy sector. Videos and posts from the events have been promoted here.

- **Facebook** targets the communication towards the younger generation, such as students and various national and local associations and communities promoting a sustainable way of living. Videos and posts from the events have been also promoted here.

### 3.1 Statistics

All the social networks are accessible from the webpage of the project, and all channels were monitored with the purpose of knowing how successful they were and for taking future measures to achieve communication targets.

The list of performance indicators considered for this purpose are the total number of followers and likes on Twitter, Facebook and LinkedIn, the total number of tweets/posts, the monthly post reach on Facebook, and the monthly Tweet impressions and mentions.

Next figure shows the webpage and social media statistics obtained during the second half of the INVADE project:

Month	M18	M19-20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M33	M36
Date	12/06/2018	10.08.2018	10.09.2018	11.10.2018	12.11.2018	11.12.2018	21.01.2019	05.02.2019	12.03.2019	09.04.2019	31.05.2019	07.06.2019	27.09.2019	09.12.2019
Followers	106	Holidays	116	125	129	130	130	130	137	138	142	143	154	165
Likes	96	Holidays	107	115	118	119	119	119	125	125	128	129	139	149
Post reach (monthly)		Holidays	130	1556	1236	59	109	456	434	125	788	825	140	155
Top post	"Blockchain is one of the world's leading software platforms..."	Holidays	The EU Horizon project, INVADE, celebrates halfway...	On September 13th, the INVADE Black Sea..	Read the article about INVADE in EnergiTeknik	None	In January, SIN goes to India to present INVADE to Indian companies and Norwegian Prime Minister	Builds revolutionizing concept based on the INVADE model	Watch the official INVADE film...	The Bulgarian INVADE pilot is making its final preparations to go live	D6.3 Lithium-ion batteries are used in a wide range of applications	The INVADE consortium meeting in Arnhem is a go...	Science blog. INVADE inspired by Amazon and Airbnb	First INVADE pilot film: Bulgaria
Top post reach	515	Holidays	855	832	1103	0	248	379	1386	309	78	559	116	2531
Followers	193	Holidays	221	274	276	282	301	306	315	328	336	337	349	377
Likes	76	Holidays	83	103	107	111	116	118	127	130	134	134	310	329
Tweets	198	Holidays	209	236	243	246	252	256	270	285	298	301	2670	5167
Tweet impressions (monthly)	2568	Holidays	3149	12600	2466	588	1097	2839	4030	10100	7905	9134	2670	5167
Number of mentions (monthly)	37	Holidays	9	53	20	18	14	18	10	47	15	11	9	29
Web page visits (views)	1166	452	207	78	31	75	68	46	41	17	20	5	8	6
Number of users	389	118	110	31	3	57	34	5	3	2	2	2	3	3
Top story	Blockchain and its application in the energy sector	Events: INVADE Oslo 2018 conference	Events: INVADE Black Sea 2018 workshop	Events: INVADE Black Sea 2018 workshop	Watch all INVADE videos here	Events	The project	Municipality rents out electric cars to inhabitants	The project	The project	Watch all INVADE videos here	Watch all INVADE videos here	Partners	Watch all INVADE videos here
Top story page views	70	64	6	11	4	3	6	4	7	3	2	1	4	3

### 3.1.1 Twitter

Twitter has been the most frequently used social media channel. It allows commenting and exchanging points of view around INVADE and related subjects internationally.

On May 25<sup>th</sup> 2018, we had 192 followers and published 194 tweets. On December 20<sup>th</sup> 2019, we had 385 followers and 331 tweets.

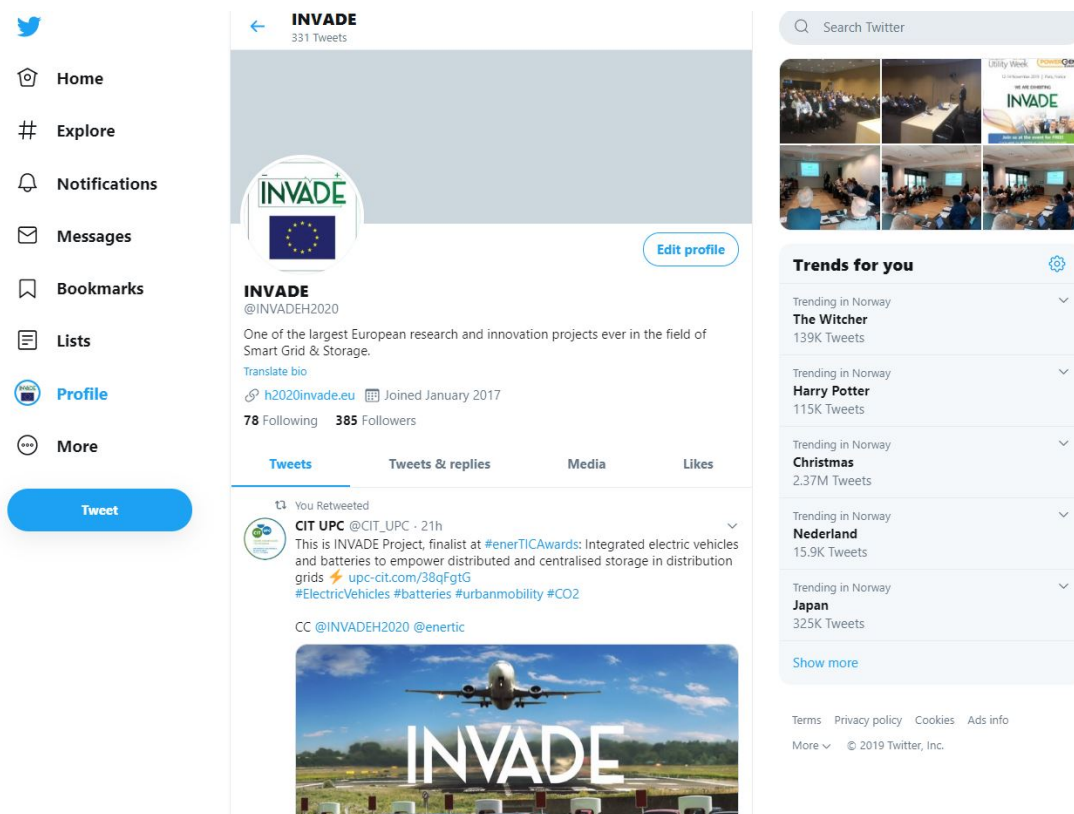
The number of followers achieved has been a result of the action done in the third year of the project, when it has been decided to endorse the reading of deliverables developed so far according to this plan for each deliverable according to the next table:

- Key ideas (with a figure if it is available) for being published in Twitter .
- Short summary of 1 to 2 paragraphs for LinkedIn, facebook and the website that will collect and connect the previous key ideas.

WP	Deliverable	Activity	Date
5	D5.1 Report on challenges in distribution grid with high penetration of renewables	3 key ideas for twitter	1/03
		1 short summary for the website	1/03
9	D9.1 Review of existing business models and storage technology database	3 key ideas for twitter	8/03
		1 short summary for the website	8/03
4	D4.1 Overall INVADE architecture	3 key ideas for twitter	15/03
		1 short summary for the website	15/03
3	D3.1 Stakeholders Engagement Plan	2 key ideas for twitter	22/03
		1 short summary for the website	22/03
3	D3.2 Stakeholders analysis	2 key ideas for twitter	22/03
		1 short summary for the website	22/03
6	D6.1 Storage system dimensioning and design tool	2 key ideas for twitter	29/03
		1 short summary for the website	29/03
6	D6.2 Battery techno-economics tool	2 key ideas for twitter	05/04
		1 short summary for the website	05/04
6	D6.3 Simplified State of health diagnostics tool	1 key ideas for twitter	05/04
		1 short summary for the website	05/04
5	D5.2 Assessment of the potential value of alternatives in the future with demand growth from EVs, renewables integration and distributed storage units	2 key ideas for twitter	12/04
		1 short summary for the website	12/04
9	D9.2 Input on user behaviour and technology domestication amongst users to the business model development	2 key ideas for twitter	19/04
		1 short summary for the website	19/04
9	D9.3 Report on legal policy implications	2 key ideas for twitter	19/04
		1 short summary for the website	19/04
5	D5.3 Simplified Battery operation and control algorithm	2 key ideas for twitter regards to sizing	26/04
		2 key ideas for twitter regards to operation	
		1 short summary for the website	26/04
4	D4.2 INVADE architecture of pilots	3 key ideas for twitter	05/05



		1 short summary for the website	05/05
7	D7.1 Communications Specifications Plan	1 key idea for twitter	12/05
		1 short summary for the website	12/05
7	D7.2 Specification of the CP-API-functions	1 key idea for twitter	12/05
		1 short summary for the website	12/05
10	D10.1 Pilot Specifications	5 key ideas for twitter (one per pilot)	19/05
		1 short summary for the website	19/05
10	D10.2 Pilots methodology	1 key ideas for twitter	26/05
		1 short summary for the website	26/05
10	D10.3 Data collection and management	1 key ideas for twitter	26/05
		1 short summary for the website	26/05



For the M36, we have had 5435 tweet impressions, 62 profile visits, 14 mentions and 15 new followers:

**Account home**  
 INVADE @INVADEH2020  
 Page updated daily

**28 day summary** with change over previous period

Tweets: 2 ↑100.0%	Tweet impressions: 5,435 ↑30.0%	Profile visits: 62 ↑40.9%	Mentions: 14 ↓58.8%	Followers: 385 ↑15
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**Dec 2019** • 20 days so far...

**TWEET HIGHLIGHTS**

**Top Tweet** earned 895 impressions  
 During the #EUW19 (European Utility Week 2019) in Paris, the @EU\_H2020 INVADE project presented itself in a unique way in the EU Projects Zone. Using videos and an informative quiz, the INVADE stand was always busy. Read more and see photos: h2020invade.eu/news/msc-stude...

