10-month periodic report – CitInES

PROJECT PERIODIC REPORT

Grant Agreement number: 288295

Project acronym: CITINES

Project title: Design of a decision support tool for sustainable, reliable and cost-effective energy strategies in cities and industrial complexes

Funding Scheme: Small or medium-scale collaborative project

Date of latest version of Annex I against which the assessment will be made: 2011-07-26

Periodic report: **1st** ☐ **2nd** ☒ **3rd** ☐ **4th** ☐

Period covered: **from** **01/08/2012** **to 31/05/2013**

Name, title and organisation of the scientific representative of the project's coordinator[1]: Laurent Fournie Executive project Manager, Artelys

Tel: +33 1 44 77 89 00

Fax: +33 1 42 96 22 61

E-mail: laurent.fournie@artelys.com

Project website[2] address:

www.citines.com

[1] Usually the contact person of the coordinator as specified in Art. 8.1. of the Grant Agreement .

[2] The home page of the website should contain the generic European flag and the FP7 logo which are available in electronic format at the Europa website (logo of the European flag: http://europa.eu/abc/symbols/emblem/index_en.htm logo of the 7th FP: http://ec.europa.eu/research/fp7/index_en.cfm?pg=logos). The area of activity of the project should also be mentioned.

Declaration by the scientific representative of the project coordinator

I, as scientific representative of the coordinator of this project and in line with the obligations as stated in Article II.2.3 of the Grant Agreement declare that:

- The attached periodic report represents an accurate description of the work carried out in this project for this reporting period;
- The project (tick as appropriate) [3]:

  ☐ has fully achieved its objectives and technical goals for the period;
  ☒ has achieved most of its objectives and technical goals for the period with relatively minor deviations.
  ☐ has failed to achieve critical objectives and/or is not at all on schedule.

- The public website, if applicable
  ☒ is up to date
  ☐ is not up to date

- To my best knowledge, the financial statements which are being submitted as part of this report are in line with the actual work carried out and are consistent with the report on the resources used for the project (section 3.4) and if applicable with the certificate on financial statement.
- All beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs, have declared to have verified their legal status. Any changes have been reported under section 3.2.3 (Project Management) in accordance with Article II.3.f of the Grant Agreement.

Name of scientific representative of the Coordinator: Laurent Fournié

Date: 28/09/2012

For most of the projects, the signature of this declaration could be done directly via the IT reporting tool through an adapted IT mechanism.

[3] If either of these boxes below is ticked, the report should reflect these and any remedial actions taken.

I. Publishable summary

Industrial leaders and local authorities have a key role in the implementation of local actions to meet the global energy scheme shift objectives. According to OECD, 67% of world energy is used by cities and 70% of CO2 emissions come from cities. Optimizing urban and industrial energy investments is therefore a central challenge to reduce polluting emissions, but requires to simulate the whole energy chain (end-use, distribution, transport, , storage, generation) with different energy sources and carriers (electricity, gas, heat, wind, waste, etc.) and to assess the environmental and financial impacts of various long-term scenarios (fuel prices, energy end-use scenarios, etc.). Today, local authorities have only partial answers to select the most appropriate energy solution (partial simulation of given end-use sectors, incomplete consideration of the energy chain, long-term risk assessment missing etc.) and lack a global analysis.

The goal of the CitInES project (www.citines.com) is to design and demonstrate a multi-scale multi-energy decision-making tool to help local authorities and industries to:

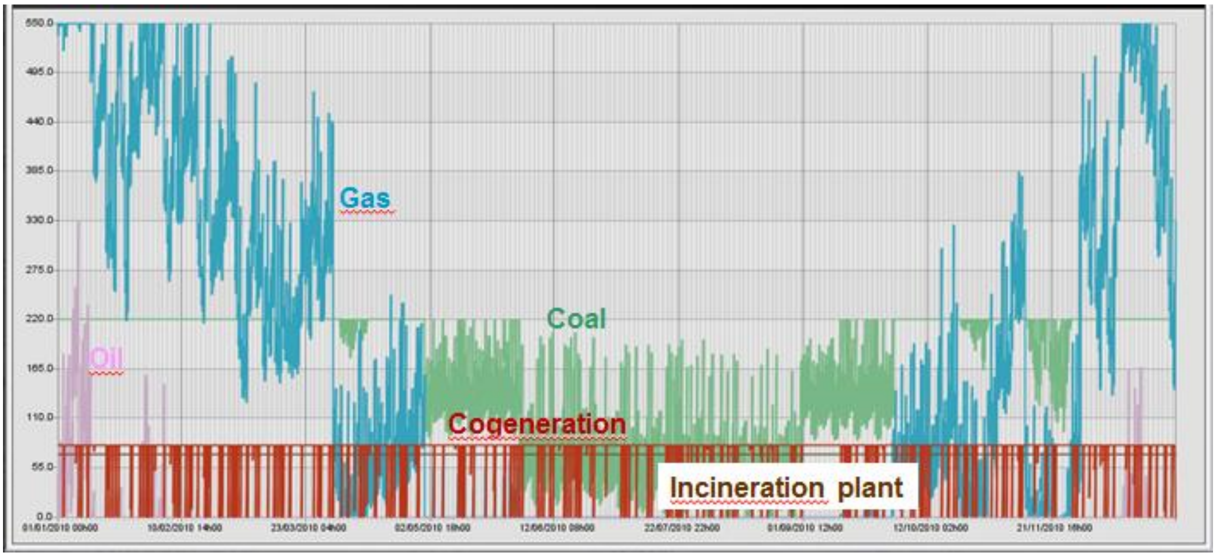
- assess and compare energy strategies through detailed energy chain simulations,
- optimize local energy strategies to cost-effectively integrate green energy and reduce CO_2 emissions,
- Define robust energy schemes to face fuel price uncertainties.

