EUROPEAN COMMISSION
INNOVATION AND NETWORKS EXECUTIVE AGENCY

INEA.H – Horizon 2020 Department
H.1 – Energy Research

GENERAL PROJECT REVIEW CONSOLIDATED REPORT

Grant agreement (GA) number:	646456
Project[1] Acronym:	GrowSmarter
Project title:	GrowSmarter
Type of action:	IA
Start date of the project:	01/01/2015
Duration of the project:	60
Name of primary coordinator contact and organisation:	Gustaf LANDAHL (STOCKHOLMS STAD)
Period covered by the report:	from 01/01/2019 to 31/12/2019
Periodic report/Reporting period number:	Final
Date of first submission of the periodic report (if applicable):	10/03/2020
Amendments (latest AMD concerning description of the action)[2]	25/10/2019 (AMD-646456-120)
Date of meeting with consortium (if applicable):	04/02/2020
Name of project officer:	Juan Ramon DE LAS CUEVAS
Name(s) of monitors:	Not applicable

[1] 'Project' means the same thing as 'action'.
[2] Only amendments to the description of the action (DoA; AT21) are relevant for general project reviews since they always have to be carried out against the latest version of the DoA

1. Overall assessment

1. Overall assessment
Project has achieved most of its objectives and milestones for the period with relatively minor deviations.
2. Significant results linked to dissemination, exploitation and impact potential
Project has delivered exceptional results with significant immediate or potential impact (even if not all objectives mentioned in the Annex 1 to the GA were achieved). The project has achieved very good technical progress and results during the last reporting period, absorbing some of the delays identified in the previous reporting period, with a good quality in the deliverables. The project has fully deployed the 12 proposed smart solutions and the monitoring period has finished as stated in the DoA. The technical impact of the deployed solutions is followed by tailored recommendations for local authorities to build similar smart city solutions across Europe. The project showcased innovations in the area of low energy districts, including all relevant sectors (buildings, energy, e-mobility and ICT). The outputs for exploitation have been identified and the corresponding business models are proposed for further replication. The main exploitable results to be highlighted are these 12 smart city solutions, with a report entitled “From dream to reality” which covers the main techno-economic and social lessons learned from the implementation phases in the lighthouse cities. The main results out of those 12 are the district heating and integrated infrastructures, the smart lighting and the building retrofitting interventions, which all have significant immediate impact combining significant technical KPI improvements coupled with solid economic viability. The business cases in terms of OPEX and CAPEX have been delivered, and it is a solid baseline to support the potential for scale-up and replication. Overall, the developed methodology to assess the potential impact and business scalability is sound and convincing and is a solid foundation to be analysed and exploited by other cities. The developed solutions have good replication potential, particularly the methodology itself, which provides guidance on the processes and barriers to be overcome for similar initiatives to take place in other cities. The qualitative and quantitative techno, socio and economic assessment provide an integrated evaluation of the interventions, which fully supports decision making for adoption and replication of the measures implemented at a policy level. The project has made a significant effort to disseminate its achievements. Dissemination has been focused on stakeholders in the Lighthouse Cities and follower cities, as well as other smart cities projects. The project disseminated the results through a number of channels and tools, including conferences, workshops, pitches, participation in activities organized jointly with other H2020 SSC projects. The scientific publications have been as well delivered in this final period and are in line with the expectations listed in the DoA.
3. General comments
GrowSmarter project includes 3 Lighthouse Cities (Barcelona, Cologne and Stockholm) and 5 follower cities (Cork, Graz, Porto Valetta and Suceava). GrowSmarter has demonstrated 12 smart, integrated solutions as a way of preparing for a wider market rollout. All the smart solutions fit into the Lighthouse Cities’ strategic development plans and the Follower Cities’ replication plans. The progress of the project was largely in line with the expectations for this last reporting period. The Consortium has prepared Amendment 8 (AMD-646456-120) to the Grant Agreement in this last reporting period, signed on October 2019, two months before the project end, including some recommendations from the previous reporting period, and some minor changes needed to embed the evolution of the project deployment in the DoA. During this period, the project achieved all objectives according to the Description of Action. The project managed to complete the implementation of the planned smart solutions: The respective 3 milestones "All Smart solutions implemented" in WP2, WP3 and WP4, although reported during the 3rd reporting period, were fully reached during the first months of this 4th reporting period (February 2019). The completion of deployment of all smart solutions in February 2019 (some of them were deployed much earlier in 2018) has ensured that all these solutions were monitored for a representative period, as data gathering started in early 2018 and has ended in December 2019. Data collected was therefore sufficient to provide sound technical performance data to sustain business development scenarios and plans. The individual monitoring periods for the action related to buildings were not all equal in duration, but overall, a full seasonal assessment of the measured impact for the variety and typology of building and system was considered, and is consistent and valid. Overall, it can be considered that the project has reached a minimum meaningful monitoring period, and it is in line with the respective call topic under which this project was selected for funding in 2014. With regards to building renovation, the delays identified in the previous period (3-4 months) have been successfully absorbed, and the district heating interventions and RES have been completed. The results delivered are promising for their potential for short-term scale-up of the measures that will not need to receive public subsidies, mainly in northern Europe, where climatic conditions are in favour of recovering the investments in interesting business models. As an