**Top mention** earned 72 engagements  
 Ramon Gallart @rgallartf · Dec 19  
 Today Chloé Coral explains the catalonian pilot of the @INVADEH2020 project outcomes at @ETSEIB\_UPC @teknoCEA @WattiusBattery @CITCEA\_UPC pic.twitter.com/5PDKGevmfj

**ADVERTISE ON TWITTER**  
**Get your Tweets in front of more people**  
 Promoted Tweets and content open up your reach on Twitter to more people.  
 Get started

**DEC 2019 SUMMARY**

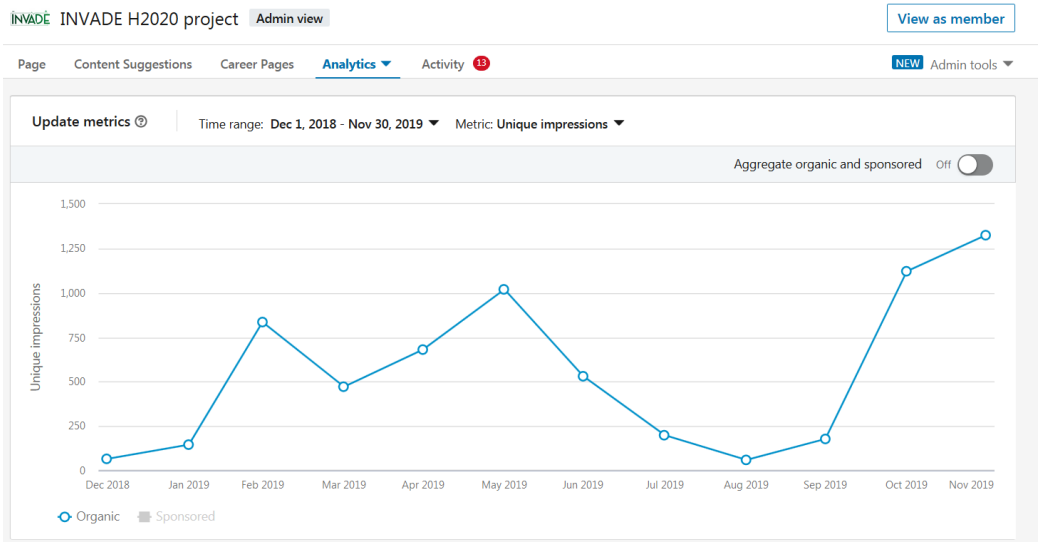
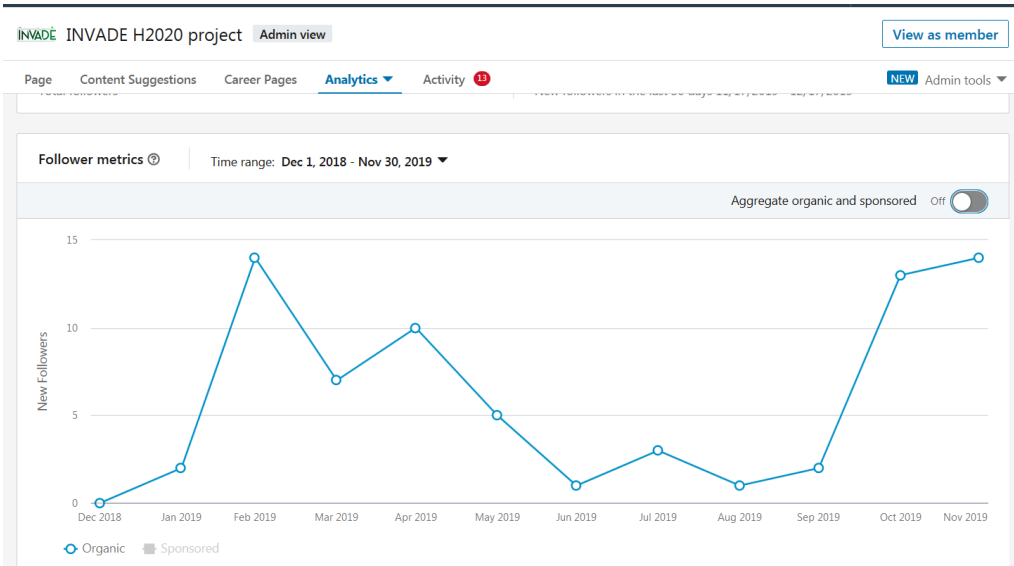
Tweet impressions: 3,603	Profile visits: 50
Mentions: 14	New followers: 12

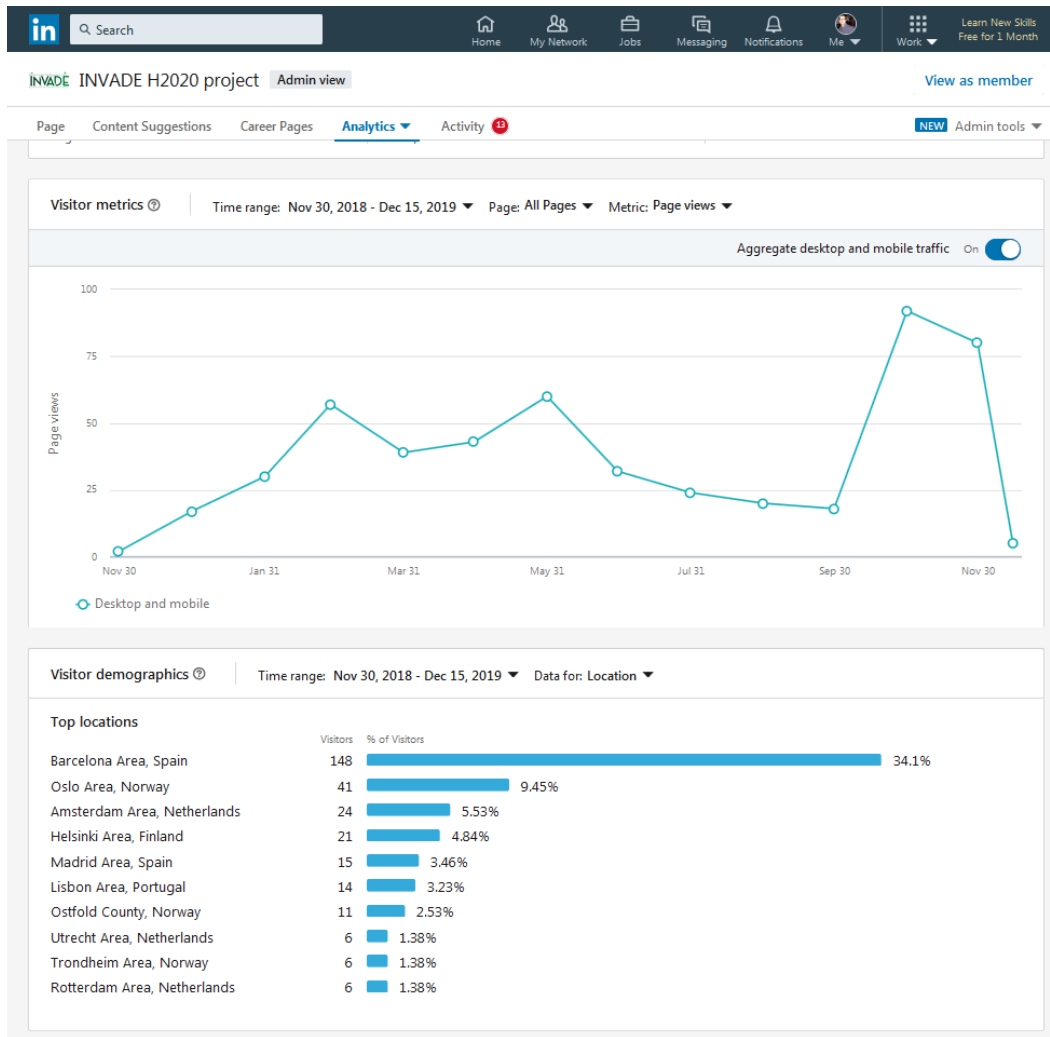
**Top Follower** followed by 7,431 people  
 Engerati

### 3.1.2 LinkedIn

LinkedIn has been widely used for keeping the awareness on the energy sector, and videos and posts with relevant information, publishing what has been doing within the project and interact the most frequently used social media channel. It allows commenting and exchanging points of view around INVADE and related subjects internationally.

On December 20<sup>th</sup> 2019, we had 164 followers.





### 3.1.3 Facebook

On May 25<sup>th</sup> 2018, we have attained 105 followers and published 84 posts. On December 20<sup>th</sup> 2019, we had 166 followers and 166 posts.

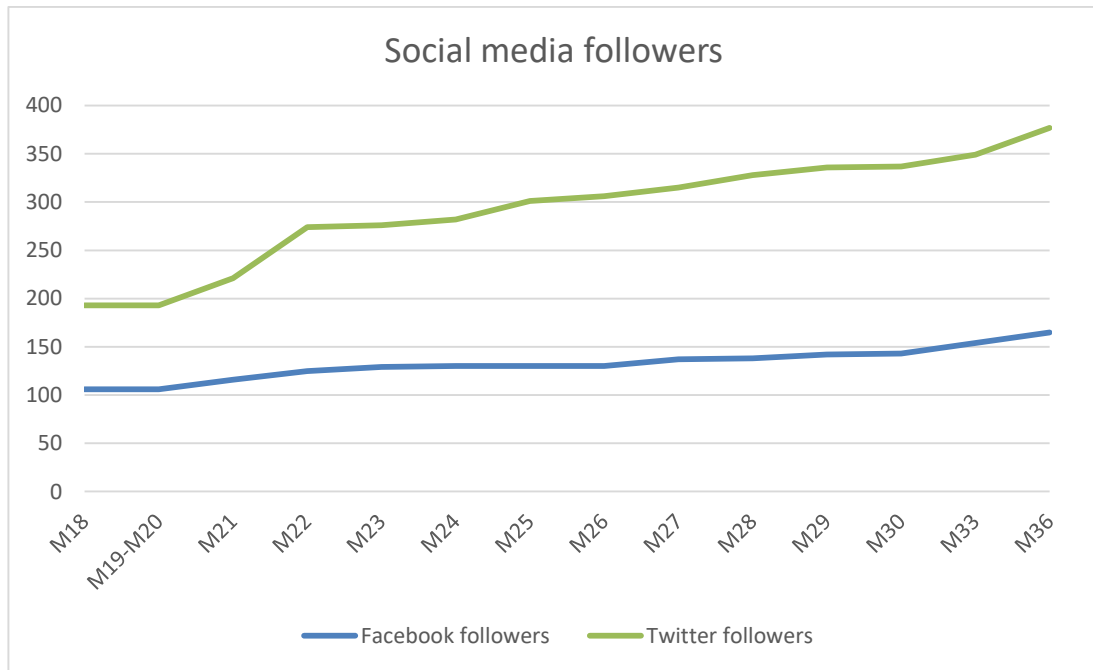
The screenshot shows a Facebook post from the page 'Invade H2020 project' (@invadeh2020). The post is titled 'Invade H2020 project' and was published by Mari Kristine Buckholm 22 hours ago. The main text of the post reads: 'It is possible to control the speed of charging electric cars on a large scale with algorithms. This can be concluded from the results of ElaadNL's Smart Charging test on 700 public charging stations as part of the EU Horizon 2020 INVADE project. Read more and watch video:'. Below the text is a video thumbnail with the text 'Large-scale Smart Charging trial completed as part of the European INVADE project'. The video title is 'Algorithms successful in controlling the charging speed of electric cars – Invade'. The post has 72 people reached, 12 engagements, and 6 likes. A 'Boost Post' button is visible. On the right side of the post, there are several tips: 'Know Friends Who Might Like Your Page?', 'Easily Manage Your Page From Anywhere', and 'Create a Group for Your Page'. The page's navigation menu on the left includes Home, About, Posts, Events, Videos, Photos, Community, Groups, Reviews, and Jobs.