Local energy generation (Cesena use case)

The general methodology is driven from supply-demand balance methodologies and load-flow computations used by Transmission Systems Operators (TSO) and has been adapted to a more local context:

- Characterization and calibration of the energy demand by usage and type of consumer;
- Choice of macroeconomic scenarios for long-term energy demand and price evolution ;
- Definition of studied energy strategies and characterization of energy generation mix and transmission networks;
- Definition of uncertainty scenarios (temperature, wind, solar radiation, power market prices…);
- Scenario simulation and optimisation:
    - Asset dimensioning for local production;

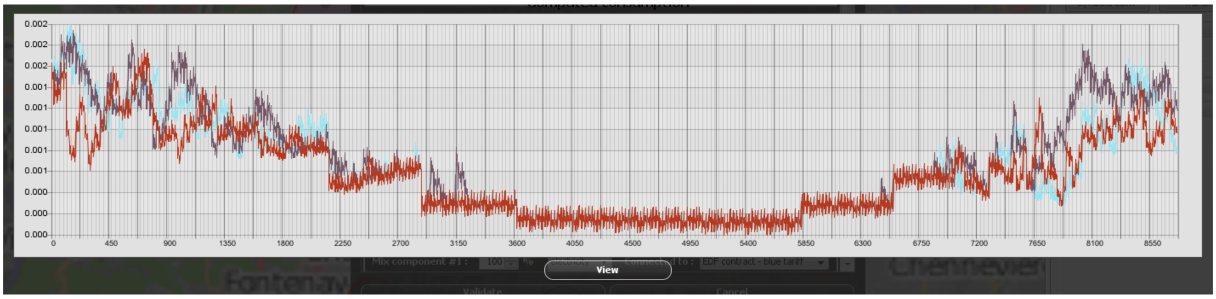
    - Simulation of the optimal management of the system (generation, contract, demand side management);
    - Assessment of network investment costs.
- Risk analysis



Example of simulation: district heating production by asset (1 hour time step)

The tool is being experimented in two Italian cities (Cesena and Bologna) and one industrial facility in Turkey (Tupras). Workshops have been organized with local representatives and decision makers to understand the end-users needs and collect data necessary for computations. Collected data include:

- Characterization of the energy demand (types of housing, density, large consumers, transportation…)
- Local consumption measures provided by the DSO
- Scenarios of demand evolution (urban development, transportation…)
- Description of local energy production facilities
- Opportunities for energy generation from renewable energy source
- Tariffs and price structure of the national energy supply
- Description of available energy action plans (Sustainable Energy Action Plans (SEAP) for European Covenant of Mayors signatories)



Load profiles for heating (existing dwellings) for 3 scenarios of outside air temperature

The main expectations for Bologna and Cesena are:

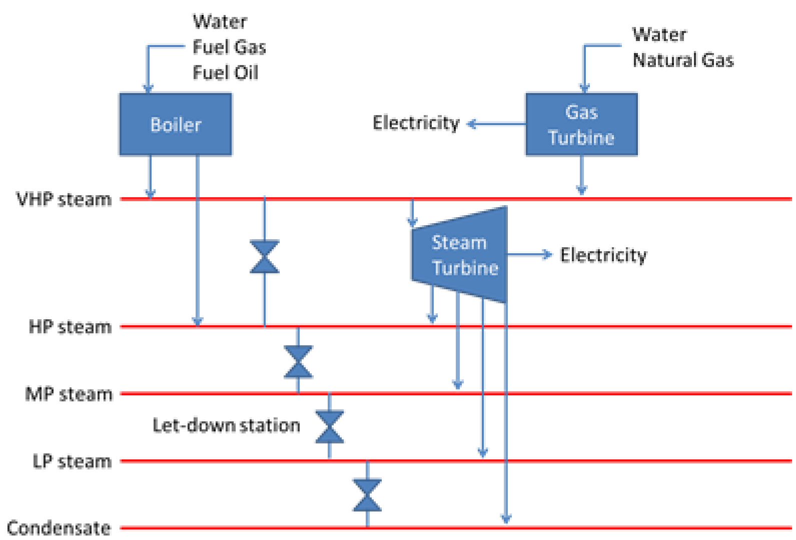
- Monitoring SEAP action progress and assessment of current situation
    - Comparison between action progress and plans
    - Impact assessment of actions in terms of reduction of energy end-use and CO_2 emission savings (bottom-up approach)

    - Track evolution of energy demand through global consumption measurements (top-down approach)
    - Input to establish the municipal energy balance
- Prospective analysis
    - Projection to 2020 according to current situation and planed actions
    - Confrontation with SEAP objectives
    - Assessment of the economic vulnerability of the different actors to fuel price uncertainties
- Decision-support analytics
    - Assessment of the potential impacts of new measures
    - Identification of cost-efficient actions
    - What-if scenarios assessment
- Reporting for stakeholders
    - Efficiency assessment of past actions
    - Comparison with similar actions in Europe
    - Detailed prospective analysis by 2020
- Communication for citizens
    - Visualisation of current situation
    - Visualisation of current actions and their impacts
    - Visualisation of projections by 2020
    - Interface to test pre-selected actions and see what would be the impacts if all citizens would make the same efforts

A detailed energy model of Cesena has been implemented. Bologna and Cesena local authorities will experiment the tool from October 2013 to monitor the performance of their SEAP in order to have a continuous analysis of the evolution in the area. The tool will also be used in the periodic reports required periodically by the competent authorities (eg Report on air quality).