example, the waste transformation to energy in Stockholm, and the virtual power plant in Cologne have confirmed in this period the forecasted performance. Moreover, in relation to the sustainability and further replication, the impact of the renovations has been compiled in individual factsheets that demonstrate significant energy savings and CO2 emissions, which opens the door for replication in other cities, starting from the follower cities, which have developed their own sustainability plans. The social side of complex and tedious processes for the citizens has also been well managed and results are an example for other similar actions to be undertaken. All renovation phases, from project planning, permitting, interventions and commissioning have involved citizens, and they have provided support and feedback. This was partially due to a well-deployed awareness campaign, which has the citizens as main beneficiaries of the newly renovated buildings with the technologies at their service.
The ICT solutions have been fully deployed in all 3 Lighthouse Cities and each city has deployed its own open ICT platform that provides market uptake possibilities for the deployed solutions. Moreover, during this fourth period, the project has developed specific measures that deliver specific KPIs to support the elaboration of specific policies by the public authorities. For example, it provided approaches to deal with sensitive and open data for the development of advanced digital services in the cities, like in Stockholm.
The mobility activities have been completed according to the original plan during this fourth period, with success. The impact of the implementation of the mobility measures is very promising in terms of greenhouse gas emissions and energy savings, not only in the lighthouse cities but also in the follower cities, which have embedded the lessons learned. However, the public support in terms of investments is still needed, as technology is yet in a market penetration early stage. This has a particular importance in follower cities or small cities in general, as these may have lower economic and social capacity to embed the infrastructures required for charging and sharing e-vehicles.
The involvement and commitment of the follower cities has significantly improved in this last period, becoming concrete, comprehensive and delivering beyond initial expectations. The strategy and preparatory work developed in the third period has been fully deployed. As a main outcome, all of 12 groups of provided solutions have been followed by at least one Follower City, and 11 of them have been planned for actual replication. A full set of conclusions for replication has been delivered, covering climate impact assessment, collaboration with industry partners, business models and policy recommendations.
The use of resources for was in accordance with the Description of Action and corresponds to the work carried out, except some deviations, which are discussed in part 5.1. Some partners declared unforeseen or higher than foreseen subcontracting and other direct costs, which are well justified and were needed for the project's implementation. During the assessment of the report, the consortium provided additional explanations concerning changes in the average rates for personnel costs and deviations from linear consumption of the budget, which are acceptable overall. Several partners confirmed that they have to cover with own resources some over-expenditure for project fruitful completion.

4. Recommendations concerning the period covered by the report

It is recommended to approve the report, as the quality of results achieved is good.
It is recommended to accept the resources and expenses claimed by the project, except the ones listed in the Resources section. They are overall in line with the work carried out and with the work plan.

5. Recommendations concerning future work, if applicable

Not applicable, as this is last reporting period.

2. Objectives and workplan

1. Is the progress reported in line with objectives and work plan as specified in the DoA? If there are significant deviations, please comment.	Yes

The progress reported is overall in line with the objectives and work plan set out in the Description of Action.
During this last period of 12 months, the project achieved all objectives according to the Description of Action. The Consortium has managed to implement all planned smart solutions, recovering from some delays in the building renovations and the energy infrastructure reported in the third period.
All 10 deliverables have been submitted, and are accepted. Most of them were delivered on time or with minor delays of between 1 and 3 months, which are justified and acceptable. Two deliverables suffered modifications and these were delivered with 5 and 8 months delay, but in very good quality, so these delays are also acceptable. Nine of the deliverables needed improvements in consecutive submissions requested either by the Consortium, or by the INEA PO to improve quality and content, and therefore their quality is very good and they are all accepted. The final version of all deliverables has a very good quality. They are comprehensive and with substantiated content, which helps to understand the innovation and impact achieved by the project in its last 12 months of execution.
The consortium demonstrates a solid awareness of the links and interdependencies between the work packages. In this final period, access to data and data analysis collaborative processes regarding economic validation and analysis has improved significantly, and the respective KPIs for project impact assessment and market uptake of the 12 solutions deployed have been provided.