The screenshot shows the Facebook Page Summary dashboard for 'Invade H2020 project' for the period of November 23, 2019, to December 20, 2019. The dashboard is divided into several sections:

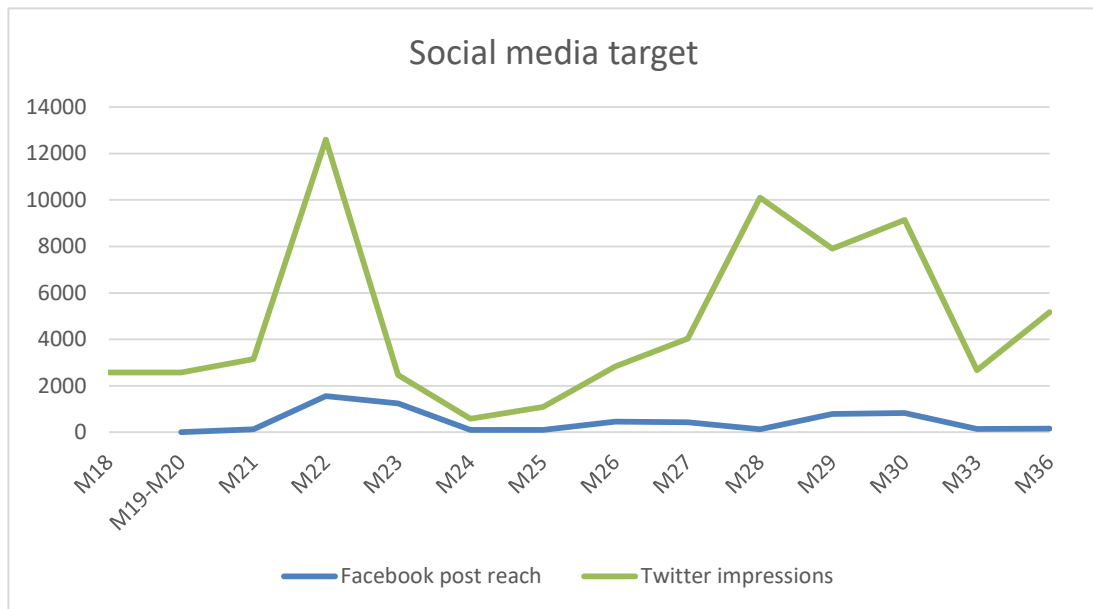
- Actions on Page:** November 23 - December 20. A calendar icon is shown with the text 'We have insufficient data to show for the selected time period.'
- Page Views:** November 23 - December 20. Total Page Views: 51. Change: Total Page Views ▼39%. A line graph shows fluctuations in page views over time.
- Page Previews:** November 23 - December 20. A calendar icon is shown with the text 'We have insufficient data to show for the selected time period.'
- Page Likes:** November 23 - December 20. Page Likes: 3. Change: Page Likes ▲50%. A line graph shows a sharp increase in likes.
- Post Reach:** November 23 - December 20. People Reached: 147. Change: People Reached ▼43%. A line graph shows reach over time.
- Story Reach:** November 23 - December 20. A 'Get Story Insights' button is present with the text 'See stats on how your Page's recent stories have performed.' and a 'Learn More' button.
- Recommendations:** November 23 - December 20. A calendar icon is shown with the text 'We have insufficient data to show for the selected time period.'
- Post Engagement:** November 23 - December 20. Post Engagement: 55. Change: Post Engagement ▼30%. A line graph shows engagement over time.
- Videos:** November 23 - December 20. 3-Second Video Views: 27. Change: 3-Second Video Views ▼71%. A line graph shows video views over time.

The following figures compare the two social media channels (Twitter and Facebook) in terms of followers and likes.

*In terms of followers:*



*In terms of targets:*



The numbers indicate that the EU Horizon 2020 project audience is more active on Twitter than Facebook.

### 3.2 Research Gate

Research Gate is a relevant social media for researchers in order to share their works. A profile for INVADE project was created (<https://www.researchgate.net/project/INVADE-H2020/update/5a53911ab53d2f0bba49c5cd>) and it includes our publications.

On December 20<sup>th</sup> it had 17 followers and 206 reads, and 12 collaborators.

The screenshot shows the ResearchGate project page for 'INVADE H2020'. The page header includes the ResearchGate logo, navigation links (Home, Questions, Jobs), a search bar, and user profile icons. The project details section lists the lead researchers: Pol Olivella-Rosell, Roberto Villafafila-Robles, and Andreas Sumper. It also shows 12 collaborators. The project goal is to design a flexibility management system using batteries. The project includes four main objectives: 1. Design a flexibility management system, 2. Develop a model for batteries including EVs, 3. Deliver the Integrated INVADE Platform, and 4. Integrate the INVADE platform with existing infrastructure. The project methods include Mathematical Optimization, Lithium-ion Batteries, Electric Vehicles, Big Data Analysis, and Smart Grid. The project dates are from January 1, 2017, to December 31, 2019. The project is associated with the lab 'Andreas Sumper's ProsumerLab'. On the right side, there are statistics: 3 updates, 0 recommendations, 17 followers, and 191 reads. At the bottom, there are tabs for Overview, Project log, References (14), and Questions (1), along with buttons for 'Add research' and 'Add update'.

The screenshot shows the ResearchGate publications page for the INVADE project. It features a 'Final paper' section with a button to 'Add another paper'. Below this, there are four publication cards, each with a title, type, date, and authors. The first card is a preprint titled 'Centralised and Distributed Optimization for Aggregated Flexibility Services Provision' from July 2019, authored by Pol Olivella-Rosell, F. Rullan, Pau Lloret, and Andreas Sumper. The second card is an article titled 'The Potential Role of Flexibility During Peak Hours on Greenhouse Gas Emissions' from November 2019, authored by Ingrid Munné, Fabio Maria Aprá, Pol Olivella-Rosell, and Roberto Villafafila-Robles. The third card is an article titled 'Reducing the climate change impacts of lithium-ion batteries by their cautious...' from November 2019, authored by Sampaa Jenu, Ivan Deviatkin, Ari Hentunen, and Mikko Pihlatie. The fourth card is an article titled 'Local Flexibility Market Design for Aggregators Providing Multiple Flexibility Services' from April 2018, authored by Pol Olivella-Rosell, Pau Lloret, Ingrid Munné, and Bert Bremndal. Each card has a 'View' button. At the bottom, there is a footer with copyright information and various links.

## 4 Scientific publications

Publications in scientific conferences and peer-reviewed journals are being published to share project's achievements with experts in the field. The list of published peer-reviewed

papers in conferences and journals is given in Table 1. There are 13 papers published in conference, 9 papers already accepted in journals, and 1 under review in journals.

Apart from the publications listed in Table 1, a PhD thesis has been developed and submitted for its defence: Pol Olivella-Rosell “Local electricity markets design and operation in distribution power systems”.



.Table 1: Published conference and peer-reviewed papers

Title	Publication type	Conference/Journal	Deadline	Partner in charge	Collaboration
Value of prosumer house batteries: Experiences across the EU	Conference	IAEE Groningen 2018	DONE	NTNU	
Improved methods for stakeholder analysis to unveil vital roles and responsibilities in the future flexibility markets	Conference	CIREC Workshop 2018	DONE	SIN	
The INVADE project: Towards the flexibility operator concept and its application to the Spanish pilot	Conference	CIREC Workshop 2018	DONE	UPC	eSmart, Estabanell
Platform based business models in the future energy market	Conference	CIREC Workshop 2018	DONE	LYSE	SIN, Stavanger kommune
Digital ecosystems as a disruptive force of flexibility services in the energy sector	Conference	IAEE Groningen 2018	DONE	SIN	LYSE
End-user flexibility: Implications for Prosumers and Computational Challenges	Conference	CMS 2018: Conference on computational management science	DONE	NTNU	
Local Flexibility Market Design for Aggregators Providing Multiple Flexibility Services at Distribution Network Level	Journal	Energies - MDPI	DONE	UPC	eSmart, SIN
Utilising End-user Flexibility for Demand Management under Capacity Subscription Tariffs	Conference	EEM 2018	DONE	NTNU	
Life cycle assessment of first and second life lithium-ion batteries: implications from existing studies	Conference	Going Green CARE INNOVATION 2018	DONE	VTT	UPC
Local electricity market designs for peer-to-peer trading: The role of battery flexibility	Journal	Applied Energy – Elsevier	DONE	NTNU	
Centralized flexibility services for distribution system operation through distributed energy resources	Conference	ICSC-CITIES 2018	DONE	UPC	

Prosumer integration in wholesale electricity markets: Synergies of peer-to-peer trade and residential storage	Journal	Energy and Buildings – Elsevier	DONE	NTNU	
A scheduling optimization model of electric water heaters for electricity cost minimization with limited information	Conference	8 <sup>th</sup> IC Modern Power System 2019	DONE	UPC	eSmart
System architecture for managing congestion in distribution grids using flexibility	Conference	CIREN 2019	DONE	UPC	eSmart, Estabanell
INVADE Flexibility Centralized Algorithm to Manage Electric Vehicles under DSO Requests in Buildings with Limited Information	Conference	ISGT Europe 2019	DONE	UPC	eSmart, NTNU, Elaad
Two-stage hybrid stochastic/robust optimal coordination of distributed battery storage planning and flexible energy management in smart distribution network	Journal	Journal of Energy Storage – Elsevier	DONE	NTNU	
Bringing Business and Societal Impact Together in an Evolving Energy Sector	Journal	Journal of Clean Energy Technologies	DONE	SIN	
Reducing the climate change impacts of lithium-ion batteries by their cautious management through integration of stress factors and life cycle assessment	Journal	Journal of Energy Storage – Elsevier	DONE	VTT	
Centralized flexibility services for distribution system operation through distributed energy resources	Conference	ICSC-CITIES 2019	DONE	UPC	
The potential role of flexibility during peak hours on greenhouse gas emissions: A Life cycle assessment of five targeted national electricity grid mixes	Journal	Energies - MDPI	DONE	UPC	
Centralised and Distributed Optimization for Aggregated Flexibility Services Provision	Journal	IEEE Transactions on Smart Grid	DONE	UPC	NTNU, VTT
Large scale smart charging in practice	Journal	Energies - MDPI	DONE	Elaad	
Centralized flexibility service for distribution system operators through distributed generation, storage and electric water heaters	Journal	Revista Facultad de Ingeniería	Under review	UPC	

## 5 Videos and press releases

### 5.1 News articles

We have published 21 news articles on the webpage from M18 to M36 whenever there is something relevant happening and worth telling INVADE stakeholders. Social media channels have also referred to these articles in order to increase their impact. During the first half of the project there have been 34 articles. During the second half of the project, social media has been preferred to keep the awareness on the project.