A workshop has also been organized in Turkey with Tupras, an oil refinery, which is the industrial end-user of the tool. Through intensive interactions with Tupras experts, models of the refinery utility assets have been developed. Hence, the global energy management of the refinery utility has been simulated in order to study different strategies to decrease polluting emissions (CO_2, SO_x emissions) and fuel costs:

- Optimize operational policy (very high pressure/high pressure use, fuel gas/fuel oil for boilers)
- Use the recent 100MW electrical connection to exchange power to the grid and optimize local production
- Invest in new production assets (new gas turbine, wind farm, solar units…)



Refinery utility flowsheet example (the actual flowsheet is confidential)

The overall objectives of the second period were to:

- Collect additional data for city use case, including consumption data from DSO (WP1);
- Design innovative multi-scale modelling to assess opportunities linked to smart grids (WP2);
- Define a long term Sustainable Energy Strategy for each use case (WP3);
- Develop intermediate software prototypes to interact with end-users and release the first version at the end of the second period for experimentation (WP4).

Innovative energy system modelling has been designed to allow end-users to assess their energy strategy through detailed simulations of local energy generation, storage, transport, distribution and end-use, including demand-side management and coordination functionalities enabled by smart grid technologies. All energy vectors (electricity, gas, heat...), usages (heating, air conditioning, lighting, transportation...) and sectors (residential, industrial, tertiary, urban infrastructure) are considered to draw a holistic map of the city/industry energy behaviour.

Energy strategy analyses encompass advanced long-term risk analysis. As economic and technical situations are constantly evolving, a relevant energy strategy should be robust to different prospective scenarios. Hence, a diversified energy portfolio will allow local and industrial authorities to react more efficiently to fuel price stresses and to decrease their exposition to a given energy solution.

Thanks to this innovative methodology, local authorities will get a solid and quantified basis for decision making in relation to strategic energy and will be able to increase the impacts of environmental policies for a given financial budget. Strengthening local energy skill will also lead new job opportunities inside the energy department of the local authority. Finally, CitInES applications can be regarded as tools for the improvement of citizens' awareness on environment and efficiency matters.

II. Core of the report for the period: Project objectives, work progress and achievements, project management

During the first review, experts recommendations were:

- To intensify efforts to collect energy consumption data from DSO
- To detail specification document (D1.3) and maintain strong interaction with end-users to ensure functional relevancy of the software.
- To ensure coherency in the granularity and level of abstraction of data modeling

The main objectives of the second period were to

- Collect additional data for city use case, including consumption data from DSO (WP1);
- Design innovative multi-scale modelling to assess opportunities linked to smart grids (WP2);
- Define a long term Sustainable Energy Strategy for each use case (WP3);
- Develop intermediate software prototypes to interact with end-users and release the first version at the end of the second period for experimentation (WP4).
- Update the web site (WP6)

A. WP 1 Specifications, analysis of end users needs and data collection

1. Objectives

During the first period, workshops have been set up to collect data and understand end-user needs. This led to a first specification document D1.3. This document addressed the overall functionality at an extremely abstract level and was inadequate for a detailed specification document. D1.3 was only conditionally accepted.

2. Work progress and achievements during the period

Only Task 1.3 remained to be achieved. Other tasks of WP1 were validated during the first review.

Task 1.2 Data collect

The WP1 of the CitInES Project has been dedicated to the description of the end-users needs, the description of current policies and data availability and data collection. Task 1.2 and deliverable D1.2 provided insights into the energy context of the different end use cases and identified potential data sources and missing data relevant to the CitInES project. With the help of the city partners this effort was pursued during the second period. A workshop has been organized in Bologna in December 2012. It was a key milestone to discuss the possibility of involving ENEL and HERA the 2 main energy suppliers. The main discussion points were updated energy data together with the necessity to include hourly consideration and the regularity of availability of new data. The direct involvement of cities as partners proved particularly useful in this process but effective access to more data proved difficult to establish. Yet data are of central importance for the modeling works envisaged in WP3 and WP5.

During the first trimester the municipality of Bologna provided a significant amount of GIS data covering various fields. These represent a valuable primary source of data covering the whole city of Bologna and access to them that has been facilitated by the implication of the city of Bologna as consortium partner was crucial. These data have been analyzed by ARMINES to identify they suitability for CitInES modeling purpose, missing data and find alternative sources. A key issue has been the design and implementation of a method to determine detailed energy consumption database at sub-urban level for different economic sectors and for different end-uses. The final detailed energy database has been realized. The process and basic assumptions are presented in the document "D1.2 Bologna period 2 Update".

For Cesena, a huge amount of work has been achieved to cross-check and complete data to build a first entire model of Cesena. A second workshop was organized in June in Cesena with AIT and ART to present this model and get CES feedbacks. This model and the feedbacks will be presented during the review. To collect these data, several Departments of the Municipality of Cesena have been involved:

- The Department of environment and territory ("Settore Tutela dell'Ambiente e del Territorio"). This department is in charge of the environmental issues in the city.
- The Department of urban planning ("Settore Programmazione Urbanistica"), that is in charge of the urban planning activities in the city of Cesena.
- The Department of mobility and transports ("Settore Mobilità e Trasporti"), responsible for the management of urban traffic and transport planning;
- The SIT, geographic information system ("Servizio SIT – Studi e statistiche"). This department is in charge of collecting, controlling and processing data related to the municipal territory.

