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# A comparison between predicted and measured energy use in social housing

Pablo Hernández-Cruz
Juan María Hidalgo-Betanzos
Carlos García-Gáfaro
Jon Fernández-Luzuriaga
Iván Flores-Abascal

Transition

10th European Conference
on Energy Efficiency and Sustainability
in Architecture and Planning

3rd International Congress on Advanced Construction

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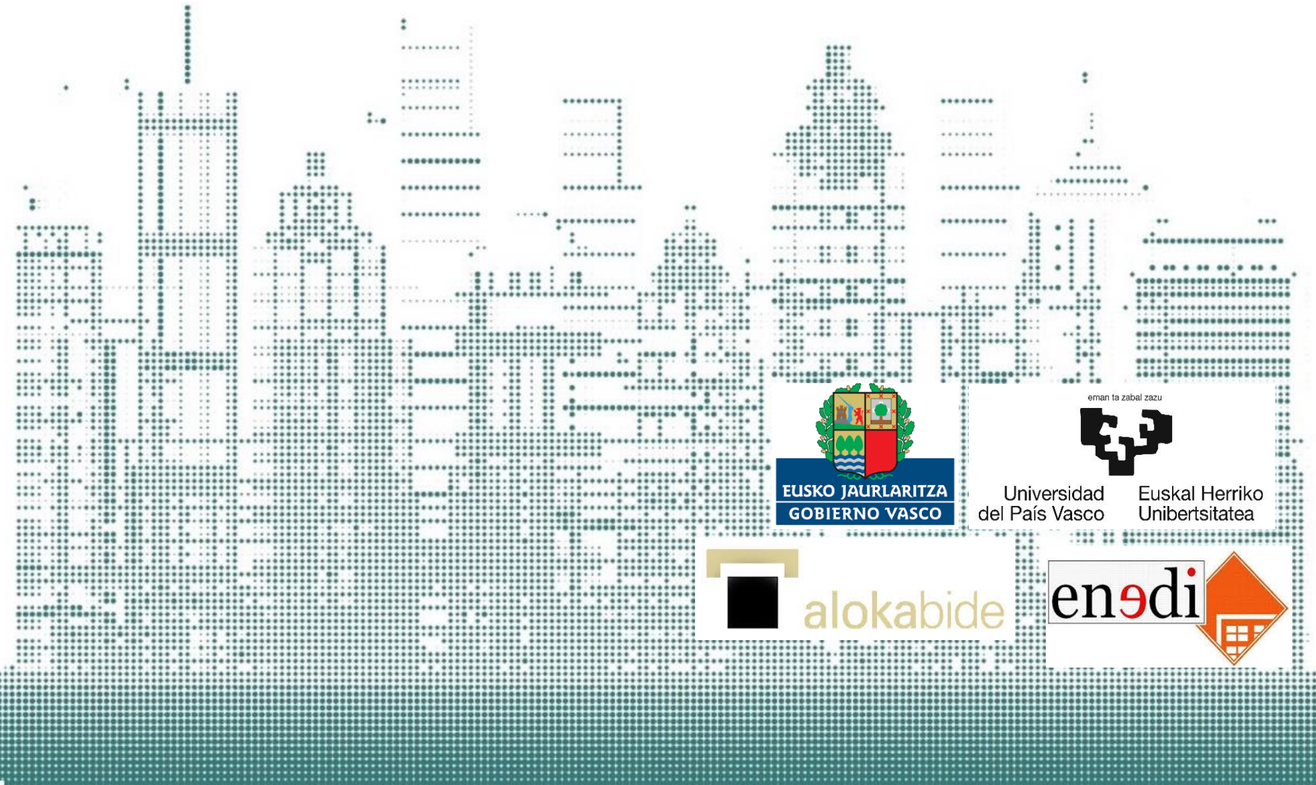


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# Who are we?