### 5.2 Video interviews

In the Youtube channel called INVADE H2020 project we have uploaded video interviews and relevant videos explaining the project. It has 20 subscribers up to December 17<sup>th</sup>. The total number of videos are 16:

- 4 videos for creating awareness on the project
  - Researchers talk about INVADE (M9 – 58 viewers in Youtube / 1200 views in Facebook))
  - Sanket Puranik (SIN) talks about the importance of INVADE stakeholders (M15 – 47 viewers in Youtube / 172 views in Facebook))
  - Joseph's (SIN) top INVADE advice (M15 – 62 viewers in Youtube / 86 views in Facebook)
  - INVADE impact: How to make money in the new power market (M24 – 57 viewers in Youtube / 115 views in Facebook)
- 3 videos from the INVADE workshop in Oslo
  - 1 video interview for promoting the event INVADE workshop in Oslo, March 2018 (M15 – 135 viewers in Youtube / 43 views in Facebook)
  - 1 video for announcing the event: Join INVADE OSLO 2018! (M18 – 43 viewers in Youtube / 324 + 36 + 20 views in Facebook)
  - 1 video with Highlights from INVADE OSLO 2018 (M21 – 90 viewers in Youtube)

- 1 video of Grand opening of test site for EV charging (M17 – 177 viewers in Youtube / 166 views in Facebook)
- 2 videos from the INVADE Black Sea 2018 Workshop
  - 1 video interview to participants (M21 – 79 viewers in Youtube / 287 views in Facebook)
  - 1 video presenting The Albena Pilot (M21 – 85 viewers in Youtube / 174 views in Facebook)
- 1 video with the vision, scope and goal of the project: This is INVADE Horizon 2020 (M26 – 291 viewers in Youtube / 51 + 555 views in Facebook)
- 5 videos presenting the achievements of the pilot sites
  - INVADE – Bulgarian pilot (M33 – 109 viewers in Youtube / 939 views in Facebook / 531 views in LinkedIn)
  - INVADE – German pilot (M33 – 96 viewers in Youtube / 231 views in Facebook / 103 views in LinkedIn)
  - INVADE – Spanish pilot (M33 – 101 viewers in Youtube / 235 views in Facebook / )
  - INVADE – Dutch pilot (M33 – 147 viewers in Youtube / 423 views in Facebook)
  - INVADE – Norwegian pilot (M33 – 82 viewers in Youtube / 435 views in Facebook)

On the project website, there are also published 3 more videos: Part 1 (119 viewers in Facebook), Part 2 (71 viewers in Facebook) and Part 3 (68 viewers in Facebook). All three from the INVADE Exploitation Workshop held in Copenhagen in M27. These videos correspond to the recorded live stream workshop broadcasted through Facebook.

All the videos have been also posted both on Facebook and LinkedIn and referred to them on Twitter and the webpage under *News* menu.

As videos engage more people than simple articles, it was decided that articles, tweets and posts documenting project happenings (meetings and events) should use both text and pictures in order to engage more people and should be spread by the different social media channels. In fact, from the previous figures some of the videos have reached higher number of views in Facebook than in Youtube.

### **5.3 Newsletters**

Four newsletters were planned to launch. The first newsletter of the project, Newsletter 1 (Q1 2019), was launched in M29, Newsletter 2-3 (Q2-Q3 2019) were on M34, and Newsletter 4 (Q4 2019) were on M36. These were sent to the network of interest, that is, people that have signed up for INVADE newsletters, which consists of 159 people.



## NEWSLETTER 1 (Q1 2019)

The EU Horizon 2020 project INVADE, a smart system of renewable energy storage based on INtegrated EVs and bAtteries to empower mobile, Distributed and centralised Energy storage in the distribution grid, aims to contribute to minimise human caused effects to climate change and energy efficiency. These are targets set at the European Union with ambitious goals for reduction of greenhouse gas emissions and for increase of renewable energy share.

Traditionally, power plants were mainly centralized and fossile-fuelled. They were dispatchable and predictable, and were able to provide flexibility to the electric system to balance generation and demand at transmission level. Currently, an increasing number of renewable-based distributed generation is transforming how electricity is generated, as these are a more variable and intermittent source of energy. In addition, the demand side is becoming more active, which emphasizes the empowerment and engagement of consumers. The proper management of available flexibility, both in generation and demand side, can help to compensate the lack of certainty of renewable sources. Moreover, the deployment of electric vehicles and batteries forces power systems to evolve.

The INVADE project started on January 2017 to address the topic "A single, smart European electricity grid" within the H2020-EU.3.3.4 programme.

- [Watch the official INVADE film](#)

### CONTENT

1. INVADE objectives
2. About the project consortium
3. Steps done so far
4. Coming newsletters
5. Interested in the project?

## 1. INVADE OBJECTIVES

To enable a higher share of renewable energy sources to the smart grid and gain traction in the market, a few critical barriers must be overcome. There is a deficiency of 1) flexibility and battery management systems 2) exploration of ICT solutions based on active end user participation 3) efficient integration of energy storage and transport sector (EVs), 4) novel business models supporting an increasing number of different actors in the grid.

INVADE addresses these challenges by proposing to deliver a Cloud-based flexibility management system integrated with EVs and batteries empowering energy storage at mobile, distributed and centralised levels to increase renewables share in the smart distribution grid. The project integrates different components, such as a flexibility management system, energy storage technologies, electric vehicles and novel business models.

## 2. ABOUT THE PROJECT CONSORTIUM

The consortium is constituted by very diverse entities:

Research

- [CITCEA-UPC](#), the Centre of Technological Innovation in Static Converters and Drives from the Universitat Politècnica de Catalunya, devotes to research, innovation and technological transfer to the industry in fields like Enertronics fields, with special expertise on power electronics and its use for smart grid application, and integration of distributed energy resources into power systems.
- [NTNU](#), the Norwegian University of Science and Technology, with large experience in technologies to contribute to a sustainable conversion of the energy system;
- [Smart Innovation Norway](#), a centre that hosts NCE Smart Energy Markets; Norway's leading cluster of industries and academic institutions within Smart Grid and Smart Energy Market Research and Innovation;
- [VTT](#) Technical Research Centre of Finland, which a large experience in storage systems;

Technology providers

- [eSmart Systems](#), a Norwegian company that develops and delivers pioneering IT-system solutions on a world-class scale to world-leading energy players;

### NEWSLETTER 4 (Q4 2019)

Smart system of renewable energy storage based on INtegrated EVs and bAtteries to empower mobile, Distributed and centralised Energy storage in the distribution grid, **INVADE H2020 project**, is finalising its activity as innovation action for assessing how the use of centralized and distributes batteries, including electric vehicles can provide flexibility services.

In this newsletter you will find how you can access the key results of the project and test your knowledge about the project through a quiz that was prepared for the European Utility Week 2019 (EUW'19). If you were not able to visit us during EUW'19 or attend the INVADE conference held in Barcelona as a side event of the Smart City Expo World Congress 2019, you will find the INVADE Quiz in this newsletter.

**CONTENT**

1. How to access to the results
2. INVADE Quiz
3. Interested in the project?
4. Project consortium

## 2. QUIZ

Do you want to test your knowledge about the INVADE project and its results?

You can access the presentations of the INVADE conference held in Barcelona on November 20<sup>th</sup>, as a side event to Smart City Expo World Congress 2019, with the main results from the different work packages, at: <https://www.invadeconference.eu/>.

You can also watch the videos from our pilot sites:

- Albena, Bulgaria
- Granollers, Spain
- The Netherlands
- Stavanger, Norway
- Freiburg, Germany

at <https://h2020invade.eu/news/watch-all-invade-videos-here/>.

After viewing the presentations and watching the pilot videos, you can do the quiz at <http://www.invadecontest.com/>. Good luck!

## 4. PROJECT CONSORTIUM

All the partners wish you a Merry Christmas and happy years of energy transition!





## 6 Organization of workshops, conferences and large events

The DoA defined that two large events should be organized for promoting the project, the first one around the mid of the project, and the second one at the end. These two events had been done:

- **Mid-term large event:** Smart Business of Batteries - Trends & opportunities (10/10/2018) in Oslo, Norway

09:00 Arrival, coffee

09:30 Introduction to venue | Dieter Hirdes, INVADE Project Coordinator

09:40 Capitalising on end-user flexibility - Smartly & Lyse in the INVADE project | Trond Thorbjørnsen, Lyse

09:55 Building a flexibility market around the end-user | Iliana Ilieva, Smart Innovation Norway

10:15 The future of EV charging - INVADE NL pilot | Michel Bayings, GreenFlux

10:30 Mingling

10:50 Enabling seamless electromobility with vehicle-grid integration | Konstantin Staschus (PhD), ENTSO-E & Ecofys

11:10 Seamless integration of EVs – experience of Enel | Federico Caleno, Enel X

11:30 Strategic flexibility services to network operator | Sarah Carter, Ricardo

11:50 Lunch

12:50 Who wins the battery race? | Mikko Pihlatie, VTT

13:05 Hydrogen as storage and novel power tariffs - new opportunities for harvesting flexibility? | Timothy C Lommasson, NORCE Research

13:25 Practical examples and applications in Freiburg | Dr. Malte Thoma, Badenova AG & Co. KG

13:40 Circular battery economy | Fredrik Andersen, Batteriretur

14:00 A modular and flexible solution for large-scale thermal energy storage | Prof. Pål Bergan, EnergyNest

14:20 Mingling

14:40 Norwegian regulations on EVs integration | Kjell Rune Verlo, NVE

15:00 Dutch regulations of Smart Charging | Joris van der Ahé, Ministry of Infrastructure and Water Management, the Netherlands