- The Department of statistics ("Dipartimento di statistica"), in charge of supplying statistical data describing the demographic structure, covering all major variables.
- The CED, data processing department ("Dipartimento di elaborazione dati"). This department handles the specific applications related to information processes in various sectors.

Work and support provided by Energie per la Città -third part of the Cesena Municipality in the Citines project – has been vital both for the data collection coordination and for the relationship with Hera and Enel (local DSO). This workshop was indeed the occasion to contact Hera again and collect daily data on gas consumption. Daily consumption data should also be provided soon for districting heating. For electricity, despite its high involvement, Cesena only succeeded in getting yearly electricity consumption by usage.

Task 1.3 Functional specifications of the software

Based on the reviewer feedbacks, additional work has been done to build a relevant specification document:

- Description of the different categories of end-users and typical workflow
- Complete data model
- Detailed description of the features
- Description of the user interface structure and views
- Description of the scripting API for indicator definition
- Platform architecture and hardware requirements

To establish this document, an additional workshop has been set up in Bologna (December 2012), with a strong participation of city end-user (BOL and CES), consortium partners (AIT, ART, ARMINES, INESC, SEISAS, ERVET) and invited DSO (Enel and Hera). This event was organized by AIT, ART and ERVET. The minutes of the meeting is provided with the deliverable D1.3.

<u>Results</u>: updated functional specifications of the software. The deliverable D1.3 was finalized in February 2013.

3. Deviations

There was a deviation on Task 1.3 during the first period and the deliverable was inadequate. Artelys engaged sufficient workforce to catch up and to ensure relevant functional specifications.

Additional work was also provided to collect and analyse additional data.

B. WP 2 System modelling

1. Objectives

The WP2 is mainly dedicated to system modelling.
The first period (Tasks 2.1 and 2.2) was dedicated to the implementation of micromodels of energy systems assets: energy generation, storage and distribution for heat, gas and electricity systems, as well as energy demand units for the building sector (thermal energy demand and electrical energy demand), the transport

sector, the industrial sector and the sector of urban facilities (public lighting and water treatment). The micromodels allowed for capturing technical, economic and social aspects and were the basis for the development of aggregated macromodels (in Task 2.4) which are used to simulate and optimise overall urban and industrial energy systems.
Task 2.3 aims at assessing the impact of smart grid technologies on energy systems. The evaluation encompasses both technical and economic aspects.
The final phase (Task 2.4) consists of the design and implementation of an aggregation methodology, able to emulate the dynamics of geographical areas including a large number of components and the impact of ICT.

2. Work progress and achievements during the period

Task 2.3 Impact of smart grid technologies on energy systems

The methodological approach adopted in this task comprised two parts. The first was a bibliographic review on the impact of smart grids on power systems; the second included the implementation of software routines to illustrate the benefits of the integration of the smart grid concept in power systems. These studies were carried out using the simulation platform developed on purpose for the project CitInES. The case studies comprise the impact analysis of electric vehicle integration, demand side management and energy storage, with and without smart grids.
The results regarding both parts are presented in the Deliverable D2.3.

Task 2.4 Design of the aggregation methodology for macro-models

This task was a major milestone of the project as it allowed to make detailed data/models (WP2.1) and aggregated data/models (used for WP3 and WP5) consistent. It is fully completed, thanks to the high interaction between AIT, ART and INESC.
The deliverable D2.4 includes:

- A description of detailed/aggregated models
- A general methodology to calibrate aggregated models using detailed models
- The application of this methodology for electrical networks and district heating networks
- An example of application of this multi-level approach for optimizing electrical vehicle charging policy

The software aggregation routines were integrated in the simulation tool. The performed tests support the validity of the proposed approach.

Detailed modelling of Tupras energy chain

During the first period, Tüpraş has provided historical data on boilers, steam turbines and gas turbine together with their operational, environmental and safety limits. Abnormalities on metering devices were detected and corrected.
The various assets of the plants were then modeled using linear and piecewise-linear yield models, which were calibrated based on the corrected historical data. These asset models, complemented with technical and operational constraints, have been assembled along with the energy markets to form the global model of the Izmit refinery energy systems.
During the second period, more focus was on updating operational, environmental and safety constraints by analyzing the outcomes of the optimization. The utility plant has highly complex relationships and failure in defining these relationships could result in optimum solutions that cannot be applied on the real system. For instance, supplying the utility demand of the refinery has higher priority, for safety reasons, than minimizing the cost of the utility production. In case of generator failure, remaining active assets should be able to provide reserve capacity.

Operational constraints have been also updated from design limits to real operational limits and work on emission estimation and associated constraints have been added.
With the corrected optimization model, scenarios that are mainly at operational level were studied. The scenarios were on selection of boiler fuel type (fuel gas or fuel oil), selection of VHP or HP boilers and possible cost reduction by selling or buying electricity from the grid. Modeling, optimization and results analysis work was achieved by ART. Tüpraş has analyzed and gave feedback on the optimum production schedules to further improve constraints for acceptable results.

3. Contributions to the state of the art and impacts of the project

Task 2.3 - Impact of smart grid technologies on energy systems – represents an important advancement in the state of the art, as it will lead to assess the impact of ICT on generic multi-energy systems including a large number of components.