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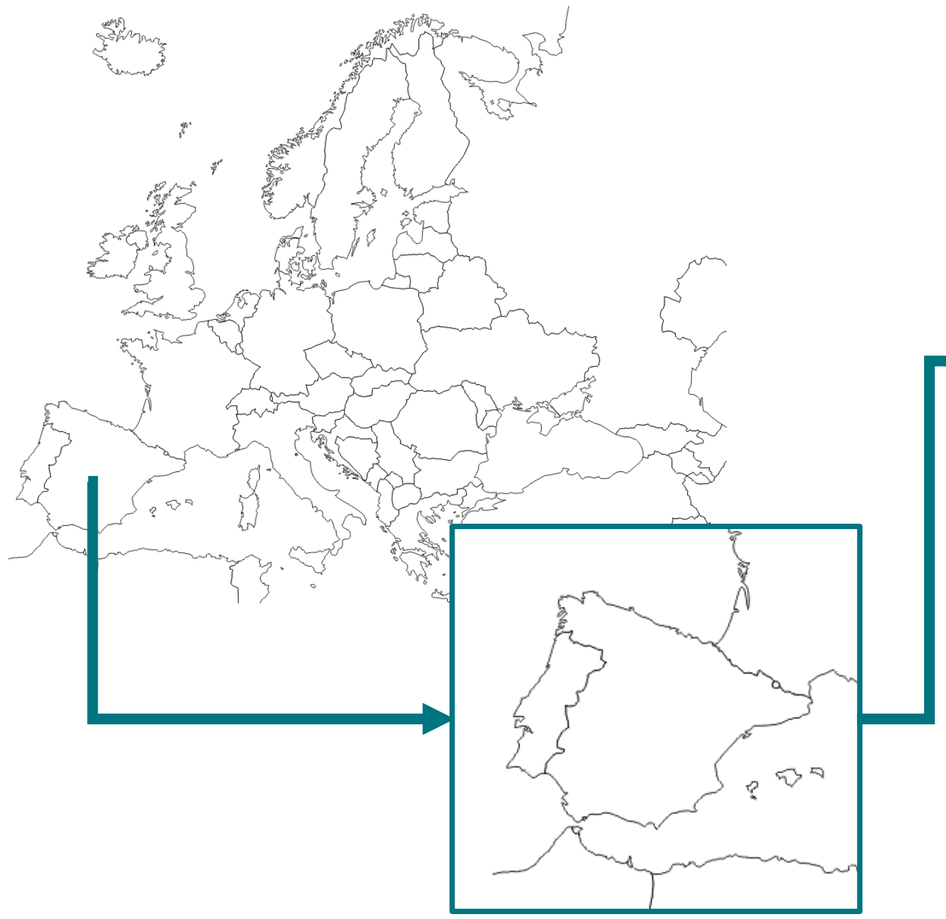
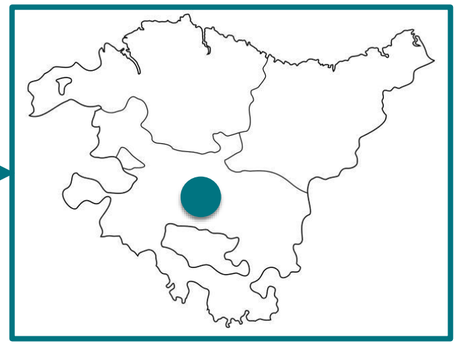
## Basque Government
## Laboratory of Quality Control of Buildings

## Laboratorio de Control de la Calidad en la Edificación del Gobierno Vasco



## Basque Country



Vitoria - Gasteiz

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## Thermal Area

Guarded hot box test

Paslink Test Cell

Infrared Thermography

Blower door test

Tracer gas leak test

… and more

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# Content

1. Introduction
2. Description of the buildings
3. Energy balance
4. Results
5. Conclusions

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# Introduction

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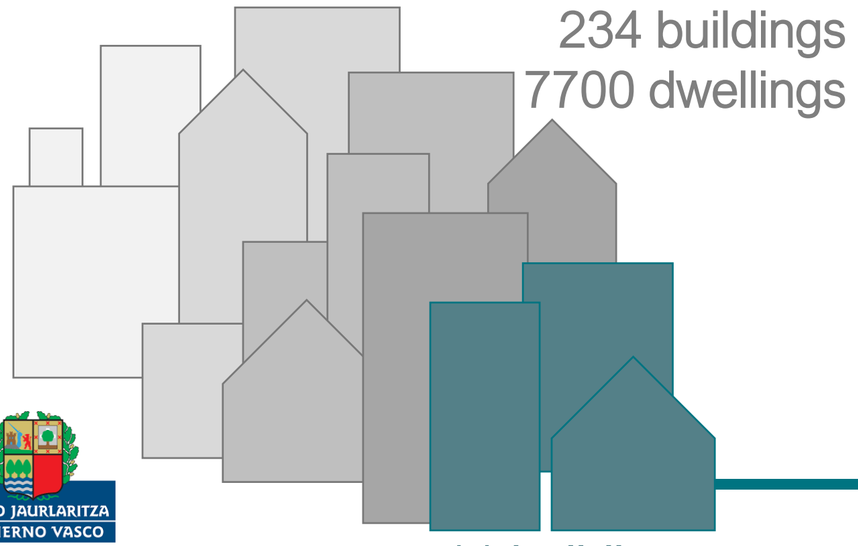
## PCTI

Rental social housing of the Basque Country

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Energy Audit

2 Buildings selected


- Detailed analysis
- Comparison with EPC

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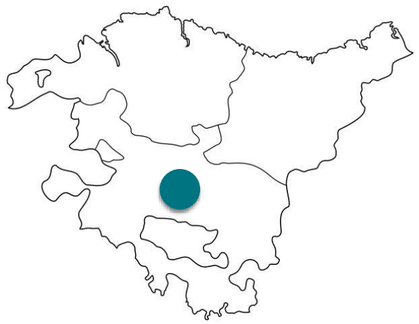
# Description of the buildings