15:20 Coffee break

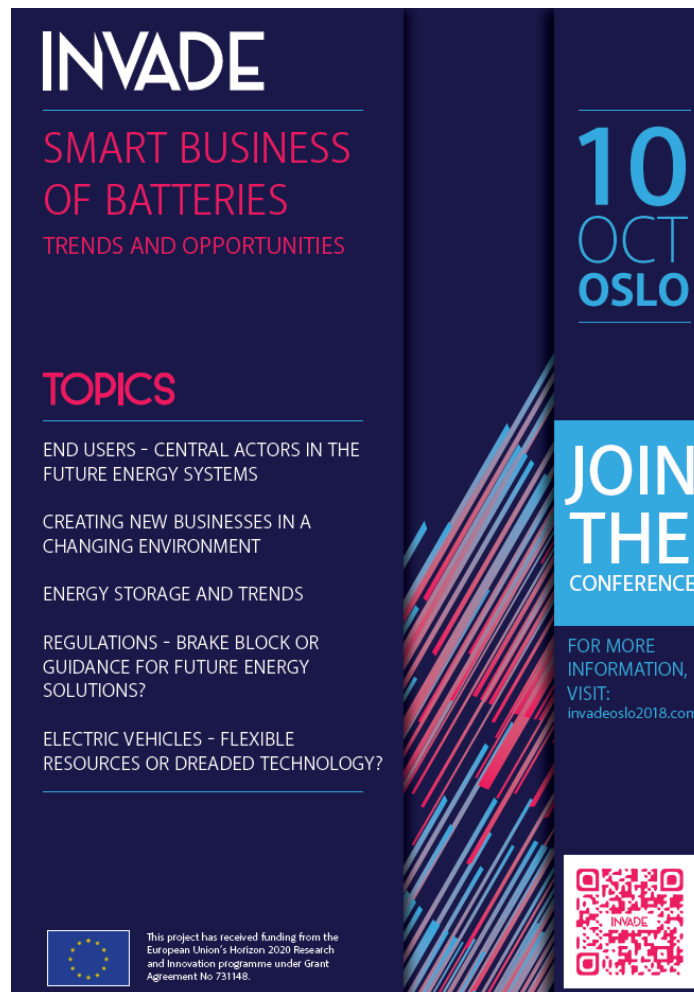
15:30 I have never tried that before, so I think I should definitely be able to do that. E-mobility: the new 'normal' | Jan van Meijl, VDL Enabling Transport Solutions

15:50 Vehicle to grid - when and how? Standards and the way forward | Frank Geerts, Elaad

16:05 How large amounts of EVs can solve capacity challenges in the distribution grid | Bo Normark, InnoEnergy

16:25 Charging infrastructure development in Europe's EV capital Oslo | Marianne Mølmen, City of Oslo, Agency for Urban Environment

16:45 Wrap up and ending



The number of attendants were 112 people, who 63% work at industry, 32% were from scientific community and 5% were policy makers. The conference require registration with a fee.

- **Final large event:** Empowering storage for flexibility in distribution grids (20/11/2019), Barcelona, Spain

It has been organized as a side event of the Smart City Expo World Congress, and as starting point for the INVADE exploitation workshop III. The program was the following:

#### OPENING

12:45 Joan Groizard, Acting Director-General at the Spanish National Energy Agency (IDAE) / Óscar Sánchez (ICAEN)

12:50 Introducing INVADE and partners | Dieter Hirdes, Smart Innovation Norway

#### BUSINESS

13:00 Are Platform-based business models relevant in the energy market? |  
Dagfin Wåge, Lyse

13:10 Exploitation of flexibility services | Bernt Bremdal, Smart Innovation Norway

#### TECHNOLOGY

13:20 Optimal use of lithium-ion batteries in grid applications | Yancho Todorov, VTT

13:30 Architecture for facilitating flexibility | Pau Lloret, UPC-CITCEA

13:40 Flexibility management algorithms | Hossein Farahmand, NTNU

13:50 The INVADE platform – An intelligent tool that optimizes the value of your flexibility | Jon Spetaas, eSmart Systems

#### PILOTS

14:00 Flexibility services to end customers | Trond Thorbjørnsen, Lyse

14:10 Renewable Energy impact managed by Smart Charging | Marisca Zweistra, Elaad & Michel Bayings, Greenflux

14:20 Centralized Storage System to provide several flexibility services | Vera Palma, Estabanell Energia

14:30 PV-batteries – a revolution for the energy market in Germany | Malte Thoma, Badenova

14:40 Energy Transition in Hospitality Sector | Dimitar Stanev & Svilen Prialkov, Albena

#### CLOSING



## JOIN THE CONFERENCE: INVADE Barcelona 2019

📅 November 20, 2019 (12:30 - 15:00)  
 📍 Fira Barcelona Gran Vía (View on Google Maps)

**The Horizon 2020 EU project INVADE is arriving at its end and the partners aim to share their findings regarding efficient use of centralised and distributed storage – for the benefit of consumers and grid operators.**

Stationary batteries and electrical vehicles can be used to optimize energy and power of households, buildings and power networks with a large presence of renewable generation, also considering the electricity market. The solution is based on a smart IT platform that facilitates advanced services in electrical energy. The project partners will share their results with engaging presentations as a side event of Smart City Expo World Congress 2019 in Barcelona on 20<sup>th</sup> of November 2019.

- **Venue:** Room 1.4. Area CC1 in Fira Barcelona Gran Vía (Av. Joan Carles I, 64, 08908 L'Hospitalet de Llobregat, Barcelona)
- **FREE** attendance via registration

### Program

12:30 Registration  
 OPENING  
 12:50 Introducing INVADE and partners | *Dieter Hirdes, Smart Innovation Norway*  
 BUSINESS  
 13:00 Are Platform-based business models relevant in the energy market? | *Dagfin Wåge, Lyse*  
 13:10 Exploitation of flexibility services | *Bernt Bremdal, Smart Innovation Norway*  
 TECHNOLOGY  
 13:20 Optimal use of lithium-ion batteries in grid applications | *Yancho Todorov, VTT*  
 13:30 Architecture for facilitating flexibility | *Pau Lloret, UPC-CITCEA*  
 13:40 Flexibility management algorithms | *Hossein Farahmand, NTNU*  
 13:50 The INVADE platform – An intelligent tool that optimize the value of your flexibility | *Jon Spetaas, eSmart Systems*  
 PILOTS  
 14:00 Flexibility services to end customers | *Trond Thorbjørnsen, Lyse*  
 14:10 Renewable Energy impact managed by Smart Charging | *Marisca Zweistra, Elaad & Michel Bayings, Greenflux*  
 14:20 Centralized Storage System to provide several flexibility services | *Vera Palma, Estabanell Energia*  
 14:30 PV-batteries – a evolution for the energy market in Germany | *Malte Thoma, Badenova*  
 14:40 Energy Transition in Hospitality Sector | *Dimitar Stanev & Svilen Priatkov, Albena*  
 CLOSING

The number of attendants were around 80 people. The conference asked for registration and was free for those that were participating at the Smart City Expo World Congress.

Moreover, consortium members has organized the following conferences, workshops and seminars:

Event	Organizer	Date	Place
Concept design technical meeting	UPC	13/06/2017	Barcelona
INVADE exploitation workshop I	SIN	06/03/2018	Oslo
INVADE workshop on grid integration of battery storages	VTT	21/03/2018	Espoo
INVADE Black Sea 2018 Workshop. Smart Energy Research - Innovation & Business	SIN, Albena	13/09/2018	Albena
XI International conference on energy innovation: integration of batteries and electric vehicles: towards a more flexible power system	UPC	16/11/2018	Barcelona
INVADE exploitation workshop II	SIN	06/03/2019	Conpenhagen
ESEW2019 European Sustainable Energy Week	Albena	21/06/2019	Albena
Workshop on techno-economics and LCA of battery storages	VTT	30/10/2019	Espoo
INVADE exploitation workshop III	SIN	20/11/2019	Barcelona
INVADE seminar: results and future challenges	UPC	19/12/2019	Barcelona

## 7 Participation in workshops and conferences

According to the Communication and Dissemination activities repository file, consortium members has participated in the following workshops, conferences and other activities where they have presented the project:

Title	Partner	Date	Publisher	Place
Local flexibility markets	UPC	15/02/2017	Energy Congress of Catalonia (Congrés d'Energia de Catalunya)	Barcelona, Spain
EMPOWER project explained in COEIC	UPC	04/04/2017	Industrial engineers association of Catalonia	Barcelona, Spain
Local flexibility markets: From EMPOWER to INVADE	UPC	11/07/2017	The International symposium on energy innovation "The transition to a flexible electricity market"	Barcelona, Spain
SENSE Workshop: Local Markets and Flexibility Services: EMPOWER and INVADE	UPC	20/10/2017		Barcelona, Spain

Title	Partner	Date	Publisher	Place
Lithium-ion Battery Diagnostics: State of Health Estimation	VTT	02/11/2017	NordBatt 2017	Kokkola, Finland
What is INVADE H2020?	UPC	07/11/2017	Industrial engineers association of Catalonia. Smart Grid working group	Barcelona, Spain
New trends in European electricity markets, EMPOWER and INVADE	UPC	14/11/2017	Universitat Politècnica de Catalunya	Barcelona, Spain
ELSA- ICT WORKSHOP Regulation, Standard, Certification	UPC	16/11/2017	ELSA H2020 Project	Internet
ELSA ICT GRID WORKSHOP	UPC	16/11/2017	ELSA H2020 Project	Internet
Energy Flexibility Now	Elaad	2018	Solarplaza, Energy Flexibility Forum	Copenhagen
The H2020 Project INVADE	NTNU	14/03/2018	NTNU and SINTEF	Oslo, Norway
Horizon 2020 innovation project INVADE	NTNU	03/10/2017	NTNU	Brussels, Belgium
The H2020 Project INVADE	NTNU	12/10/2017	NTNU, SINTEF, Institut Français de Norvège	Trondheim, Norway
The H2020 Project INVADE	NTNU	03/10/2017	Pyomo	Trondheim, Norway
The H2020 Project INVADE	NTNU	22/10/2017	NTNU	Roskilde, Denmark
Flexibility in EMPOWER and INVADE projects	SIN	20/11/2017	Pentalateral Energy Forum	Brussels, Belgium
User involvement and participation in the innovation process and digitalization of the energy	SIN	30/11/2017	NEXT - Power to ideas	Bologna
eMI3	ElaadNL	06/03/2018	eMI3	Brussels, Belgium
eMI3	ElaadNL	08/06/2017	eMI3	Berlin, Germany
eMI3	ElaadNL	12/10/2017	eMI3	Ehningen
Grand opening of test site for EV charging	ElaadNL	18/04/2018	ElaadNL	Arnhem
Circular Economy of EV Batteries	VTT	24/05/2018	EIT RawMaterials, Aalto University, VTT, CloseLoop Project	Espoo, Finland
Energy storage technologies and systems requirements: An outlook with focus on batteries	VTT	31/01/2018	ACI	Cologne, Germany
New business models and their relevance in the future energy market	Lyse	14/06/2018	Lyse	Stavanger
The INVADE project case in The Netherlands	Greenflux	20/03/2018	RUGGEDIZED H2020 Smart City project	Glasgow, UK

