adene

Agência para a Energia

Contribution of Water Efficiency in Buildings to Primary Energy Savings: example of the AQUA+ in Portugal

Patrícia Malta Dias

Originally presented in CEES 2023

November 2024

European Energy Network (EnR)

- Voluntary network of European Energy Agencies
- 24 members
- Information Exchange, benchmarking and best practices, knowledge transfer, collaborative projects
- EnR acts as a bridge between national, regional and local activities and those of the European Community
- 9 thematic working groups

Water-Energy Nexus (WEN) WG – 11 agencies

Contribute and advocate for the Water-Energy Nexus approach under current and future European and national policies on water, energy & climate action, fostering a stronger connection between these policies at EU and Country levels.

adene
Agência para a Energia

adene

Agência para a Energia

The National Energy Agency

People are at the center of our mission. Our ambition is to reinforce Portugal´s positioning in the decarbonization and to be an active partner in the energy transition, strengthening partnerships as well as public policy and being closer to the citizens. Full of energy!

adene.pt

Introduction
Portuguese framework

RNC2050
Roteiro para a Neutralidade Carbónica

Roadmap to Carbon Neutrality 2050

Strategic plan that establishes a roadmap to decarbonize Portugal by 2050.

PNEC 2030
PLANO NACIONAL ENERGIA E CLIMA

National Plan for Energy and Climate 2030

2030 horizon plan to positioning the country for carbon neutrality.

Targets:

- ✓ 35% reduction in primary energy consumption
- ✓ 30% emissions reduction in the water and wastewater sectors

Introduction
Water and wastewater sectors

Water and wastewater sectors account for:

- ✓ 4% of global electricity consumption
- ✓ 6 to 18% of energy demand consumption in cities

Sources: ERSAR, 2018. Gregório, V. Quintela Martins, M., 2011.

Reduce energy needs of water and wastewater sectors

- ✓ Increase energy efficiency
- ✓ Reduce water demand through water efficiency

Understand how implementing **water efficiency measures** in residential buildings can contribute to **achieving climate neutrality by 2050**

Methodology

- ✓ Simple, agile and voluntary system to evaluate **water efficiency in buildings**
- ✓ Expeditious assessment in all typologies and life stages of building (**new, existent, retrofitted**)
- ✓ Values the most efficient solutions, **identifies improvement measures** and guides and promote the best practices

Audits performed until the end of 2022:

- ✓ Saving of 55 m^3/year per household with water efficiency measures
- ✓ 32% reduction in water consumption

Methodology

$$E_f = \frac{Total\ energy\ consumption\ for\ the\ water\ services\ [kWh/year]}{Authorised\ water\ consumption\ [m^3/year]}$$

$$+\frac{Total\ energy\ consumption\ for\ the\ wastewater\ services\ [kWh/year]}{Collected\ wastewater\ [m^3/year]}$$

$$E_f\ -Final\ specific\ energy\ consumption\ [kWh/m^3]$$

$$E_p = 2{,}5\ \times\ E_f$$

$$E_p\ -Primary\ specific\ energy\ consumption\ [kWh_{EP}/m^3]$$

2,5 kWh_{PE}/kWh is the conversion factor from final to primary specific energy consumption, from the Portuguese Energy Certificate System

Methodology

AQUA+

55 m³/year

4 million conventional dwellings of usual residence

218 millions m³/year

$$Final\ energy\ saving\ potential\ [kWh/year] = E_f \times 218 \times 10^6$$

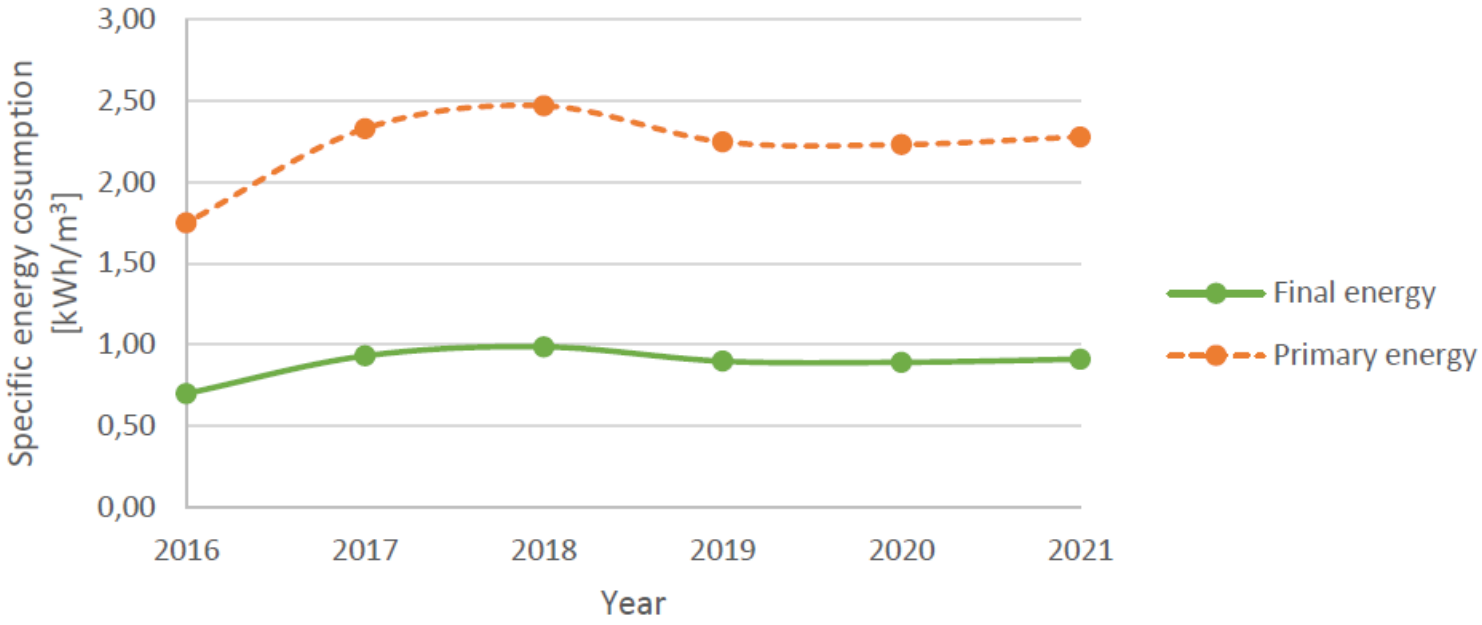
$$Primary\ energy\ saving\ potential\ [kWh_{EP}/year] = E_p \times 218 \times 10^6$$