Work Package 1 "Project management". WP1 was implemented in line with what is to be expected from the DoA. The Work package has effectively coordinated the implementation of the 12 smart city solutions the project has delivered in the 4 domains considered. During the project duration, a total number of 8 amendments have been implemented, adapting the project evolution to the reality of the cities, with a high administrative and communication effort, well-coordinated and which shows fluent and productive communication among all beneficiaries. IPR and open data aspects have been successfully dealt through implementation of the data management plan‘ KPIs and business models were provided, respecting the GDPR regulations in a complex and large number of interventions across the 3 Lighthouse Cities. Overall coordination has been successful, proactive and effective.

Work Package 2 "Low energy districts". The progress was overall in line with latest Description of Action. About the retrofitting activities (measure 1.1.) in total around 120.000 m2 have been renovated. Main outcomes per Lighthouse City are:
In Stockholm, all building were successfully delivered and tenants moved in according to the plan stated in the DoA. This last period of one-year duration has been devoted to monitoring works and system optimisation for comfort and savings.
• Valla Torg (six residential buildings, 29,757 m2): All defined energy efficiency measures were installed according to plan. Three of the buildings had a full two-year evaluation of energy use. The rest of the buildings had a shorter evaluation time, but as they are identical to the first three, the shorter evaluation time did not affect the validity and reliability of evaluation. The refurbishment of the last building was finalized in January 2019, but all energy efficiency measures were implemented by the end of 2018, which ensures more than one full year of monitoring. Overall annual 64% reduction of the purchased final energy by the group of 6 buildings in the residential neighbourhood of Valla Torg. This translates to a reduction of 70% of the carbon dioxide emitted by this group of buildings.
• Slakthus Area (two historic buildings, 4,105 m2) The refurbishments of Slakthuset and Kylhuset buildings were finalized in period 2017, and the Slakthuset building had a two-year evaluation that started in 2018. The Kylhuset building had the energy efficiency measures implemented in January 2018, but the renewable energy sources (PVs cells) were installed during the summer of 2018 and the waste heat recovery in December 2018. Evaluation began in the beginning of 2018 providing almost two full years of data. Energy reduction levels account for 66 and 30% respectively.
• Brf Årstakrönet (private condominium, 4,950m2): As private newer building, it was renovated quicker, August 2017, but the energy savings were lower due to the nature of the envelope, which is in better conditions. Therefore, the last period was dedicated to monitor and improve building performance, achieving a 14% energy cost reduction.
In Cologne, the large retrofitting project implemented in Stegerwaldsiedlung (16 buildings, 33,529m2), and executed in three phases, ended at the end of period 3, with the monitoring starting in period 2. Therefore, in period 4 the final tenants have moved in and data has been gathered for energy and tenants’ behaviour. Final energy purchase price has been reduced by 37%, meaning a 57% of CO2 emission savings.
In Barcelona, the final period has served as a year of monitoring, data gathering and building performance improvement, for the 10 buildings renovated. In the milder climate of Barcelona, a total reduction of 30% of the annually purchased final energy has been obtained as the overall figure when adding up the impact in the 5 retrofitting projects that included extensive building thermal envelope upgrade (both residential and commercial buildings). The associated overall CO2 emission savings for this group of buildings in Barcelona has been close to 28% on an annual basis. Building are; Ca l‘Alier (Tertiary building by Municipality, 2,400 m², renovations ended in April 2018); Library Les Corts (Tertiary

building by Municipality transformed from industrial to library, 4,105 m², renovation ended in December 2017, last period devoted to data analysis with a reduction of 26% in energy purchased); Residential buildings by Municipality, Big Blue (14,165 m²), renovation ended in December 2017, with a last period providing final data analysis related to 20% energy consumption reduction; Naturgy Tertiary Buildings (Hotel, Sports Centre and Education Centre, total around 10,500m2), with a total 32% energy savings. Works ended in the third period, so the monitoring period is larger than the required 12 months; Residential buildings by Naturgy (4 residential building, total around 19,000m2). During the third period, all buildings were commissioned and monitoring started. The fourth period served as monitoring period, with an average 22% energy savings in the buildings.
As for Measure 2.1 Integrated multi-modal transport for construction materials/logistics centre in Årsta (Stockholm), the final period has served to gather final data from the digital contained, which shows CO2 savings of 45% after the implementation of the action. About Measure 3.1 Active house (Stockholm), Smart home system (Cologne) and Home Energy Management Systems (Barcelona), these 3 ICT tools to improve tenant's energy behaviour has been successfully implemented in a representative number of dwellings of the Lighthouse Cities. The main outcome is that this is a powerful tool to influence on tenants daily habits (at building level, not individualised due to GDPR compliance restrictions), and also to identify maintenance and operation problems in the heating and cooling systems at building level. Measure 4.1 Virtual Power Plant (VPP): balancing demand with supply. The final period has been an analysis and optimisation periods in both cities. In Stockholm, the system has worked properly (balancing PV and storage versus the Grid, as expected) and the monitoring, which started in autumn 2018, will continue in the future. In Cologne, the energy company Rhein Energie has run its optimisation software successfully, to balance PV, heat pumps and PV in the 16 buildings included in the trial, which started in June 2017. This will also continue beyond the project end. Measure 4.2 Smart energy and self-sufficient block (Barcelona); in continuation with works from former periods, period 4 has ended with all data gathered in the platform and a successful rollout and integration campaign in the selected buildings.

