

## Water ( Energy Enerwat Da água à energia Nexus

Caracterização, modelação e medidas para a diminuição dos consumos domésticos urbanos e rurais



## **O** projeto

POCI-01-0145-FEDER-016730 (PTDC/AAG-REC/4700/2014)

### Sandra Pereira

UTAD / C-MADE - Centre of Materials and Building Technologies







Fundo Europeu de Desenvolvimento Regional



### Project



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## Task 2: Collection of the background information

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Economic Analysis (Task 7)

#### **Previous results:**

- Matos, C., Silva Afonso, A., Moura, T., Bentes, I. 2012. Evaluation of the consequences of the implementation of efficiency measures in water efficiency and CO2 emissions. Case study in a single family dwelling, In CIB W062 2012 – Water Supply and Drainage for Buildings. Edimburgh, Scotland, 27 a 30 de September 2012.
- Cristina Matos, Carlos A. Teixeira, Duarte, A.A.L.S., Bentes, I. (2013). **Domestic water uses:** characterization of daily cycles in the North Region of Portugal. Science of the Total Environment doi:10.1016/j.scitotenv.2013.04.018
- Cristina, Matos; Briga Sá, Ana; Pereira, Sandra; Silva Afonso, A.. 2013. Water and energy consumption in urban and rural households, In 39th CIBW062 International Symposium Water Supply and Drainage for Buildings, Nagano.
- Matos, C.; Pereira, S.; Amorim, E.V.; Bentes, I.; Briga Sá, A.. 2014. Wastewater and greywater reuse on irrigation in centralized and decentralized systems — An integrated approach on water quality, energy consumption and CO2 emissions, Science of The Total Environment 493, x: 463 471. doi: 10.1016/j.scitotenv.2014.05.129

#### **Objectives:**

- Identification of the main differences to consider on the evaluation of water and energy consumption in rural and urban areas.
- Bibliographic review on the following topics:
  - water supply and consumption,
  - differences in urban and rural areas,
  - energy consumption associated with water supply and consumption

#### **Deliverables:**

- S. Pereira, C. Matos, A. Briga-Sá, A. Cunha, F. Pereira, I. Bentes, "From water to energy: Methodology to characterize, measure and model urban and rural domestic consumptions".
- It's in production one paper with the updated state of the art.

Task 2 Cristina Matos Ana Sá Sandra Pereira Isabel Bentes Diana Faria Elisabete Silva

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## Task 3: Quantitative and qualitative analysis of water consumption

#### **Previous results:**

There are several works with the concerns of water and energy saving, but the concern of water saving independent of energy saving. Only recently has the problem of related water and energy consumption started to be studied.

#### **Output:**

The collected data in this task with the collected in Tasks 4 and 5 will allow the mathematical modeling in task 6.

#### **Objectives:**

- Design of a survey to be applied, where the main factors that influence water consume will be researched, namely, type of water production (ground water or surface water pumping), end use distribution and volume of water per end use;
- Selection of at least two representative samples of Portuguese rural and urban environments, where the survey will be applied;
- Data compilation and analysis.

#### **Deliverables:**

- C.Matos, I.Bentes, S.Pereira, A.M.Gonçalves, D.Faria, A.Briga-Sá, "Which are the factors that may explain the differences in water and energy consumptions in urban and rural environments?".
- C. Matos, D. Faria, I. Bentes, A. Briga-Sá, S. Pereira," Energy to Water nexus: trying to understand the differences between urban and rural households consumptions".
- Cristina Matos, A. Manuela Gonçalves, Ana Briga-Sá, Sandra Pereira, Isabel Bentes, Diana Faria, "Metodologia estatística na caracterização do consumo doméstico de água".
- A. Manuela Gonçalves, Cristina Matos, Ana Briga-Sá, Sandra Pereira, Isabel Bentes and Diana Faria, "Determinants of Domestic Water Consumption: A Case Study in Northern Portugal".

Task 3 Isabel Bentes Cristina Matos Ana Sá Sandra Pereira Diana Faria Elisabete Silva

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## Task 4: Energy consumption in water production and use and greenhouse gas emission

#### **Output:**

- The collected data in this task with the collected in Tasks 3 and 5 will allow the mathematical modeling in task 6.
- It is expected to identify the main differences between rural and urban areas and provide the necessary data to perform the costs analysis in task 7.