To estimate the **impact of water efficiency measures in buildings on the Portuguese energy consumption**, energy savings produced by water efficiency measures were compared to the Portuguese final electricity consumption

Results

Energy specific consumption

Evolution of energy specific consumption over the years



- ✓ Almost constant evolution over time
- ✓ Follows the same trend as the total utility energy consumption and authorized water consumption

Results

Impact of water efficiency measures in buildings

AQUA+

4 million conventional dwellings of usual residence

218 millions m³/year

193 GWh/year (final energy)

484 GWh/year (primary energy)

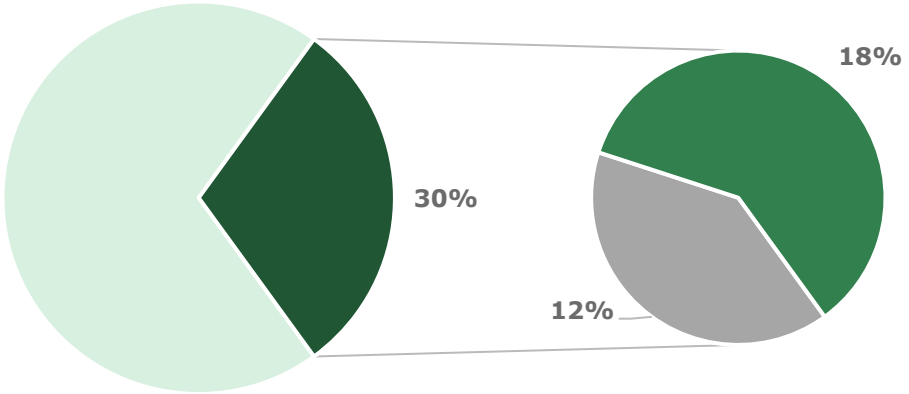
18% energy consumed by water and wastewater utilities

0,41% of the final electricity consumption in Portugal

Results

Contribution to decarbonisation

Water and wastewater sector targets and contribution of water efficiency in residential buildings to achieve them



- PNEC2030 emissions reduction target
- Potential reduction of emissions
- Additional reduction of emissions to achieve PNEC2030 target

- ✓ Water efficiency measures in residential buildings contribute to an **18% reduction in emissions**
- ✓ This represents **60% of the target set in PNEC2030** for the water and wastewater sector

Results
Contribution to decarbonisation

Water saving potential range from 30% in new buildings to 50% in renovated buildings

European Commission, 2017

AQUA+ average saving potential: **32%**

(more new buildings are audited than existing ones)

→ The majority of the existent buildings today are the buildings that will exist in 2050

Conservative approach

Higher saving potentials can be identified when:

- ✓ More existent buildings in the residential sector go through AQUA+ audits
- ✓ Commercial buildings, including hotels, are considered in the analysis

Conclusions

1. Water efficiency measures in buildings can help **achieve 60% of the PNEC2030 targets for the sector**, hence contributing to the decarbonization of the water and wastewater sector and meeting national climate targets

2. Potential for **primary energy savings via water efficiency is approximately 484 GWh/year**, when considering the entire primary housing building stock, the equivalent to the yearly energy consumption of **144 families**.

3. Application of AQUA+ audits and recommendations can lead to savings of up to **18% of the total energy consumed by water and wastewater utilities** in Continental Portugal

4. **Higher saving potentials can be identified** if we consider water retrofit of existing buildings and water efficiency in commercial buildings

adene.pt

aquamais@adene.pt

Patricia.dias@adene.pt

(+351) 214 722 800

linkedin.com/company/adene/mycompany/

Obrigado!