Work Package 3 "Integrated infrastructure" and Work Package 4 "Sustainable urban mobility" with a focus on integrated infrastructures and smart urban mobility have made very good progress overall in line with the Description of Action.
The City of Stockholm has developed very innovative solutions for open heat district heating with the reuse of waste heating into the district heating as well as smart waste collection strategies, turning waste into electricity and biogas for vehicles. Those two interventions have shown a great level of innovation as well as a solid business case with potential for adoption in other cities across northern Europe. The smart waste collection mechanism has a large impact in saving CO2 emitted by avoiding trucks picking up waste. The Stockholm big data service for travel guiding applications has been completed and now the city has the ability to provide the data as open data and better foundations for the establishment of sound business models for digital city use cases exploiting smart city data. The intervention has paid particular attention to data anonymization and a clear strategy (IoT platform) is in place to deal with sensitive personal data; e.g. citizen real-time location. The delays observed in the previous period for some measures like Travel demand app (Measure 10.3), Traffic Control System for Passenger Vehicles (Measure 10.4) and Electrical Cargo Bike Pool (Measure 12.2), have been recovered and proper monitoring has been performed providing sound technical performance data to sustain business development scenarios and plans.
Barcelona has successfully deployed their smart lighting solutions, as stated in the DoA. The interventions related to mobility have been fully implemented and the V2X (Measures 11.1/11.2) and Smart Taxi (Measure 12.6). Another important outcome relates to the successful implementation of micro-distribution using e-cargo bikes terminals in Barcelona. All measures have absorbed the reported delays in the previous period, and therefore have delivered the required KPIs. In all cases, the monitoring period has been longer than 1 year. About the taxi app and the NISSAN led intervention related to V2G e-CAR, it has proven to be a challenge for the smart grid, which needs still to be further elaborated before market uptake. In this regards, the project has identified regulation barriers that need to be overcome with innovative business models and suitable energy tariffs. The multi-functional towers implemented in the city exhibit a nice property of rationalising public spaces and provide neutral hubs for supporting the operation of smart city services.
In terms of integrated infrastructure, Cologne has successfully implemented very innovative solutions, such as the virtual power plant that it is delivering high innovation with impact both in the region and nationally. The mobility interventions have also been implemented successfully and providing good results (60% CO2 reduction).
Concerning mobility, both Barcelona and Stockholm have achieved significant CO2 reductions from measures such as electric and conventional car- and bike-sharing services, with CO2 reductions between 73% and 99%. Other key results related to the mobility interventions are the demonstration of consolidation services and alternative fuels in heavy vehicles saving time (54% time reduction in traffic) and reducing CO2 by 45%, and the 21.7% reduction in noise through use of cargo bikes for distribution in Barcelona. In addition, 110 tonnes of CO2 are saved through use of e-vehicle charging points and validation of potential of V2X charging.
In relation with innovative smart lighting (lighting posts and traffic posts), the three cities have implemented the planned measures according to the DoA, and results set the ground for the development of the EU smart lamppost initiative, as the energy savings have proven to be 20-30%, with an evident replication potential across any city. Sound business models have been developed, and fully support the replication and scale up of this particular measure.

The 3 Lighthouse Cities have provided data platforms with open APIs and have conducted research on the legal and business framework to make such data available respecting GDPR and privacy EU regulations. The 3 integrated ICT platform infrastructures in the 3 digital cities incorporate open data models, which is necessary but not sufficient to ensure future interoperability of services not only across the city and between cities. Standardization of Urban Data Platforms is a key element to define business models, which shall also identify and define the relationship between businesses and public administration and citizens.