Title	Partner	Date	Publisher	Place
New business models - and how they disrupt markets	Lyse	06/05/2018	Lyse	Stavanger
New business models - and how they disrupt markets	Lyse	12/04/2018	Lyse	Stavanger
New business models - and how they disrupt markets	Lyse	30/03/2018	Lyse	Stavanger
Albena: Why Going Green Pays Off?	Albena	06/06/2018	Ministry of Tourism, Bulgaria	Sofia, Bulgaria
Power quality and electricity distribution in an environment with distributed generation and storage	Estabanel	28/11/2018	Industrial engineers association of Catalonia	Barcelona, Spain
Opening the flexibility in Spain	Estabanel	12/12/2018	ENTRA	Madrid, Spain
Smarter Grids and storage in emerging energy ecosystem – Leveraging Norwegian expertise	SIN	06/01/2019	SmartIO	
4th annual ancillary services and demand response management forum	SIN	17/01/2019	SmartIO	Berlin, Germany
Catalonian Energy Efficiency Cluster: Self-consumption & Renewable Energies	UPC	30/01/2019		
The Solutions for Our Climate	eSmart	10/07/2019		Seoul, Korea
How business model innovation in H2020 projects is disrupting the status quo and enabling in the energy transition	SIN, eSmart	30/09/2019	IEEE	Bucharest, Romania
Presentation of INVADE exploitation case to large housing organisation	SIN	18/10/2019		Oslo, Norway
Industry 4.0 at the ETSEIB	UPC	03/07/2019	ETSEIB- UPC	Barcelona, Spain
R&I for managing complexity of smart grids	UPC	29/10/2019	Enginyers Industrials de Catalunya	Barcelona, Spain
Large scale smart charging in practice	ElaadNL	08/10/2019	EVS33	Portland, USA
Virtual Conference: A Circular Economy in Central and Eastern Europe	Albena	27/11/2019		Sofia, Bulgaria
X-FLEX H2020 Project Kick-Off Meeting	Albena	07/10/2019	X-FLEX H2020 Project	Valencia, Spain
SENSE Workshop: Energy Transition and Flexibility	UPC	17/10/2018		Barcelona, Spain
InnoEnergy Community: Speakers Series	UPC	29/03/2019		Barcelona, Spain
UPC School: Smart Energy. Local Markets and Flexibility	UPC	25/09/2019		Barcelona, Spain



## 8 Technical Advisory Group

The Technical Advisory Group (TAG) was created during the first half of the project and there was the first meeting in M6 for Concept design description

A second TAG meeting was organized in combination with Exploitation Users Groups (EUG) workshop in Barcelona on 20<sup>th</sup> November 2019 after the last event. The objective was to discuss the INVADE achievements presented in the INVADE conference (in the figure below there is the brochure prepared for this).


The agenda was:

- 12:30 – 15:00 INVADE conference
- 15:00 – 17:00 TAG & EUG
- 18:00 – 19:30 Visit to Estabanell pilot site
- 20:00 – 21:30 Dinner\*

\* *Courtesy of CITCEA-UPC*

Meeting attendees were:

Project members		TAG & EUG members	
SmartIN	Bernt Bremdal	Spanish Royal Academy of Engineering	Eloy Alvarez
	Bryan Pellerin	SQC	Sergio Ugarte
	Santi Martinez	Endesa (Spanish DSO)	Santiago Cascante
	Joseph Negreira	ICAEN (Catalan Energy Agency)	Óscar Sánchez
	Sanket Puranik	UPC PhD student	Sara Barja
	Dieter Hirdes	Marc Pages	teknoCEA
UPC	Roberto Villafafila	Ciprian Comsuela	CREESC
	Pau Lloret	Wattius	Xavier Massot
	Íngrid Munné Collados		Eduard Godori
NTNU	Hossein Farahmand	IOTA	Wilfred Pimienta
VTT	Sampaa Jenu	TTA	Xavier Vallvé
eSmart	Jon Spetaas	ISEA RWTH Aachen	Fabian Ruecker
badenova	Malte Thoma	Transport of London	David Talbot
Albena	Dimitar Stanev	NKL	Roland Ferwerda
	Svilen Prialkov	Km0 Energy	Montse Mussons
Schneider	Per Gjerløw	ESADE Business School	Carlos González
Lyse	Trond Thorbjornsen	ENTRA	Niccolò Fattirolli
	Dagfin Wåge		
EPESA	Ramón Gallart		
Elaad	Marisca Zweistra		
GreenFlux	Michel Bayings		



# INVADE

## BATTERY STORAGE AND FLEXIBILITY

Welcome to the third INVADE EUG & TAG workshop to be held in Barcelona on  
**November 20, 2019**

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**Organized by:** INVADE project  
**Contact person:** [Bernt Bremdal](#), [Roberto Villafafila](#)  
**Date:** 20/11/2019  
**Location:** Fira Barcelona Gran Via (Av. Joan Carles I, 64 - Halls 1 & 2, 08908 L'Hospitalet de Llobregat, Barcelona)  
**Cost:** Free

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In association with the [Smart City Expo World Congress](#) the H2020 project **INVADE** will organize a final event that consists of two sections. During the first section we will present the results and findings from the INVADE project on operations of batteries, demand-response, smart charging and V2G. The achievements from five different full-scale pilots in Norway, Spain, Germany, The Netherlands and Bulgaria will be presented. Highlights for first session are:

- Deep insights on:
  - experiences with grid connected Redox/Flow batteries,
  - management of numerous EV charging facilities by means of smart charging,
  - efforts to integrate V2G operations into flexibility regimes and business models that can support this.
- Demand-response based upon thermal loads to increase the energy efficiency of group of hotels. The energy system consists energy generation from distributed renewable resources and storage units.
- Practical experiences with large scale integration of flexibility management platforms with Home Automation Systems/EMS. Both business aspects and technical issues will be treated.

Section two is dedicated to business opportunities and societal impacts that the INVADE findings offer. New business models as well as regulatory and policy issues will be discussed. EU's recent release on pertinent directives and recommendations, especially, Clean Energy For All European Citizens will be one among several references for the discussion that is going to be raised during the discussion. Panel based format will be followed in second section that was previously introduced in Oslo (2018) and followed in Copenhagen in March this year (2019). Second section will be followed by a visit to Spanish pilot in Granollers and dinner together with project consortium.

**A special invitation is extended to members of the Exploitation User Group (EUG) and Technical Advisory Group (TAG).**

### AGENDA


**12:30-15:00**  
INVADE large scale event  
*Room 1.4. Area CC1*

**15:00-17:00**  
Exploitation workshop  
*Room 1.2. Area CC1*

**18:00-19:30**  
Visit Spanish pilot site at Granollers

**20-21:30**  
Dinner

**Note:** Travel to Spanish pilot and back to the venue will be arranged by the organizers



## 9 BRIDGE and other EU activities

INVADE Project has been actively contributing into the BRIDGE community. Project has assigned representatives for each working group, which are shown in the table below:

Coordinator	Business Models	Customer Engagement	Data Management	Energy Regulation
SmartIO/Dieter Hirdes	Lyse/Dagfinn Wåge	SmartIO/Joseph Negreir (previously Trine Wildt Andersen)	eSmart/Erik Åsberg	UPC/ Andreas Sumper (previously Pol Olivella)

Consortium considers the collaboration fruitful for the dissemination of the INVADE learnings and also sees working groups as excellent platforms for learning from other H2020 projects and finding collaboration possibilities. In the tables below the participation from the length of the INVADE project, 2017-2019, in the different working groups is listed.

INVADE participation in BRIDGE Customer Engagement working group:

Date	Location	What event/activity was attended?	Who attended?	Main issues addressed?	INVADE contribution in the event	INVADE ToDo list for future and responsible person
20-21/11/17	Bru ssel s	CE General meeting	Joseph Negreira	Work on Deliverable 2015-2017	Leader of sub-group A	Generate contributions to the deliverable.
22/11/2017	Bru ssel s	BRIDGE General meeting	Joseph Negreira	Work on Deliverable 2015-2017	Leader of sub-group A	Generate contributions to the deliverable.
07/12/2017	Sky pe	CE General meeting	Joseph Negreira	Work on Deliverable 2015-2017	Leader of sub-group A	Generate contributions to the deliverable.
14/12/2017	Sky pe	CE General meeting	Joseph Negreira	Work on Deliverable 2015-2017	Leader of sub-group A	Generate contributions to the deliverable.
21/12/2017	Sky pe	CE General meeting	Joseph Negreira	Work on Deliverable 2015-2017	Leader of sub-group A	Generate contributions to the deliverable.

Date	Location	What event/activity was attended?	Who attended?	Main issues addressed?	INVADE contribution in the event	INVADE ToDo list for future and responsible person
11/01/2018	Sky pe	CE General meeting	Joseph Negreira	Work on Deliverable 2015-2017	Leader of sub-group A	Generate contributions to the deliverable.
01/03/2018	Sky pe	CE General meeting	Joseph Negreira	Work on Deliverable 2015-2018	Leader of sub-group A	Generate contributions to the deliverable.
13/04/2018	Sky pe	CE General meeting	Joseph Negreira	Work on Deliverable 2015-2018	Leader of sub-group A	Generate contributions to the deliverable.
18/05/2018	Sky pe	CE General meeting	Joseph Negreira	Work on Deliverable 2015-2018	Leader of sub-group A	Generate contributions to the deliverable.