#### **Objectives:**

- Definition of the main factors and parameters related with energy consumption that should be included in the survey referred to in the task 3;
- Identification of the data water consumption obtained in task 3 that imply energy consumption;
- Comparison between water and energy consumption in rural and urban environment.

#### **Deliverables:**

The publications are the same as the previous task, because we wanted to observe the relations between the two types of consumption

Task 4 Ana Sá Sandra Pereira António Cunha Francisco Pereira Cristina Matos Elisabete Silva Diana Faria



## Task 5: In situ experimentation and data acquisition

Water data collected survey (Task 2) (Task 4)

Economic Analysis

#### **Previous results:**

The work field carried out at the dwelling level is very scarce, maybe due to the level of intrusion in the houses and, to a certain extent, the invasion of the privacy of the consumers. Most of the works collects data from surveys and then proceeds to the modulation of water and energy consumptions and surveys.

#### **Output:**

- It is expected that the data acquisition resulting from this task will allow the validation of the results obtained in the surveys implemented in tasks 3 and 4.
- The collected data in this task with the collected in Tasks 3 and 4 will allow the mathematical modeling in task 6.

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#### **Objectives:**

In this task it is intended to measure the water and energy consumption related with water production and end use in rural and urban households submitted to the surveys conducted in tasks 3 and 4.

#### **Deliverables:**

- António Cunha, Elisabete Silva, Francisco Pereira, Ana Briga-Sá, Sandra Pereira, From water to energy: low cost water & energy consumptions readings.
- António Cunha, Francisco Pereira, João Grácio, Elisabete Silva, Cristina Matos and Sandra Pereira, "WATERS: A system architecture for acquire dwellings water & energy consumptions".

Task 5 António Cunha Francisco Pereira Isabel Bentes Cristina Matos Sandra Pereira Elisabete Silva Diana Faria Filipe Marques João Grácio

## Task 6: Simulation of consumptions

### **Objectives:**

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 The aim of this task is to develop and apply a model for water use, water related energy as well as related CO<sub>2</sub> emissions that is applicable to any dwelling as well as on an urban or rural scale. The model should take into account all relevant contributions to residential water use. It should provide a system understanding of water related household activities and should show what the most relevant contributions to water use are, water related energy use and greenhouse gas emissions in households, what are the key drivers of these flows and what possible measures could be applied to reduce these flows.

Task 6 **Francisco Pereira** António Cunha Sandra Pereira **Filipe Margues** João Grácio

Water dat collected survey (Tark 3) Data collected survey

- In this task, will be used a mathematical model to quantify the household flows of water and energy.
- The collected data in Tasks 3 and 4 will allow the mathematical modeling in this task.
- It is expected that the data acquisition resulting from Task 5 will allow the validation of the results obtained by the mathematical model in this task. Will also permit the calibration of the model.
- Simulation including uncertainty analysis, sensitivity analysis and scenario calculations is also an objective of this task.

wat	<ul><li>calibration of the model.</li><li>Simulation including uncertainty calculations is also an objective</li></ul>						
ner	Deliver • http://	Bathrooms	Shower / Bath Washbasin Bidet Toilet	tad.pt			
	Energy	Kitchen Laundry Outdoor	Dishwasher and other uses Dishwasher machine Washing machine Taps Wells Pool	Water and Energy consumptions			

	Simulador de cor	nsumos em	fase de proje	to
Sir	nulador de cons	umos em fa	ise de explora	ição

Poupança em àgua esperado:	120 €/mês
Poupança em energia associados esperado:	1 <b>2</b> €/mês
Total:	<b>132</b> €/mês

## Task 7: Economic Analysis

#### **Output:**

 It is expected to give valuable information about the costs with the different types of energy consumption in the analyzed water cycle stages depending on the rural and urban residential consumption.

### **Objectives:**

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- This task will be focused in the analysis of the energy consumption costs for water in rural and urban residential scenarios.
- The similarities and the differences between these two environments will be also identified.
- The research work developed in the support for the energy cost

the second s	10000
Investimento	1110 €
Periodo de retorno	0.70 anos



**Task 7 Sandra Pereira** João Grácio

Vater dat collected survey

## Task 8: Practical recommendation and results diffusion

#### **Output:**

• The diffusion of the obtained results will be performed by the organizations of a seminar and completed by publishing the final report.