Task 2.4 – The multi-scale aggregation methodology is also a significant step beyond the state of the art in complex systems modelling, as it allows accurate representation of large scale systems taking into account very local phenomena like network constraints or end-user flexibility. This work has led to the publication of two papers: "A multi-scale optimization model to assess the benefits of a smart charging policy for electrical vehicles" in IEEE Grenoble PowerTech 2013 and "a multi-energy modelling, simulation and optimization environment for urban energy infrastructure planning" for the IBPSA International Conference "Building Simulation 2013".

Tupras use case. First results show that more than 10% of cost and CO2 emission can be saved without major investments, using simple operational rules (these figures have still to be confirmed thanks to the implementation of these rules in Tupras utility). The use a very detailed modeling of the system and its dynamics proved to be critical in order to get pertinent solution strategies. The intermediate models developed led to solutions that could not be understood by Tüpraş experts and were found irrelevant due to lack of modeling details. The global approach is directly replicable to other large industries with local energy generation.

4. Deviations from the initial plans / Failures to achieve critical objectives

Although slightly delayed, the work is being developed according to the initial plan in terms of objectives, methodology and expected outcomes.

The slight delays (end of WP2 in June instead of March) can be explained by the following points:

1. The beginning inertia of large projects, triggered by the difficulty of contracting new valuable collaborators and the adaption to the modus operandi of the other partners;
2. Another reason for the delay is related to the effort appraised for some tasks, which was clearly underestimated. For instance, the modelling phase: a large number of system components, for three energy systems (electricity, gas and heat), to be characterized under various perspectives (technical, reliability, economic and environment impact) with lots of interactions among system elements to be considered, under different perspectives (micro and macro-models), etc.
3. The difficulty in getting data on energy systems infrastructures. In fact, local distribution companies show a quite conservative position about sharing their data. Thus, additional unplanned efforts were devoted to obtain information about these systems and to manage the data from different sources in order to build a coherent system model.

These delays are not considered as an issue to the success of the global project.

For industry energy strategy optimization, the multi-scale methodology was less relevant. Consequently, a part of ART WP2 effort was dedicated to model operational, environmental and safety constraints with sufficient details so that recommended energy management policy can be applied operationally.

C. WP3 Long-term energy analysis

1. Objectives

The objective of WP3 as specified in the DOW is to define a set of advanced energy strategies for each end-use case and for the long term. The advanced energy strategies are intended to increase the global coherence between the 3 to 5 year action plans and the long term synthetic visions. Covering the whole local energy system those strategies are intended to be explicitly derived over multiple periods, for several energy flows and for differentiated urban zones.

The targeted outputs for WP3 are:

- Analytical formulation of a reference Local Energy Systems architecture
- Quantitative assessment of short term and long term sources of uncertainty
- Definition of advanced Sustainable Energy Strategy for each end-use case

The objectives for this work package during the second phase of the CitInES project were the definition of long term energy scenarios to extend the policy objectives and energy choice assessment up to 2050 and to quantify the systems changes.

2. Work progress and achievements during the period

The second period was a delicate period for WP3. Approximately ¼ of the effort initially planned for the second period was effectively allocated to WP3. As a result WP3 experienced important delays on the deliverable planned for the second period.

Task 3.2 Models and methodology for uncertainty assessment

The goal of this task was to build realistic and fine mathematical representation of uncertainty, to enable local authorities to assess and optimize energy strategy facing this uncertainty. As climatic uncertainty modeling (temperature, wind speed, solar power) is already well known, a focus was given on the load curve modelling.

ART developed and implemented a method to:

- Build local hourly load curves using data temporally aggregated (typically yearly data) and national load curves;
- Decompose the load curve by usage : heating, cooling and non-thermo sensitive usage;
- Generate new consumption scenarios representing the evolution of the users

According to the granularity of the available data, different approaches are described in the intermediate deliverable D3.2. These approaches have been tested on Italian and French data.

As daily consumption data have been recently provided by Hera (Cesena DSO), additional work remains to refine load curves according to this data. This issue will be addressed before end of September.

Task 3.3 Advanced Sustainable Energy Strategy

The main objective for this task during the second phase of the CitInES project was the definition of long term energy scenarios that extend the policy objectives and energy choice assessment up to 2050. This assessment is based on a long term energy system optimisation model. As model calibration relies on data availability, the modelling work in this task has experienced important delays and it will only be fully completed in the next period. Three main modelling building blocks have been designed:

- Data model: the data model directly builds on the detailed sub-urban database to define calibration tables for each sector described in the long term model. The principle is to aggregate compiled data in a suitable form.
- Future ESD models: the ESD model specifies long term projections of energy service demands. This is a step after final energy use as it considers the useful service to be satisfied. Five key dimensions have been identified and preliminary projections of alternative parametric values for Bologna have been made. A first version of the mobility module has been developed but needs further improvement. In the next phase selection within the consortium should reduce the combination of option to a limited set of 3 scenarios storyline to be run through the model. The preliminary work started with the Bologna end-use case and the Cesena case will also be assessed.

Optimisation model: The finally selected geographical scope for Bologna includes 9 geographical zones corresponding to the administrative districts. The Space heating energy consumption and technologies have been calibrated. The full model is still only partially calibrated.

3. Contributions to the state of the art and impacts of the project

Task 3.2 – Models and methodology for uncertainty assessment. The specificity of the problem is the fine granularity of the results expected (load curves scenarios by usage and type of user at an hourly granularity) compared to the available data (it is not possible to lead a measurement campaign for each study on the concerned perimeter and aggregated consumption data are often difficult to get from DSO). The contribution of this task is to by-pass this problem by proposing new approaches to use complementary data sources with different aggregation levels (time, space, usage) to get a fine and robust modelling of the energy demand at a local scale.