#### INVADE participation in BRIDGE Data Management working group:

Date	Location	What event/activity was attended?	Who attended?	Main issues addressed?	INVADE contribution in the event	INVADE ToDo list for future and responsible person
24/05/18	Remote	Completed Data handling questionnaire	The template was completed by Mark Fisher and Terje Lundby	Data access and interoperability	The questionnaire was filled out based on data access and interoperability in the Norwegian INVADE pilot.	No specific tasks at the moment

#### INVADE participation in BRIDGE Energy Regulation working group:

Date	Location	What event/activity was attended?	Who attended?	Main issues addressed?	INVADE contribution in the event	INVADE ToDo list for future and responsible person
03/04/2017	Remotely	Support requested by Bridge managers	Andreas Sumper & Pol Olivella	STEP 2 - Analysis of the Clean Energy Package	Clean energy package reading	Send major issues
26/04/2017	Remotely	Support requested by Bridge managers	Pol Olivella	STEP 2 - Analysis of the Clean Energy Package	Clean energy package reading	Send major issues
01/06/2017	Remotely	Support requested by Bridge managers	Andreas Sumper & Pol Olivella	STEP 3 - Analysis of the Clean Energy Package	4 articles reviewed	Send articles reviewed

Date	Location	What event/activity was attended?	Who attended?	Main issues addressed?	INVADE contribution in the event	INVADE ToDo list for future and responsible person
20/11/2017	Brussels	Bridge regulation WG meeting	Pol Olivella	Presentation of the "Feedback on the Clean Energy Package proposals" report + Interactive session on the year's activities and EC's expectations	Project presentation + Lead of one sub-issue regarding storage	Send sub-issue reviewed and coordination of the sub-group
12/02/2018	Remotely	Storage issues sub-working group	Pol Olivella	Battery flexibility services	Definition of regulatory barriers	Provide inputs to the bridge report of 2018
02/03/2018	Remotely	Storage issues sub-working group	Pol Olivella	Battery flexibility services	Definition of regulatory barriers	Create a questionnaire for other H2020 projects collaborating in the Bridge cluster
20/04/2018	Remotely	Storage questionnaire	Pol Olivella	Battery flexibility services	Creation of the H2020 questionnaire	Analyse the replies from the questionnaire
31/05/2018	Remotely	Storage regulation recommendations	Pol Olivella	Battery flexibility services	Draft of regulatory recommendations	Send draft regulatory recommendations to Dowel for the new Bridge report
19/07/2019	Remotely	BRIDGE Regulations Working Group Findings and Recommendations	Andreas Sumper / Pol Olivella / Ingrid Munné	Storage valorisation / Safety and environment / New market design options, leading to new services, business models and roles for system operators, requiring increased coordination between system operators	Coordination and contribution	Coordination of the section within this final report

Moreover, INVADE has appeared in three Bridge newsletters: #5 Apr 18, #7 Apr 19 and #Dec 19.


Newsletter #8: December 2019

**INVADE**

**Launched Europe's first EV Charge Court**

A consortium of energy and technology companies, research partners and a municipality are building a revolutionizing charging concept for electric vehicles in Sarpsborg, Norway, based on the [INVADE](#) model.

*"This is primarily an exploitation case. It shows that what we have done in the INVADE project is appealing to others beyond the project and that the results can be industrialized,"* says Prof. Bernt A. Bremdal, Senior Advisor R&I at Smart Innovation Norway, the company which coordinates the large-scale EU Horizon 2020 project, INVADE.

In January, the Norwegian Minister of Trade and Industry, Mr. Torbjørn Røe Isaksen, put down the very first building block. By the end of 2019, INSPIRA Charge Court will be opened in 2020.

Read more:  
<https://h2020invade.eu/news/launched-europes-first-ev-charge-court/>




## 9.1 Participation in the European Utility Week

The European Commission under Bridge initiative promotes the participation of its funded H2020 project within the European Utility Week (EUW), where it provides a stand shared by the different projects and special sessions where the projects present their challenges and achievements. INVADE project has participated in three editions of the EUW:

- 2017 in Amsterdam (The Netherlands)
 

Session: Main obstacles to engage customers (04/10/2017). Presenter: Dieter Hirdes (SIN), project coordinator
- 2018 in Vienna (Austria)
 

Session: Interoperable platforms and data exchange for energy services: practical experience from the Bridge projects (06/11/2018). Presenter: Dieter Hirdes (SIN), project coordinator
- 2019 in Paris (France)
 

The project prepared a quiz in order to attract the attention of the attendants to the exhibition.

Session: Storage services for network operators (14/11/2019). Presenter: Dieter Hirdes (SIN), project coordinator





## 10 Other dissemination tools

### 10.1 Project presentation

In order to help to disseminate the project while reaching possible potential stakeholders in events like congress, conferences, exhibitions or workshops, a presentation describing the objectives and the consortium has been prepared (see captions in Annex 12.1).

### 10.2 Poster / Roll-up

To be shown to delegates in conferences, events or workshops, a poster of the project was created (see flyer in Figure 1).



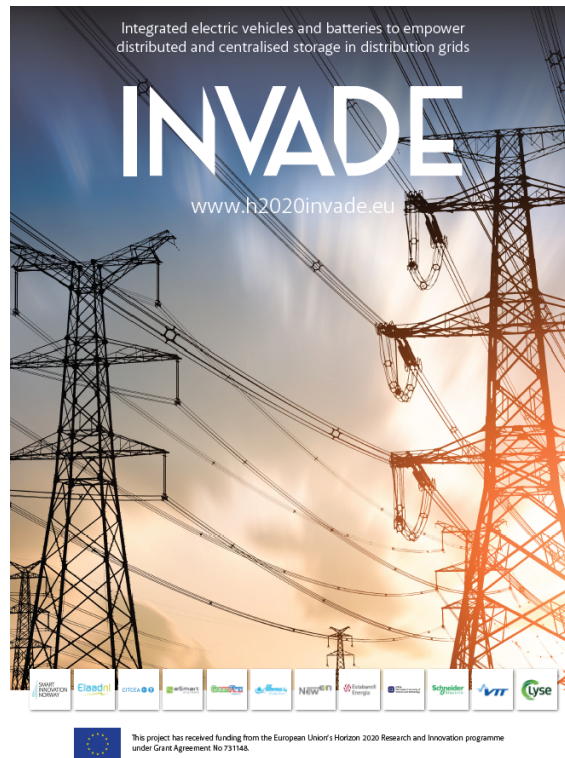


Figure 1: Poster of the INVADE project

### 10.3 Flyer

A flyer presenting key insights about the project was created to be handed out at conferences, to colleagues and to engaged or interested stakeholders (see flyer in Figure 2).

**INVADE**

Integrated electric vehicles and batteries to empower distributed and centralised storage in distribution grids

[www.h2020invade.eu](http://www.h2020invade.eu)

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 731148.

**WHAT IS IT ABOUT?**

Our current electrical infrastructure faces several challenges in the coming years, one being a greater share of renewable energies, another is aging infrastructure. These challenges should be resolved in a cost-efficient manner.

Renewable energies set higher demands to system resilience and flexibility, as we deal with intermittent energy resources, and are often produced locally in the distribution grid. New system infrastructure is very expensive, urging for better use of existing infrastructure in conjunction with new inexpensive technologies.

INVADE seeks to solve these issues by combining already existing technologies into a new framework. At the core is a cloud-based flexibility management system integrated with electric vehicles (EVs) and batteries empowering energy storage to increase the share of renewables in the smart grid. Additionally, smart control of domestic appliances will aid in load-balancing over the course of a day.

Combining physical batteries with state of the art data technology will open new marketplaces to trade energy and energy services, which in turn will provide the latest technology within big data analytics.

**12 PARTNERS**  
With expertise in IT, smart energy and technology

**16 MILLION EUROS**  
INVADE is a large European research and innovation project in the field of SmartGrid & Storage

**5 PILOT SITES**  
Located in Germany, Norway, Spain, Bulgaria and The Netherlands

Want to know more, visit us at [www.h2020invade.eu](http://www.h2020invade.eu)

Figure 2: Flyer of the INVADE project

## 10.4 ZENODO repository

A community is created into the ZENODO public repository to add uploads from the project and deposit research data. INVADE community in ZENODO can be found following this link:

<https://zenodo.org/communities/invade/?page=1&size=20>

zenodo Search Upload Communities pol.olivella@citoea.upc.edu

## INVADE H2020 Project

Recent uploads

Search INVADE H2020 Project

April 2, 2018 (1.0) Journal article Open Access View

**Local Flexibility Market Design for Aggregators Providing Multiple Flexibility Services at Distribution Network Level**

Olivella-Rosell, Pol; Lloret-Gallego, Pau; Munné-Collado, Ingrid; Villafafila-Robles, Roberto; Sumper, Andreas; Ottesen, Stig Odegaard; Rajasekharan, Jayaprakash; Bremdal, Bernt A.;

This paper presents a general description of local flexibility markets as a market-based management mechanism for aggregators. The high penetration of distributed energy resources introduces new flexibility services like prosumer or community self-balancing, congestion management and time-of-use opt

Uploaded on May 23, 2018

May 16, 2018 (1.0) Presentation Open Access View

**INVADE project presentation**

Olivella-Rosell, Pol; Lloret-Gallego, Pau; Thomsen, Ketil;

INVADE project concept presentation

Uploaded on May 23, 2018

December 20, 2017 (1.0) Project deliverable Open Access View

**Simplified Battery operation and control algorithm**

Ottesen, Stig Odegaard; Olivella-Rosell, Pol; Lloret-Gallego, Pau; Hentunen, Ari; Crespo del Granado, Pedro; Bjarghov, Sigurd; Lakshmanan, Venkatachalam; Aghaei, Jarmshid;

The main objective of the INVADE project is to study possibilities to increase RES penetration and integration in the power system by adding more storage, i.e., batteries. The analysis centres on the flexibility services that different types of storages can provide, namely: centralized, distributed

Uploaded on May 10, 2018

New upload

Want your upload to appear in this community?

- Click the button above to upload straight to this community.
- The community curator is notified, and will either accept or reject your upload (see community curation policy above).
- If your upload is rejected by the curator, it will still be available on Zenodo, just not in this community.

Community

**INVADE**

**INVADE H2020 Project**

This community will discuss and share about flexibility in distribution networks in smart grid dominated environments. Specially flexibility provided by electric vehicles and small/mid-size batteries

## 10.5 Demonstrations and local meetings

Consortium members have done several demonstrations and local meetings in order to explain their experience within INVADE. Following there are some of these activities done by partners:

### Albena:

- Interview and demonstration for Schauinsland Reisen - Germany
- Live data presentation at the hotel lobbies of Hotels in Albena
- Meeting with Academics: Technical University Varna, Bulgaria
- Meeting with BG Transmission System Operator - ESO EAD
- Meeting with Schneider Electric Bulgaria

### Lyse

- Demonstration of flexibility service in Stavanger (06/05/2018 & 14/06/2018)

## 11 KPI

The status of communication and dissemination commitments that include contributions to project milestones are detailed below. This table records the commitments achieved during the project. Those that have been achieved have their status marked in green, those that have been postponed or changed have been marked in blue and those that have not been carried out yet have been marked in grey if the reason is that they are planned as future actions and in red if they have not been done yet.

