Interreg Sudoe
IMPROVEMENT

Integration of combined cooling, heating and power microgrids in zero-energy public buildings under high power quality and continuity requirements

FINAL DISSEMINATION MEETING

Seville, 7th & 8th March 2023

Applicability of IMPROVEMENT: Implementation Plan and Good Practice Guide

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Centro Nacional del Hidrógeno · UCLM Universidad de Castilla-La Mancha · isae ENSMA · IST TÉCNICO LISBOA · LNEG · Junta de Andalucía · UNIVERSIDAD D CORDOBA · Junta de Andalucía Consejería de la Presidencia, Administración Pública e Interior Consejería de Hacienda y Financiación Europea · Agencia Andaluza de la Energía · UNIVERSITÉ PERPIGNAN VIA DOMITIA

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Activities carried out

- **Applicability Study** of the proposed technology in different public buildings
- **Global Architecture** of the system, dimensioning and definition of the Pilot Plans
- **Business Model**
- **Regulatory and certification** framework
- **Implantation Plans**

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Products

1.Good Practices Guide for the diminution of energy consumption in public buildings with critical loads

2. Regional plans and transnational strategy in SUDOE area

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Integration of combined cooling, heating and power microgrids in zero-energy public buildings under high power quality and continuity requirements

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IMPROVEMENT PRODUCT:

1. Good Practices Guide for the diminution of energy consumption in public buildings with critical loads

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Good Practices Guide for the diminution of energy consumption in public buildings

Coordination: AAE

Partners involved: CNH2, UCLM, LNEG, UPVD, JA

Associated beneficiaries involved: AREAL, AREC, ENSMA, IST

MAIN GOAL: help public building managers, so that they acquire a better knowledge of the best available technologies to reduce the energy consumption of their buildings and, in particular, those innovative technologies developed within the framework of the IMPROVEMENT project.

Deadline: product published in February **2023**

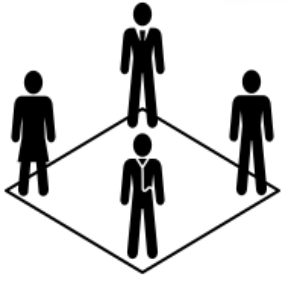
Target Readers

Profiles of the readers :

- The guide is addressed to a varied profiles, from **technicians** with background in energy engineering to **public managers** with a background in economics or laws.

- The guide offers both **technical information** on technologies of IMPROVEMENT, as well as **general information and recommendations** on how to reduce energy consumption.

- The guide also serves to **bring these technologies closer to the private sector,** and in this way, identify possible niche markets to exploit their potential development



Document Structure

Section 1/3: Introduction and aim of the document.

Section 4: Recommendation of efficient technologies for different energy services

- Heating, Cooling, Ventilation, SHW, CHP, Self-consumption …
- Both for new buildings and existing ones
- Emphasis on Improvement technologies and the integration between systems that Improvement provides

Section 5: Real example cases :

- CNH2 pilot plant
- LNEG pilot plant

Section 6: and Section 7: General recommendations and tips for energy saving in the use management of the buildings

Glossary of energy terms

GUIA DE BUENAS PRÁCTICAS EN LA IMPLEMENTACIÓN Y USO DE TECNOLOGÍAS EFICIENTES PARA REDUCIR EL CONSUMO DE ENERGÍA EN EDIFICIOS PÚBLICOS DE LA REGION SUDOE

OBJETIVO DE LA GUÍA

Objetivo de la guía

Esta guía recoge un conjunto de pautas dirigidas a los administradores, mantenedores, responsables de la licitación de nuevos edificios y usuarios de edificios públicos, para acercarse a un consumo más responsable de la energía y recursos mediante un mejor conocimiento de las soluciones tecnológicas, así como de su gestión y explotación. Buscando el doble objetivo de acercar a los edificios a un consumo casi nulo y a la vez dotarlos de mayor calidad y fiabilidad en el suministro.