Work Package 5 "Technical & social validation" has collected in the last period, all data from the different solutions, providing significant results, in line with the DoA. In this regards, this work package has delivered a thorough technical assessment of the 12 smart city solutions, in the three areas represented in the three previous WPs.
With regards to WP2-Low energy districts, main outcomes are: An energy saving of 60% after refurbishment has been demonstrated as feasible for buildings in northern climates, total annual energy savings achieved is 5.8 GWh, representing an energy saving of about 39%. The highest reduction of energy use was in Stockholm (average energy saving of about 64%). About CO2, the highest reduction of emissions was over 57% (for Stockholm and Cologne). In relation to the social impact, mainly achieved by awareness activities and surveys, citizens involved are 7300 in Stockholm, 1100 in Cologne and 380000 (including library visitors) in Barcelona.
In the context of WP3-Integrated infrastructure, main achievements are related to the increase the quality of life of the citizens and decrease energy use by cities. These have been demonstrated in several measures, including the implementation of Smart Lighting (over 20% of energy saving), the energy recovery from data centres and supermarkets (over 65% of CO2 reduction) and the Smart Waste Collection, which reduces local traffic (90%), waste (66%) and CO2 emission (71%). It is to be mentioned that the European General Data Protection Regulation (GDPR) entered into force during the Project execution, adding additional constraints to data collection.
In relation to urban mobility, man conclusion is that the direct replacement of usual private vehicle with an alternative vehicle running on (renewable) electricity would allow energy and CO2 reductions above 60%. Also, for new alternatives for travel (e.g. shared bikes) conclusion indicate that user engagement is fundamental, the demographic factor plays a major role in the success of the initiatives, and on a large scale, these measures implemented by themselves would not be enough to reach the goal of 60% reductions.

Work Package 6 “Economic validation and analysis”. The project has finalised a comprehensive development of the business model and assessment of economic and financial sustainability of the measures (at individual level within the 12 smart city solutions). Although the business cases are accompanied with some relevant KPIs (like net present value), there are others missing (e.g. pay back periods). Overall, results presented are generic and, although valid for the communication with the citizens, a more rigorous and economic/financial based approach would have provided benefit for investors to understand their preferences from the 12 smart solutions deployed. Moreover, given the vast amount of data collected, the specific business models for each specific intervention could have been presented in a consistent manner for the replication to be deployed based on purely economic indicators. Nevertheless, the methodology for impact assessment and replication/scale-up has proved sound and a significant amount of measures (particularly in integrated infrastructures and building retrofitting/energy management) show good economic viability and potential for replication and scale up.

Work Package 7 "Replication in follower cities" has finalised absorbing all pending issues from the previous reporting period. The main outcome is in the form of Deliverables D.7.3 (Five Replication Plans) and D.7.4 (Concluding Report (D7.4), where the follower cities have finally crystallised their replication plans, with good success overall. From the 12 smart solution of the Project, Follower Cities are aiming at partial or full replication as follows: Porto (4), Graz (2), Cork (4), Valetta (3) and Suceava (6), with 8 solutions in full implementation already taking place in Porto, Cork and Valetta. A comprehensive list of challenges for replication has been identified in continuations with works from previous periods, in the fields of policy, regulation, business models, climate impact assessment and collaboration models. Moreover, a list of recommendations has been delivered, with specific stakeholders approached, namely local governments, EU authorities and business and industry partners.

In Work Package 8 "Dissemination" the project has consolidated final and beyond the DoA dissemination campaign. Final KPIs have been identified in the following set of actions deployed in the final period, which ends a successful campaign over the whole project duration; 4 European workshops, 5 study visits to the Lighthouse Cities from a group of following 21 cities integrate the so called “City Interest Group”, a total number of 165 visits to the Lighthouse Cities by students, national delegations and public and private companies (128 in Stockholm, 25 in Barcelona and 10 in Cologne). About media channels, the KPIs reached are the following: 5000+ website unique visitors, 1400+ social media followers, 10,000+ view views and 500+ newsletters subscriptions. About press releases, Stockholm published 9, Cologne, 5 and Barcelona 3. The project has received 6 national and international awards, from which the World Smart City Award to Stockholm in the Barcelona Smart City World Congress 2019 is the most relevant. The project has also delivered a number of relevant dissemination actions form the Follower Cities.