#### **Objectives:**

- The knowledge acquired in the previous tasks will be very important to characterize the residential water and energy consumption in rural and urban environment.
- With these results it is intended to warn for the resources scarcity problem and to encourage the stakeholders to adopt more sustainable policies, techniques and behaviors.
- The research team believes that the dissemination of the results will be a contribution to the development of strategies for water and energy efficiency in this sector.

#### **Deliverables:**

- Diana Filipa Gouveia de Matos Faria, Estudo da relação entre o consumo de água e energia ao nível do utilizador final.
- Matos, C.; Briga-Sá, A.; Bentes, I.; Faria, D.; Pereira, S., "In situ evaluation of water and energy consumptions at the end use level: The influence of flow reducers and temperature in baths".
- Matos, C, Bentes, I, Pereira, S, Faria, D, Briga-Sá, "Energy to water nexus in domestic consumptions".
- Briga-Sá, A, Faria, D, Silva, E, Pereira, S, Matos, C, "Experimental analysis on energy and water consumptions at the domestic end use level: the particular case of baths".
- Cristina Matos, Isabel Bentes, Sandra Pereira, Diana Faria, Ana Briga-Sá, "Energy consumption, CO2 emissions and costs related to baths water consumption depending on the temperature and the use of flow reducing valves".

Task 8 Isabel Bentes António Cunha Ana Sá Cristina Matos Francisco Pereira Sandra Pereira João Grácio Rafael Faria

(Task 7)

## Task 8: Practical recommendation and results diffusion

Collection of the background information (see 2) (Ten 2) (Ten 2)

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### **Deliverables:**



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### Task 8: Practical recommendation and results diffusion

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#### Economic Analysis (Task 7) Task 8 **Isabel Bentes** António Cunha Ana Sá Cristina Matos Francisco Pereira

Sandra Pereira João Grácio **Rafael Faria** 

### Investigadora de Vila Real alerta para o "flagelo" da escassez da água

As alterações climáticas, os incêndios florestais e as imprudências de alguns comportamentos humanos, estão a Ø pôr em causa, de forma acelerada, as reservas de água do país, alertou hoie uma investigadora de Vila Real.

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O alerta partiu de Sandra Pereira Cunha, investigadora da Universidade de Trás-os-Montes e Alto Douro (UTAD), em Vila Real, e coordenadora do projeto "ENERWAT" que está a estudar as melhores formas de diminuir os consumos de água urbanos e rurais.

"O uso ineficiente da água como se fosse um recurso inesgotável leva a que, em determinadas alturas, se atiniam niveis de 'stress' hídrico elevados", afirmou, em comunicado, a especialista.

Por isso mesmo, Sandra Pereira Cunha defendeu que "uma gestão sustentável deste recurso é fundamental para minimizar os impactos nefastos no ambiente"

> wsletters Diário de Notícias e ormações em primeira mão.

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**A** 

Regiões

Vila Rea

UTAD alerta para o flagelo da escassez da água

As alterações climáticas e os incêndios florestais, associados às imprudências de alguns comportamentos humanos, estão a pôr em causa de forma acelerada as reservas de água do país e a levantar sérios problemas para o futuro.

UTAD alerta para o flagelo da escassez da água











Nexus Água-Energia

UTAD alerta para a escassez da água

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rta de uma investigadora e docente da Universidade de Trás-os-Montes e Alto Douro (UTAD), Sandra Pee -- "numenant" nue estuda un militores formas de diministr os consumos de água urbanos e runais.

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#### isto faz-se para si Faz-se o estudo do hábitos de uma amostra da população, no entanto os resultados poderão ser utilizados pela população em g feito para promover o uso equilibrado e eficaz dos recursos de forma a não os comprometer para gerações futuras.

**Deliverables:** 

### Task 8: Practical recommendation and results diffusion

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									Economic Analysis (Task 7)
								Task 8	•
								Isabel	Bentes
								Antón	io Cunha
								Ana S	á
								Cristin	na Matos
								Franci	sco Perei
								Sandr	a Pereira
ABOUT	TEAM	PUBLICATIONS	PRESENTATIONS	GOALS	CONTACTS	SEMINAR	SIMULATOR	João (	Frácio

ra João Grácio **Rafael Faria** 

Project Coordin (Task 1)

Simulation model ergy comsumption in rural/urb

Energy/Co2 Data



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## Questions

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Thank you!