Se puede considerar que la instalación eléctrica de un edificio es alimentada por una energía fiable y de gran calidad cuando ésta no presenta desviaciones de los valores esperados de tensión, corriente o frecuencia, evitando, en consecuencia, fallas u operaciones anómalas de los equipos. Cierto tipo de edificios necesitan particularmente esta garantía al albergar en ellos cargas sensibles o cargas críticas. Ejemplos de cargas sensibles son los equipos de instrumentación, de diagnóstico y tratamientos médicos, ordenadores, autómatas programables, robots, instalaciones de telecomunicaciones y en general las TICs. Cargas críticas son aquellas que al dejar de funcionar ponen en peligro la vida humana, la seguridad del personal u ocasionar grandes perjuicios económicos. Ejemplos de éstas son las salas de cirugía y de cuidados intensivos, los centros de datos, infraestructuras de transporte y telecomunicaciones esenciales. Por ejemplo, un paro no programado en una línea de producción industrial es muy costoso, pero que se paralice el centro de datos de un banco o no funcione el quirófano de un hospital puede ser catastrófico.

Se centra la presente guía en aspectos divulgativos sobre las tecnologías energéticas de ahorro, sistemas de generación renovable, y sistemas de gestión y almacenamiento energético que se han estudiado y desarrollado en el proyecto IMPROVEMENT.

Las pautas serán aplicables tanto en el diseño de nuevos edificios, como en las reformas de las instalaciones existentes, como en el uso de las mismas.

Se completa la guía con una serie de recomendaciones generales, así como recomendaciones por tipo de uso energético, ya sea calefacción, refrigeración, iluminación, etc. Estas últimas pueden implementarse de forma inmediata sin coste alguno por los trabajadores y usuarios de los edificios públicos.

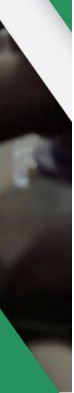
PRINCIPIOS GENERALES

Como principios generales para alcanzar la sostenibilidad energética se deben considerar los siguientes, en el orden de prelación indicado:

1. Evitar consumir energía y recursos que realmente no son necesarios
2. Emplear la energía y los recursos que se necesiten de la forma más eficiente posible
3. Priorizar las fuentes de energía renovables frente a los combustibles fósiles

Para aplicar los principios anteriores es conveniente:

- Conocer las soluciones técnicas que nos permiten aprovechar la energía y recursos que nos ofrece la naturaleza de forma gratuita
- En licitaciones de obras, reformas y/o adquisición de equipos y sistemas considerar siempre los criterios de la Contratación Pública Ecológica (CPE).
- Tener presente el ahorro y la eficiencia energética en todos los aspectos de la actividad profesional.
- Divulgar dicha conciencia entre el personal de los edificios públicos y sus usuarios



Key Contents of the guide

Decarbonization and resilience :

All the recommendations in the guide affect the double objective of carbon neutrality and security of supply

Microgrids :

Microgrids are presented in the guide, as a way to integrate generation and consumer systems in buildings, adding safety and quality for the supply

Integrated solutions :

The **Improvement project** is recommended as a necessary integration of solutions, like passive and active thermal and electrical systems

Green Hydrogen :

The production and storage of hydrogen in buildings is explained as a technology to be developed in the near future.