2. Are the objectives of the project still scientifically and /or technologically relevant?	Yes
The project objectives are still scientifically and technologically relevant. All of the solutions demonstrated in the project have important potential. The project has addressed effectively their technical objectives and the achievements remain still valid. Lines for future research and innovation have also been identified by the project. The implementation and the replication of the smart solutions of the project will allow cities to achieve smart buildings and homes, very efficient energy infrastructures, well-managed and sustainable and clean transport.	
3. Are the critical implementation risks and mitigation actions described in the DoA still relevant?	Yes
Critical implementation risks and mitigation actions described in the DoA are still relevant. The risks have been monitored, addressed and mitigated successfully during the whole project implementation. The major risk identified in the previous period, ensuring that a full year monitoring data is carried out, was mitigated by a plan that has been strictly followed. This has ensured that 4 seasons are observed, with particular attention to the retrofitting interventions. The availability of data for impact and KPI assessment has also been duly addressed and all the interventions finalised in WP2, 3 and 4, as compromised in the DoA.	
4. Have the pilots/case studies started to showcase innovative results as described in the DoA?	Yes
The pilots have started to showcase the first results and indications of potential impact and innovation in line with the DoA. Once the monitoring period ended, the full impact of the solutions has been delivered in an integrated manner at a smart city level. The impact regarding solutions scale-up and sustainability has also been validated in this final period. Besides the 3 solutions preliminary validated in the previous reporting period (efficient lighting, management of the energy systems and waste heat recovery), the fourth reporting period has provided the final validation of the rest of 12 smart city solutions form the project. From these 12 measures, 8 have proven to be already economically viable, or viable with some public support (economic, legal). These are solutions 1, 2, 4, 6, 7, 8, 9 and 10. The remaining solutions (namely 3, 5, 11 and 12) are not financially viable yet, and would need further public and private development to become ready for the market.	
5. Have the ethics deliverables due for the current period been adequately addressed and approved?	Not applicable
The ethics deliverables were already submitted and approved during the first period of the project.	
6. Have the comments and recommendations from previous project reviews been taken into account?	Partially
The consortium has taken on board most of the recommendations of the previous period. However, gender balance has not been reached either in this fourth and final period (34% female workers versus 66% males). With regards to the monitoring periods, from the 80 measures included, all but 12 have reported more than 1 full year of monitoring. This is justified and acceptable in all these cases. For the building cases, where seasonal coverage is more relevant, the measures are the following: • Stockholm. Measure 1.1 Valla Torg, two out of the six buildings, Building 5E and 3B, were monitored for less than a year, although they both have two exact “twins” in the same area covered and renovated within GROWSMARTER, so data gathered has been sufficient to provide a reliable and homogeneous set of outcomes. • Barcelona. Measure 4.2, Smart Energy and SelfSufficient Block, Naturgy BCTA (Generation) Component. Only one measure implemented by Naturgy had less than one year of monitoring for a component of the building (generation). This building had: consumption data for more than two years, one year data on the battery operation and 10 months of PV production data. This was agreed with INEA PO at the second review meeting. • Cologne. Out the 16 buildings, 4 of them (added in the 6th Amendment) belonging to the third phase, were delivered at the end of period 3, so in the first months of period 4 they started the monitoring, not reaching the whole full year, although covering the 4 seasons (February to December 2019). As building typology and tenant profile is the same, this is considered to be acceptable. In the other measures not related to buildings, with less than a full year of monitoring, KPIs are not strictly related to seasonal behaviour, and these are more related to human behaviour, weather or other parameters, which are uncontrollable. Therefore, it is acceptable to have gathered less than a year, as explained here below: Stockholm. • Measure 10.3, Travel Demand Management. Efforts were made to gain more users in Valla Torg, the mobile app was also launched to other users for data collection and evaluation purposes. In the end it was not possible to engage users, to monitoring was not achievable.	

• Measure 10.4, Traffic Control System for Passenger Vehicles. Testing was conducted according to the plan and evaluation was completed. No need to gather one full year of data to provide consistent results.
• Measure 12.2, Electrical and Cargo Bike Pool. The electrical cargo bike pool was implemented in autumn 2018. Unfortunately, there were no users for the bikes during the winter season. The biking season in Stockholm is generally from March to October, when the bike pool was actively marketed and monitored.
Barcelona.
• Measures 11.1 Developing Charging Infrastructure and 11.2 E-mobility management system: V2X Component. These measures will only report monitoring and evaluation data for 8 months. The evaluation of the measures and its conclusions are not affected by having less than one year of monitoring data. This was accepted by the INEA PO and added as part of Amendment 6.
• Measure 12.6, Smart Taxi: App component. The monitoring period was composed then of two different stages, the first one to gather information of the taxi spots monitored before the APP was launched, and the second one to evaluate the impact of the new service for the taxi stops usage. Thus, the second phase of the monitoring was less than 12 months, although this is not so relevant in terms of outcomes reached.
Cologne:
• Measure 3.1 SmartHome & Green Air. With regards to Green Air the approval to add this measure was given in the 6th Amendment (14/5/2018), therefore, the implementation was completed in May 2019, and the monitoring to evaluate social acceptability of the measure started on 31.05.19. To evaluate social acceptance, there is no need to dedicate one full year of data gathered, so this shorter period is this acceptable.
• Measure 5.3. Smart Plugs. Monitoring started in February 2019. Hence, this measure could not provide a quantitative evaluation for full 12 months. However, 11 months of data from the Stegerwaldsiedlung together with the SmartHome data from other tenants over a longer period of time filled this gap, and provides an evaluation for a whole year. This was accepted by the INEA PO in the third period review meeting.
• Measure 12.4, Electrical and Conventional Car and Bike Sharing: Only the PEDELEC e-bikes have less than one year of monitoring data (starting in March 2019) because of various legal reasons (Technical Inspection Agency). All four seasons were covered from March to December 2019. Data is available for the regular bikes since mid-2017. Data extrapolation is therefore acceptable.
In relation with the rest of recommendations, the Consortium has implemented all then in a way or another, for instance for the recommendation to add a new deliverable to include all the exploitation results at project level, the Consortium as added instead a new chapter is some deliverables (D2.6, D3.6, D4.6, D7.4, D1.7 and D1.6) to bring in this information. Moreover, the implementation of recommendations for establishing baselines and improving the final set of results has been followed, which has allowed the project to complete the intervention and KPI monitoring to the requirements of the programme. Professional and visually appealing reporting of results, combined with the quantitative analysis of impact should be very valuable for the community to design on next steps to see some of the not yet fully mature measures to be adopted by cities across Europe. Scientific publications have been delivered in this final period as recommended, as well as solidly reported economic data, which substantiate the business models (e.g. Internal Rate of Return). All the suggestions and recommendations for Amendment 8 were also take into consideration and embedded in the final version of the DoA.