Task 3.3 – The three basic building blocks have been designed and their integration in a single long term analysis work is still to be done. However despite partial completion, the data model work and in particular the usage of the TABULA methodology which is among the most referred to in terms of thermal characteristics of existing building stocks today in association with TIMES type models is to our knowledge novel. The different steps of the long term methodology have been presented at the 26th European Conference on Operational Research in July 2013.

4. Deviations from the initial plans / Failures to achieve critical objectives

For Task 3.2, given that daily consumption data have been recently provided by Hera, additional work is foreseen to refine the load curve generation methodology.

For Task 3.3: Important delays occurred in period 2 due to the work required to find a viable solution to suburban data questions. The effort has been increased during the months of June and July and there is still further work to be done to complete the calibration for Bologna, as well as initiate and complete the analysis for Cesena. Based on the advances in data gathering process for Cesena this process will be facilitated. Synergies in the two modeling exercises in WP3 and WP5 will have to be used to ensure completion in next phase. Seven person months that haven't been allocated are still to be dedicated to this task and given the current data status a completion by end 2013 is achievable.

D. WP4: Software developments

1. Objectives

This WP is dedicated to the development of the decision support tool.

Task 4.1 aims at designing optimization algorithms. The quantitative evaluation of an energy strategy requires optimizing simultaneously asset dimensioning, operating and fuel costs. This implies to solve a high-dimension optimization problem in reasonable computation time.

Tasks 4.2, 4.3 and 4.4 aim at developing a first release of the decision support tool, including energy asset and uncertainty model library and specific HMI for cities and industries.

2. Work progress and achievements during the period

Task 4.1 Algorithm for the optimisation for the global energy system

Costs for new energy projects include both infrastructure investment costs and energy bill (fuel cost, energy purchase). That is why designing efficient energy strategy requires optimizing simultaneously technology selection, asset dimensioning and operating/fuel costs. This problem is a specific case of a more generic framework: investment optimization in energy systems. This task was dedicated to the computational intelligence part of it, namely the numerical solving of corresponding Markov Decision Processes.

Deliverable 4.1 proposes a large range of techniques for energy producers to optimize and manage their energy asset portfolio. These techniques are also very relevant for public authorities to design national energy strategies. For local authorities, energy projects are more on the fringe of national policies. The question is more “is this project relevant given local (public acceptance, project costs given local renewable potential, local job implications) and national constraints (regulations, feed-in tariffs. . .) ?”. And main uncertainties come from the durability of national policies themselves. Hence, the main stake for local authorities is to be able to assess the financial and environmental impacts of studied energy strategy, rather than optimizing them. This simulation capacity has been studied in details in WP2 and has been implemented in WP4.2. Nonetheless, Direct Value Search (Section 1.10) is a stable and principled approach compliant with such constraints. Additionally, our bandit contributions are directly applicable to comparisons of fixed policies by Monte-Carlo methods; we refer to Section 8 for more on this, or to our detailed work http://www.lri.fr/~teytaud/metagamingjournal.pdf.

Tasks 4.2-4.4 Decision support tool for cities

The goal of these tasks is to implement a first prototype of the decision support tool for cities based on WP1 specifications and models developed in WP2.

Released software present the following main functionalities:
- geographical display of the local energy park (consumers, local generation, networks, administrative districts…): exact location for large generation assets/consumers, spatial repartition for small ones
- detailed representation (hourly time series on a typical year) of the load curves by usage and type of energy
- detailed representation of generation asset technical and operational constraints
- simulation capability to assess the financial and environmental impacts of a given energy strategy
- large database of energy generation assets, consumption profiles and energy supply contracts
- capability to represent detailed network, communicate with external simulators (heat, gas and electricity network simulation tools developed in WP2.1) and build aggregated models (according to WP2.4 methodology)

- capability to build new scenarios easily and project the city energy context at 2020
- capability to handle energy prices scenarios and make risk analysis
- capability to define detailed indicators, compare these indicators for different scenarios and display them on the map or on intuitive graphs
- easy imports/exports of data
- pre-checks functionalities to ease the validation of input data
- web publishing of main indicators for disseminating the results

These functionalities will be presented during the project review.

The main challenge for the software development was that

- the software could be highly configurable so that it can be applied to other use case: all indicators, views, data models can be tuned by advanced users (AIT and Mines for the experimentation phase, local authorities technical services after Citines)
- the HMI would be intuitive enough so that standard users can easily use the software

Tasks 4.2-4.4 Decision support tool for industries

For the specific needs of the Tüpraş study, several functionalities have been implemented in Crystal software platform. Since this study involves the definition of smart management strategies, it is necessary to compare such new strategies with the current/historical management policies.
For that purpose, the software allows users to replay the historical production data in order to generated reconciled history that satisfies all material balances and asset yields models.
Additionally, the tool allows users to define smart strategies as scripts that represent the operator's decision sequence, and then simulate/optimize such ad-hoc strategies to be compared with the historical and/or optimized strategy. This functionality is particularly useful in order to iteratively refine the strategy developed by Artelys consultants to improve Izmit's refinery energy efficiency.
Finally, the interpretation of the results over a year horizon requires very flexible view capabilities.
To that end, the CitInES tool integrates a highly configurable view of asset-related time series as well as user-defined views: various mode of organization of charts are possible based on assets/energies/productions/consumptions/test cases/etc. with unified coloring among graphs.