Recomendations in HVAC

Passive Design and Insulation :

Solar protection of windows, double glazing, Trombe wall, air tightness …

Heat and cold generators :

Solar Thermal panels, Aerothermic and Geothermic heat pumps, CHP systems…

Heat and Cold storage :

Inertial storage, phase change materials …

Control and optimization

Prediction of the demand to optimize generation and storage

Recomendations in Electric consumption

Self Consumption :

PV panels, micro wind generators, CPH systems (gas engines, fuel cells…)

Power grid disturbances :

Active harmonic filters, power factor correction systems

Critical Loads :

Microgrids management system with back up capabilities

Electricity storage

Batteries, in-building Hydrogen production

Information and Awaredness

Basic knowledge of energy efficient technologies:

The guide provides basic knowledge in efficiency, renewables, and energy management, so that all staff in public buildings have these basic concepts

Energy saving awareness :

The guide conveys that in addition to technology, **energy saving depends on the attitude and behavior of all users**

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SOLE

ACT GREEN

5 actions to reduce energy waste

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FINAL DISSEMINATION MEETING

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IMPROVEMENT PRODCUT
2 Regional plans and transnational strategy in SUDOE area

IMPLANTATIONS PLANS. Regional plans and transnational strategy in SUDOE area

Coordination: AAE

Partners involved: CNH2, UCLM, LNEG, UPVD, JA

Associated beneficiaries involved: AREAL, AREC, ENSMA, IST

MAIN GOAL: to **suggest reginal and transnational strategies** for the implementation of IMPROVEMENT solutions to minimize the energy consumption of the public buildings, including possible technical, financial and regulatory changes in the existing framework.

Deadline: product published in **February 2023**

Document structure

Section 1: Aim of the document.

Section 2: Results of the experiences in CNH2 and LNEG's pilot plants and laboratories testing. IST Alameda campus plant experience added too.

Section 3: Recommendations and proposals on aspects related to:

- Buildings (on the site conditions and the legal framework)
- Technology and equipment (technical, legalization, accreditation, certification, standardization, financing, environment).

Section 4: IMPROVEMENT implementation roadmap for:

- nZEB with energy microgrids and critical loads.
- IMPROVEMENT System Certification.

Section 5: Conclusions, lessons learned and potential of the IMPROVEMENT system.

Results of the experiences for the IMPROVEMENT system from pilot plants and laboratories testing

FIRST ORIENTATION

1. A list of the most relevant results and findings .
2. The feasibility for each of the indicated results to be transferable as a result of the IMPROVEMENT system.
3. In case of difficulties or barriers to overcome in order to achieve those results, what tools would be necessary to achieve them: (policies, financial, regulations, etc.)

Results of the experiences for the IMPROVEMENT system from pilot plants and laboratories testing

FIRST INPUTS

1. **The CNH2 and LNEG pilot plants** as well as findings related to power **management systems** and **quality of energy supply** (UCO and UCLM) **developed on CNH2 pilot.**
2. **Energy management and energy cost forecasts algorithms** (UPVD and ENSMA) **modelled and applied on LNEG pilot.**
3. Additional information on the experience carried out on the **Alameda campus of the Technical University of Lisbon, by IST.**

Recommendations and proposals

- On aspects related to building:
  - Analysis of the environmental characteristics and infrastructures of the environment for the optimal operation of the system
  - Prioritization strategies for critical loads in public buildings
  - Public and funding support
  - Minimization of administrative and bureaucratic barriers
  - Promotion of EMS in buildings
  - Promotion of the implementation of the energy certificates
  - Enable mechanisms to disseminate IMPROVEMENT system solutions
  - Implementation of IMPROVEMENT system on public buildings with critical loads

Recommendations and proposals

- On aspects related to technologies and equipment:
  - Technical aspects and conditions: equipment and system architecture, communications protocols for microgrid management and control and forecasting algorithms
  - Aspects of legalization, accreditation, and standardization of IMPROVEMENT solutions and their components
  - Aspects related to public financing and support of these technologies
  - Environmental aspects: waste generation, circular economy, the Eco-design Directive, or the DNSH principle

IMPROVEMENT implementation roadmaps

Proposal of roadmaps with **temporary milestones, to certify and put on the market the products** included in the technologies involved in the IMPROVEMENT system, addressed to **new or existing public buildings with critical loads.**