3. Impact

1. Does the work carried out contribute to the expected impacts detailed in the DoA?	Yes
The project has carried out work in accordance with the DoA and contributes to the expected impacts detailed in the DoA. The monitoring data collected has proven that the expected impacts detailed in the DoA have been achieved. The project has implemented a convincing plan to validate all results with the vast amount of data gathered, and, where not feasible (as said above), they have scientifically addressed a consistent strategy to report clear and solidly based results. Overall, the Consortium has validated all the expected impacts.	
2. Does the work carried out follow the plan detailed in the DoA to enhance innovation capacity, create new markets opportunities, strengthen competitiveness and growth of companies, address issues related to climate change or the environment, address industrial and/or societal needs at regional level or bring other important benefits for society? Give information on the relevant innovation activities carried out (prototypes, testing activities, standards, clinical trials) and/or new product, service, reference materials, process or method (to be) launched to the market, if any.	Yes
The project has successfully carried out the plan as foreseen in the DoA. The project addresses climate change and societal needs by testing a full set of measures (buildings, energy, e-mobility, ICT) in the smart cities sector. The project has so far developed relevant specific business models for the different solutions. Moreover, in this final period, the innovation assessment has been finalised, with the support of a consistent set of monitored data in the Lighthouse Cities, which provides a substantiated innovation assessment. In this regards, the project has shown a high level of innovation (represented by clear qualitative and quantitative statements) that paves the road for economic and financial market uptake of the interventions.	
3. Does the work carried out contribute towards European policy objectives and strategies and have an impact on policy making?	Yes
The project contributes to the EU smart cities policy, as well as the EU climate, energy efficiency and mobility policies. The project solutions remain of the highest political importance and this is evidenced through increased levels of citizen and authority involvement and support. KPIs provided have been shared with citizens and policy makers, and the innovation potential of some interventions go well beyond the cities where they are implemented and can contribute to the European strategies on smart lighting and mobility.	
4. Does (or will) the work carried out have an impact on SMEs?	Partially
Given the urban nature of the project, the urban concentration of Europe's population and economy, and also the predominance of SMEs in the construction sector, the project will have a significant impact on SMEs. Although the project has not implemented any specific SME-centric activities to promote the results among this type of stakeholders, it is foreseen that all activities carried out will have a continuation where SMEs will play an active role.	
5. Have the beneficiaries reached gender balance at all levels of personnel assigned to the action? If not, have the reasons been explained in the periodic report?	Partially
TThe consortium has included in the participant portal the details of the number of participants per gender and per partner, and their conclusion is that they have not reached gender balance in the team (34-66% split).	