Table 2: C&amp;D obligations

Action	Commitment	Status
Website	1 INVADE project website: www.invadeh2020.eu	Done: created & periodically updated
Social networks	Facebook, LinkedIn and Twitter project accounts.	Done: created & periodically updated
Press releases	3 formal announcements. First at M3	Done
Project video	1 project video at M18	Done: launch at M25 (07/02/2019)
	videos from meetings / events / workshops	Done
	5 videos from pilots	Done
Flyer	1 flyer / roll-up	Done
Poster	1 poster	Done
Newsletters	4 newsletters.	#1 (Q1 2019) M29, #2-3 (Q2-Q3 2019) M34, #4 (Q4 219) M36
	Other newsletters	3 from Bridge: #5 Apr 18 / #7 Apr 19 / #Dec 19
Local meetings	Number not specified	2 done
Technical Advisory Group	15 members maximum and 3 physical meetings	2 done
Project events	2 large-scale project events	Mid:Oslo at M22 (10/10/18)
		Final: BCN at M35 (20/11/19)
Workshops	8 technical workshops and 2 business workshops	10 oorganized
Conference presentations	28 presentations (national + international conferences)	Around 45 presentations done
Demonstrations	Number not specified	Several done
Scientific Papers, Journal articles	13 scientific papers to indexed and peer-reviewed journals	9 papers accepted in journals, 1 under review in journals, 13 papers published in conference
Reports and other documents	Number not specified	Several done
Programme meetings	Number not specified	Several done

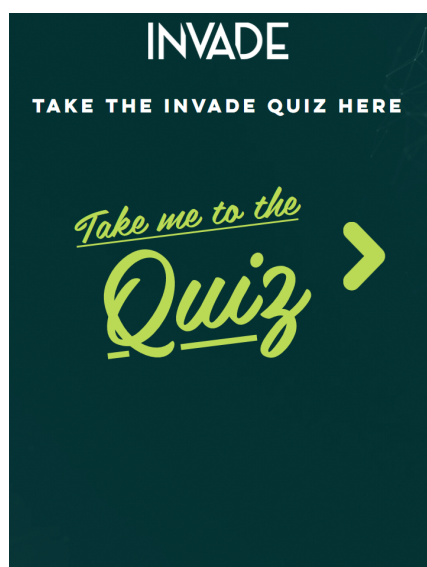
Apart from the KPIs that were defined in the DoA, following are listed activities that have been done and have helped to a further dissemination of the project:

- **Quiz**

An on-line test has been prepared with the pilot videos and 3 questions on each of the INVADE pilots. This is available at <https://www.invadecontest.com/>.

Its aims was to encourage people to know about the project by watching the pilot videos. It was launch in the European Utility Week 2019 in Paris within a contest frame. Among the people who answer right all the questions, there was a draw for an iPhone XS as a prize.

The screenshot shows the INVADE website with a navigation bar (The project, Deliverables, Partners, Contact, Events, News, Videos) and a search bar. The main content features a news article titled "MSc student won the INVADE contest at EUW19: 'I found the INVADE pilots incredibly interesting'" by Mari Kristine Buckholm, dated 26 November 2019. The article describes the INVADE project's presence at the European Utility Week in Paris, highlighting a quiz and a contest where a winner received an iPhone XS. To the right, there is a "Social media" section with updates from @INVADEH2020 and a tweet from the MSc student.



The slide is titled "The Bulgarian pilot" and features the INVADE BULGARIA logo. It contains three quiz questions:

1. What kind of installations are included in Albena pilot?
  - a. Solar thermal panels + PV panels + a battery.
  - b. Solar thermal panels + cooling systems + 2 batteries
  - c. EV + PV + laundry loads
  - d. Solar thermal + Air heat-pump + laundry loads
2. What percentage of cost has Albena saved with the INVADE platform?
  - a. 5.4 %
  - b. 27.3%
  - c. 13.5 %
  - d. 43%
3. How many hotel buildings are involved in Albena pilot?
  - a. 6
  - b. 8
  - c. 11
  - d. 2



- Prizes and awards

- GrausTIC awards

Estabanell has been awarded twice with a GrausTIC award in the category of *Digital Innovation*, because its participation in the INVADE project (2019) among other R+D+i projects (2018).

*GrausTIC is the brand of ONES Associació d'Enginyeria Tècnica de Telecomunicació de Catalunya (AETTEC) (ONES Technical Telecommunications Engineering Association of Catalonia). GrausTIC Awards distinguish yearly those professionals, companies or institutions that promote the use of ICT and use them to improve innovation, exporting effort and social responsibility. The Awards are addressed to both the ICT sector, and those, that even if they belong to another sector, significantly incorporate them into their internal and external processes or its products and services.*



o enerTIC platform Awards

UPC-CITCEA has been a finalist in 2019 in the category of H2020 European project of the enerTIC Awards.

*The mission of the enerTIC platform is to contribute to the development of Information and Communication Technologies in the field of energy efficiency in Spain with the support of associated companies and public institutions, in favor of a more competitive and sustainable economy.*

*The enerTIC Awards have as main objective to identify, reward and disseminate innovative technological projects carried out by companies and organizations committed to energy efficiency and sustainability, and professionals.*

The screenshot displays the enerTIC platform interface. The top navigation bar includes 'HOME', 'LA PLATAFORMA', 'ACTIVIDADES', 'CENTRO DE CONOCIMIENTO', 'ACTUALIDAD', 'PÁGS', and 'CONTACTO'. The main content area features three project cards:

- GROWSMARTER**: Implemented by Naturgy. Description: "GrowSmarter es un proyecto europeo englobado dentro del programa Horizonte 2020 con el objetivo de aplicar tecnologías enfocadas al empoderamiento del ciudadano, ahorro económico y reducción de emisiones en...".
- SMART SYSTEM OF RENEWABLE ENERGY STORAGE BASED ON INTEGRATED EVS AND BATTERIES TO EMPOWER MOBILE, DISTRIBUTED AND CENTRALISED ENERGY STORAGE IN THE DISTRIBUTION GRID (INVADE)**: Implemented by CIT UPC. Description: "El objetivo de este proyecto es diseñar un sistema de gestión de la flexibilidad que respalde la red de distribución y el mercado eléctrico, a la vez que aborda las limitaciones de la red, la alta penetraci...".
- WASTE4THINK. MOVING TOWARDS LIFE CYCLE THINKING BY INTEGRATING ADVANCED WASTE MANAGEMENT SYSTEMS.**: Implemented by Fundación Deusto - DeustoTech. Description: "Waste4Think propone ir del actual sistema de gestión de residuos a un modelo de economía circular integrando y validando 20 soluciones eco-innovadoras que cubren la cadena de valor basándose en: - Herrami...".

Below the cards, logos for Schneider Electric and a 'GALARDONADO' badge are visible. To the right, a tweet from INVADE retweeted by CIT UPC is shown, containing the text: "This is INVADE Project, finalist at #enerTIC Awards: Integrated electric vehicles and batteries to empower distributed and centralised storage in distribution grids upc-cit.com/38qFgtG #ElectricVehicles #batteries #urbanmobility #CO2 CC @INVADEH2020 @enertic". The tweet image shows an airplane flying over an electric vehicle charging station with the word 'INVADE' overlaid.



# 12 Annexes

## 12.1 Project presentation captures



### WHAT ARE WE AIMING AT?

Our current electrical infrastructure face several challenges in the coming years, one being a **greater share of renewable energies** another is **aging infrastructure**. These challenges should be resolved in a **cost-efficient manner**.

INVADE

### WHAT ARE WE AIMING AT?

The INVADE project aims to provide a **Cloud-based flexibility management system integrated with EVs and batteries** empowering energy storage at **mobile, distributed and centralised levels** to increase renewables share in the smart distribution grid.

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### RENEWABLE GENERATION AND EVs ARE COMING

Renewable power forecast to grow by 36% over 2015-21, making it the fastest-growing source of electricity generation. Source: IEA.

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### SYSTEM DESCRIPTION

The system is a peer-to-peer platform based on direct control of demand and supply. The flexibility operator (FO) takes decisions based on flexibility contracts. Third party platforms can be integrated.

**Flexibility resources to be controlled are:**

- Batteries
- Electric vehicles
- Photovoltaic panels
- Water heaters
- Heat pumps

**Flexibility services for:**

- End users/prosumers reducing the electricity bill
- BRP to reduce imbalance penalties
- DSO to control grid congestions

INVADE

### FLEXIBILITY SERVICES

Flexibility customer	Flexibility services INVADE	Description of flexibility services
DSO	Congestion management	Avoiding the thermal overload of system components by reducing peak loads where failure due to overloading may occur.
	Voltage / Reactive power control	Using load flexibility by increasing the load or decreasing generation, in an effort to avoid exceeding the voltage limits. Voltage control is typically requested when solar PV systems generate significant amounts of electricity.
	Controlled islanding	Preventing supply interruption in a given grid section when a fault occurs in a section of the grid feeding this.
BRP	Day-ahead portfolio optimization	Setting loads from a high-price time period to a low-price time period before the day-ahead market closure. It enables the BRP to reduce its overall electricity purchase costs.
	Intra-day portfolio optimization	Flexing water creation on hourly market, equivalent to the day-ahead market.
	Self-balancing portfolio	Flexing resources by the BRP when its portfolio is about to exceed imbalance charges. The BRP does not actively bid on the imbalance market (initial order flexibility, but does not bid on high prices).
Producer	FAZ optimization	Flexibility from high-price intervals to low-price intervals or even complete load shedding during periods with high prices.
	Wholesale control	Reducing the maximum load (peak shaving) that the Producer consumes when a production station (e.g., month, year, other) through load shedding or shedding.
	Self-balancing	Value is created through the difference in the prices of buying, generating, and selling electricity (including taxation if applicable).
	Controlled islanding	Being grid outages.

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### USE CASES

Use cases (UC):

- Mobile energy storage using EVs for V2G, V2B and V2H operations.
- Centralized energy storage using an array of batteries at the substation or street level.
- Distributed energy storage using individual batteries at the household level.
- Hybrid level energy storage solutions addressing a combination of use cases 2 and 3.

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### PILOTS IMPLEMENTATIONS

5 Pilots:

- Norway: UC 1 & 3
- The Netherlands: UC 1
- Bulgaria: UC 2
- Spain: UC 2
- Germany: UC 4

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