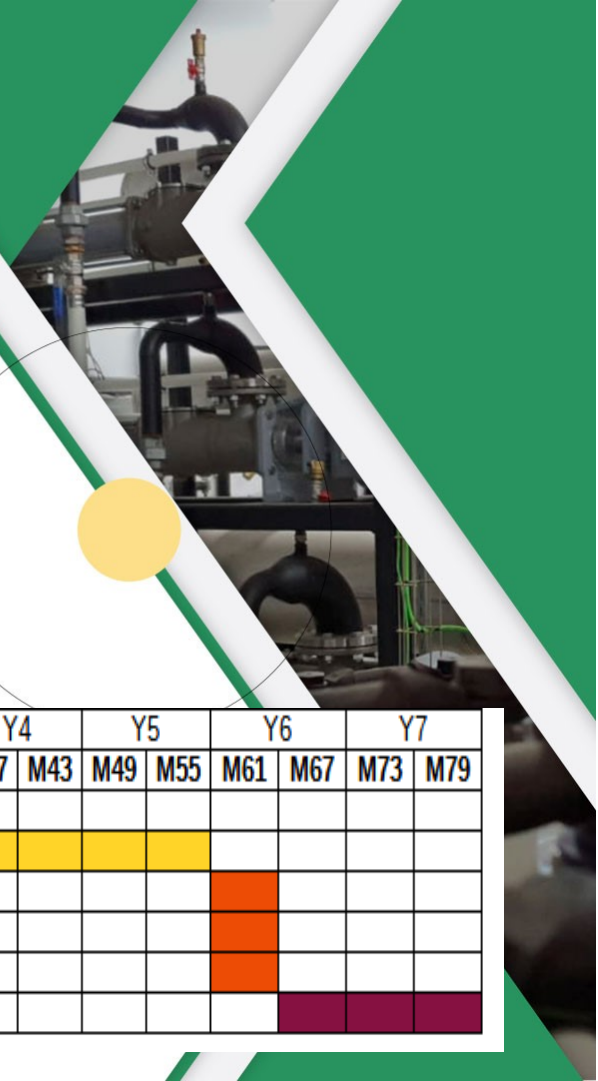
A. **Public buildings: The necessary certification framework for public buildings with critical loads and the legalization** needed (6 phases)

B. **IMPROVEMENT system and its components: The necessary certification framework for the legal incorporation for the technologies covered by the IMPROVEMENT system (6 phases)**

Roadmap scheme for each phase:

- Description
- Objective
- Activities
- Starting (month)
- Milestones

IMPROVEMENT implementation roadmaps



A. Roadmap for the legalization of nZEB with energy microgrids and critical loads

Phase 1. Defining the taxonomy framework for critical load buildings.
Phase 2. Harmonized technical standard and requirements for a NZEB in all SUDOE regions
Phase 3. Harmonized definition of the concept of microgrids in buildings.
Phase 4. Implementation of a nZEB certification seal systems
Phase 5. Simplification and harmonization of administrative procedures for the implementation of microgrids in public buildings.
Phase 6. Implementation of economic and fiscal support schemes.

B. Roadmap for the IMPROVEMENT System Certification

	Y1		Y2		Y3		Y4		Y5		Y6		Y7	
	M1	M7	M13	M19	M25	M31	M37	M43	M49	M55	M61	M67	M73	M79
PHASE 1. Technical development of components and systems in simulation environment (TRL 6)														
PHASE 2. Demonstration and validation of the IMPROVEMENT system in real environment (TRL 7)														
PHASE 3. Equipment certification in a real environment (TRL 8)														
PHASE 4. Certification of control and power systems (TRL 8)														
PHASE 5. Certification communications, IT systems, IoT plattform (TRL 8)														
PHASE 6. Successful system testing in real environments, and microgrid certification (TRL 9)														

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IMPROVEMENT TASK
PRODUCT 1.6.2 IMPLANTATION PLANS
(Transnational Strategy)

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