4. Implementation

1. Has the project been efficiently and effectively managed?	Yes
Overall, the project has been efficiently and effectively managed especially taking the complexity of the project in terms of activities and participants. The project faced some delays in the Lighthouse Cities, which was absorbed in the final period, and required all efforts of the consortium to minimise impact on monitoring activities. The coordinator and the consortium have actively addressed the challenges and delays in implementation in a successful manner. During the last reporting period the Consortium has focused on ensuring that the monitoring plans, set out in line with the latest version of the Grant Agreement, were strictly followed and that the agreed monitoring periods were respected. The measures where this monitoring periods were not strictly met, were immediately reported to the INEA PO, and a solution, either to consider the real need of the full year, or to cover the gaps with similar data, as explained above in section, was agreed. With this into consideration, at the end of the Project, an integrated and full assessment of the impact of interventions at all levels has been provided, with KPIs fully quantified and substantiated in meaningful data. The coordinator has ensured that the partners that had already reached the use of planned resources for the implementation of the project in the third period have not caused additional delays. The project has exhausted all contingency reserves and in the end, managed to deliver the overarching objectives compromise din the DoA.	
2. Is the management of the project in line with the obligations of beneficiaries (including ethics and security requirements, risk and innovation management if applicable)?	Yes
The management of the project is in line with the obligation of beneficiaries. The beneficiaries have provided the contributions expected from them in the description of action, the management has been carried out in line with their obligations. Risk and innovation management was applicable and has been properly implemented.	
3. Is the contribution of each beneficiary in line with the work committed in the DoA? (applicable only to multibeneficiary projects)	Yes
Each beneficiary is contributing as planned in the DoA. There is no evidence of underperformance, lack of commitment or change of interest by any beneficiary. There is clear evidence of fruitful collaboration and interaction within the consortium and across the WPs. In this final period, access to data and data analysis collaborative processes regarding economic validation and analysis has significantly improved within the Consortium, which has ensured the timely delivery of respective KPIs for project impact assessment.	
4. Have the beneficiaries disseminated project results (foreground) in scientific publications as planned in the DoA (including the deposition of publications in open access repositories)? Do they include a reference to EU funding?	Yes
After submitting no publications during the first three reporting periods, the Consortium has delivered 14 scientific publications in the final period. All of them are open access, and all have reference to EU funding.	
5. Have the beneficiaries disseminated and communicated project activities and results by other means than scientific publications (social media, press-release, the project web site, video/film, etc) as planned in the DoA? Do they include a reference to EU funding?	Yes
The dissemination and communication activities have been efficiently implemented in line with the Description of Work. The project has made a significant effort in creating a community of cities which could benefit from the results of the project and have effectively organised open visits to demonstration sites. The project has also participated and communicated results in the context of SCC1 project network activities. The project has prepared a number of materials and webinars for the communication and dissemination of the project results and has been very open in terms of displaying the solutions performed to other cities. All material included reference to EU funding. In this final period, the project has delivered the necessary material to disseminate the innovation outcomes of the project, based on the KPIs identified after the finalisation of the monitoring activities in the three Lighthouse Cities. Overall, the consortium has managed to give a large visibility to the project outcomes, which have proven to be successful given the 6 awards received, which sets the achievement in dissemination beyond the plan established in the DoA.	
6. Has the plan for the exploitation and dissemination of the results (if required) been updated and implemented as described in the DoA, in particular as regards intellectual property rights? Is it appropriate?	Yes
Dissemination and Exploitation of results have been implemented successfully and the compromises of the DoA have been greatly achieved. All the dedicated deliverables envisaged for dissemination purposes are of good quality. During this reporting period, the project has made a thorough dissemination of the finally selected KPIS and the defined business models based on well-established approach to the key stakeholders, in a quantitative and qualitative manner. INEA	

considers that the dedicated approach to include the exploitation of the results in a new deliverable (as recommended in period 3) would have been positive, but the approach proposed by the project to add all those results in a series of new chapters in already existing deliverables is acceptable, and has good quality.	
7. Has the data management plan (DMP) (if required) been updated and implemented? Is it appropriate?	Yes
The Data Management Plan deliverable (D1.2) has been updated in this final period.	
8. Have the proposed institutional changes been appropriately promoted?	Not applicable

5. Resources

1. Were the resources used as described in the DoA and were they necessary to achieve its objectives? If there are deviations from planned budget, have they been satisfactorily explained? Have they been used in a manner consistent with the principle of sound financial management (in particular economy, efficiency and effectiveness)?	Yes

The use of resources for all partners was in accordance with the Description of Action and these resources were necessary to achieve its objectives. The use of resources corresponds to the work that was carried out so far, except the rejected costs listed below. The information presented and reported indicates that resources have been used in a manner consistent with the principles of sound financial management.

Some partners declared unforeseen or higher than foreseen other direct costs, which are well justified and were needed for the project's implementation. During the assessment of the report, the consortium provided additional explanations concerning changes in the average rates for personnel costs and deviations from linear consumption of the budget, which were acceptable. Some partners spent all or a very significant part of their budget already in the previous period, and in this final period, they have carried out all their tasks with their own resources until the project end.

During the assessment of the report, some costs were identified as ineligible for Beneficiary 2 and two Linked Third Parties to beneficiaries 2 and 30. More specifically:

Beneficiary 2 STADT KOLN: In accordance with auditor’s finding number 36 Audit (Ref. Ares(2020)5087653 - 29/09/2020), 10,018 EUR of personnel costs are rejected.

BEN 2 Third Party 1 Urban institute: Due to discrepancy between the declared cost and the costs certified by the CFS the amount of 86,817.00 EUR personnel cost are rejected.

BEN 30 Third Party 1 GAS NATURAL SERVICIOS: 4,500.00 EUR audit fees are rejected, as this Linked Third Party does not qualify for a CFS.