3. Contributions to the state of the art and impacts

It is still too soon to assess the impacts of the decision support software. This is the goal of WP5 experimentation phase which is just starting.

4. Deviations from the initial plans

There were no deviations from the initial plans outside of slights delays for WP4.1 which did not affect the project. All efforts (mainly from ART, AIT and Mines) to parameter the new software release and integrate city data have been posted in WP5.

E. WP5 : Experimentation and impact study

Work Package 5 aims at experimenting Citines software for the different use cases. It was planned to start in June. However, it was important to build a first model of Cesena and Bologna to start soon the interaction with the cities authorities and present first results for the second project review.

Consequently, some efforts have been already made during the second period to parameter the software and integrate data from cities.

This work package will continue until the end of the project.

F. WP6 : Dissemination and exploitation of project results

1. Work progress and achievements during the period

Task 6.1 Project website

The website www.citines.com was delivered at the end of January, 2012 and was designed by ARTELYS. It is an open area for the general public (internet) and a private area specifically dedicated to the consortium (intranet) and the Commission.
The structure of the site consists in the following tabs:

- Home
- Project Overview: Objectives, Benefits, Work program
- Consortium
- Experimentation & Results
- News and events
- Private area

A hosting plan has been purchased for 5 years, ensuring the sustainability of the platform after the project life.
The website is updated, following project events.

Task 6.2 Dissemination towards potential end-users

The following dissemination actions have already been implemented (from the beginning of the project up to June 2013):

- Presentation of the project during the INRIA – industries meeting with the presence of the French Minister for Higher Education and Research (8th March 2012, Grenoble): INRIA, ARTELYS
- Presentation of the project at an energy management forum in Taiwan (16th – 19th May 2012, Tainan): INRIA and ARTELYS
- Presentation of the project during the conference "Smart cities and prospective: a contribution at Rio+20" (4th June 2012, Paris): ARMINES, SCHNEIDER
- Workshop with the five other FP7 project coordinators to share experience (14th June 2012, Rotterdam): ARTELYS
- Presentation of the project at the international congress "Smart Grid Paris" (20th-22nd June 2012, Paris): ARTELYS, TUPRAS, SCHNEIDER
- Presentation of the project at the Paris Climate Agency prospective salon (18th September 2012, Paris): ARTELYS
- Networking with Cesena and Bologna network operators (Enel and Hera): CESENA, BOLOGNA and AIT
- Promotion of the project within the Joint Programme on Smart Cities of the European Energy Research Alliance : AIT
- Promotion of the project within the European Smart City Stakeholder Platform: AIT
- Presentation of the project within the Paris Climate Agency prospective salon (Sept 2012): ARTELYS
- Set-up of an energy management forum in Tainan, China (Sept 2012): INRIA, ARTELYS
- Presentation of CitInES project within the Smart City Exhibition in Bologna (Oct 12): AIT, BOLOGNA

- Participation in the California France Forum on Energy Efficiency Technologies 2012: "Smart City: What Is the Added Value?", at CITRIS, Berkeley, California, USA (oct 2012): ARTELYS
- Workshop in Bologna with Citines partners and local DSO (Dec 2012)
- Participation in "Les Assises de l'énergie", the French main salon for local authorities in the field of energy, in Grenoble, France (Jan 2013)
- Networking in Cesena and Bologna in order to involve network operators , 2012-2013
- Participation in the 15th international congress "Low carbon, High growth – Business models for a changing climate (June 2013): SEISAS
- Promotion of CitInES in Innovative City, in Nice, France, (June 2013): INRIA, ARTELYS
- Presentation of CitInES work at The biennial international conference IEEE/Powertech 2013, entitled "Toward carbon free society through smarter grids" has been held in Grenoble : ARTELYS
- Workshop in Cesena, for prototyping of the tool, (June 2013)

A detailed list of dissemination actions is provided in D6.3.

Task 6.3 Exploitation plan

A second of the Exploitation Plan version has been delivered in July 15th, 2013.

2. Results

The results of the second period are the web site (D6.1) and the second version of the Exploitation Plan (D6.3)

3. Deviations from the initial plans

There was no deviation from the initial plans for this Work Package.

III. Project management during the period

The main objectives of the Management activities for this period were the following:

Administrative objectives:

- Collect all data from the partners
- Explanation of the administrative tasks and how to do it
- Evaluate the fit between the forecasted budget and the actual expenses
- Link with the EU
- Organization of meetings
- Set-up schedules

Financial objectives:

- Management of financial issues
- Ensure the correct collection of figures
- Ensure the right calculation of expenses
- Improvement of timesheets, expenses charts, …
- Money transfers
- Validation of the Forms C
- Getting explanations regarding Financial Officer remarks on last reporting
- Looking for an auditor as Artelys' demand on its expenses was over the threshold of 375 00 euros

Results and achievement

Administrative tasks

This report was easier as we all had the experience from the 1st periodic report.
Some tasks are always the same: checking all partners' documents and clarifying when necessary, changes in ECAS, when necessary, keeping good relationships with everyone, taking into account the diversity…
Elaborating reports was easier this time, even though we had to make adjustments on previous Forms C.
We took great consideration in explaining the costs that have been refused last time.
Artelys has to find an auditor to produce the Form D, as we asked for a subvention above 375 000 euros

Organization of meetings

1 meeting was organized that involved all the Consortium:

- the Project and Review meeting in Cesena. July 18 and 19, 2013

In order to have the meeting for the review on time, our Project officer kindly asked if this could be done in the same time as our Project meeting, in Cesena, forecasted in July. It was quite hard, as some figures were hard to get for the time, but we managed to have all meetings set up, thanks to professional goodwill of everyone.

We also organized technical meetings so that the tasks could be done. We set up several skype conferences among technical partners, as usual.

Moreover, the consortium participated in several dissemination events and workshops, in order to promote the project.

Problems

All the consortium is 100% involved in this project, and we want to make things the best way possible. We have taken into consideration all the recommendations given by the technical reviewers during our last review. Things were not going as fast as we'd have liked them to go. Some deliverables were given late.

FINANCIAL TASKS

Collection of financial data:
After the 1st report, we improved the financial tables.
Data were collected in March 2013 (as a mid-term report) and in June 2013.
Artelys' task was to check whether every partner from the Consortium were on the right scope or if there were big gaps to be explained in the budget.
The partners were asked to send their sheets and expense proofs by scan, but most of them didn't do it, as it is in their own organization, and quite difficult to get.

Remarks and adjustments:
Some partners needed to answer remarks done by the Financial Officer in last Periodic report.

- TUPRAS
- ARTELYS
- SEISAS

Most of the partners have exceeded their M/M budget, in WP1. The reason is the under-estimation of the work on the collection data.
The number of M/M in WP2 is also higher for one partner.
All partners have complained about the big management tasks for such a project. They have underestimated their budget.
Despite all these remarks, the financial budget is kept under control.

Some adjustment Forms C for Period 1 have been put simultaneously with Forms C for this Period, mostly because of a better accuracy in personnel cost caluclations.

- AIT
- INESC
- ARTELYS

Artelys needed to hire an auditor in order to produce a Form D, as we were asking for more than 375 000 euros. All their remarks have been taken into account, and they declared all financial issues were well-managed and followed European rules.

Artelys could not validate all Forms C, as all partners have not submitted them yet.

IV. Deliverables and milestones tables

A. Deliverables

The deliverables due in this reporting period, as indicated in Annex I to the Grant Agreement have to be uploaded by the responsible participants (as indicated in Annex I), and then approved and submitted by the Coordinator. Deliverables are of a nature other than periodic or final reports (ex: "prototypes", "demonstrators" or "others"). If the deliverables are not well explained in the periodic and/or final reports, then, a short descriptive report should be submitted, so that the Commission has a record of their existence.

If a deliverable has been cancelled or regrouped with another one, please indicate this in the column "Comments".
If a new deliverable is proposed, please indicate this in the column "Comments".

This table is cumulative, that is, it should always show all deliverables from the beginning of the project.

Del. no.	Deliverable name	Version	WP no.	Lead beneficiary	Nature	Dissemination level[4]	Delivery date from Annex I (proj month)	Actual / Forecast delivery date Dd/mm/yyyy	Status No submitted/ Submitted
D1.3	Functional specifications of the software. Update	2	1	Artelys	R	RE	10	15/02/2013	Submitted
D2.3	Impact of the smart grid technologies on energy systems	1	2	INESC	R	PU	12	26/03/2013	Submitted
D2.4	Design of the aggregation methodology for macro-models	1	2	INESC	O	RE	18	05/07/2013	Submitted
D3.2	Models and methodology for uncertainty assessment	1	3	Artelys	O	RE	18	01/10/2013	Intermediate version submitted
D3.3	Advanced Sustainable Energy Strategy for the three end-users	1	3	MINES	R	RE	18	01/12/2013	
D4.1	Algorithm for the optimization for the global energy system	1	4	INRIA	O	RE	14	01/07/2013	Submitted
D4.2	Decision-support tool - first version	1	4	Artelys	P	RE	20	01/06/2013	Submitted
D4.3	Energy asset and uncertainty model library	1	4	Artelys	O	RE	20	01/06/2013	Submitted
D4.4	HMI for cities and for industries	1	4	Artelys	O	RE	20	01/06/2013	Submitted
D6.4	Exploitation plan V2	1	6	Artelys	R	RE	20	05/07/2013	Submitted
D7.2	Periodic report 2	1	7	Artelys	R	RE	20	05/07/2013	Submitted

[4] **PU** = Public
PP = Restricted to other programme participants (including the Commission Services).
RE = Restricted to a group specified by the consortium (including the Commission Services).
CO = Confidential, only for members of the consortium (including the Commission Services).
Make sure that you are using the correct following label when your project has classified deliverables.
EU restricted = Classified with the mention of the classification level restricted "EU Restricted"
EU confidential = Classified with the mention of the classification level confidential " EU Confidential "
EU secret = Classified with the mention of the classification level secret "EU Secret "

B. Milestones

Please complete this table if milestones are specified in Annex I to the Grant Agreement. Milestones will be assessed against the specific criteria and performance indicators as defined in Annex I.

This table is cumulative, which means that it should always show all milestones from the beginning of the project.

TABLE 2. MILESTONES							
Milestone no.	**Milestone name**	**Work package no**	**Lead beneficiary**	**Delivery date from Annex I dd/mm/yyyy**	**Achieved Yes/No**	**Actual / Forecast achievement date dd/mm/yyyy**	**Comments**
MS3	Micromodels	2	AIT	30/09/2012	Yes	30/09/2012	
MS4	Macromodels	2	INESC	31/03/2013	Yes	01/07/2013	
MS5	Models and methodologies	3	INESC	31/03/2013	No	01/12/2013	

V. Explanation of the use of the resources

Every document needed has been uploaded in NEF web site.