Vitoria - Gasteiz

## Building A

- Constructed in **2010**
- **126 dwellings, 385 tenants**
- **Centralized boilers** and solar thermal system

## Building A

- Constructed in **2004**
- **228 dwellings, 498 tenants**
- **Individual boilers**

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# Description of the buildings

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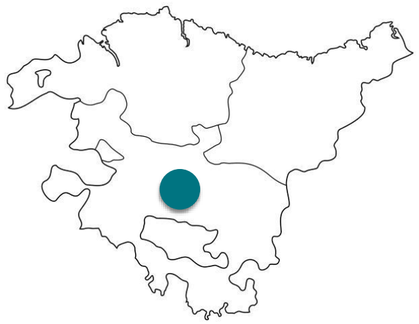
## Building A





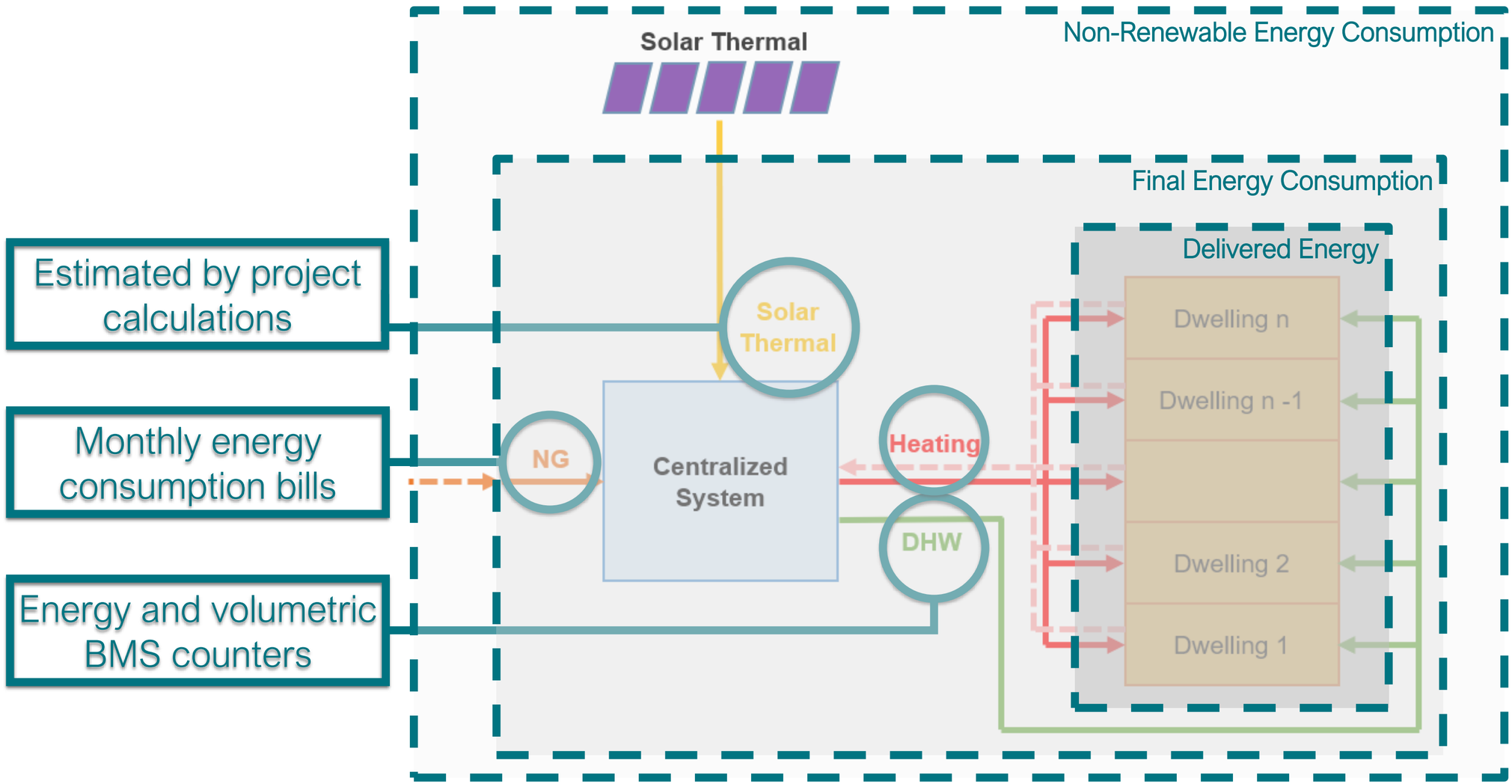
| | |
|---|---|
| NRPEC | D – 99,80 kWh/m²·a |
| $CO_2$ Emissions | D – 21,47 kg/m²·a |
| Heating demand | D – 55,10 kg/m²·a |

## Building A

| | |
|---|---|
| NRPEC | E – 260,9 kWh/m²·a |
| $CO_2$ Emissions | E – 219,2 kg/m²·a |
| Heating demand | E – 140,3 kg/m²·a |

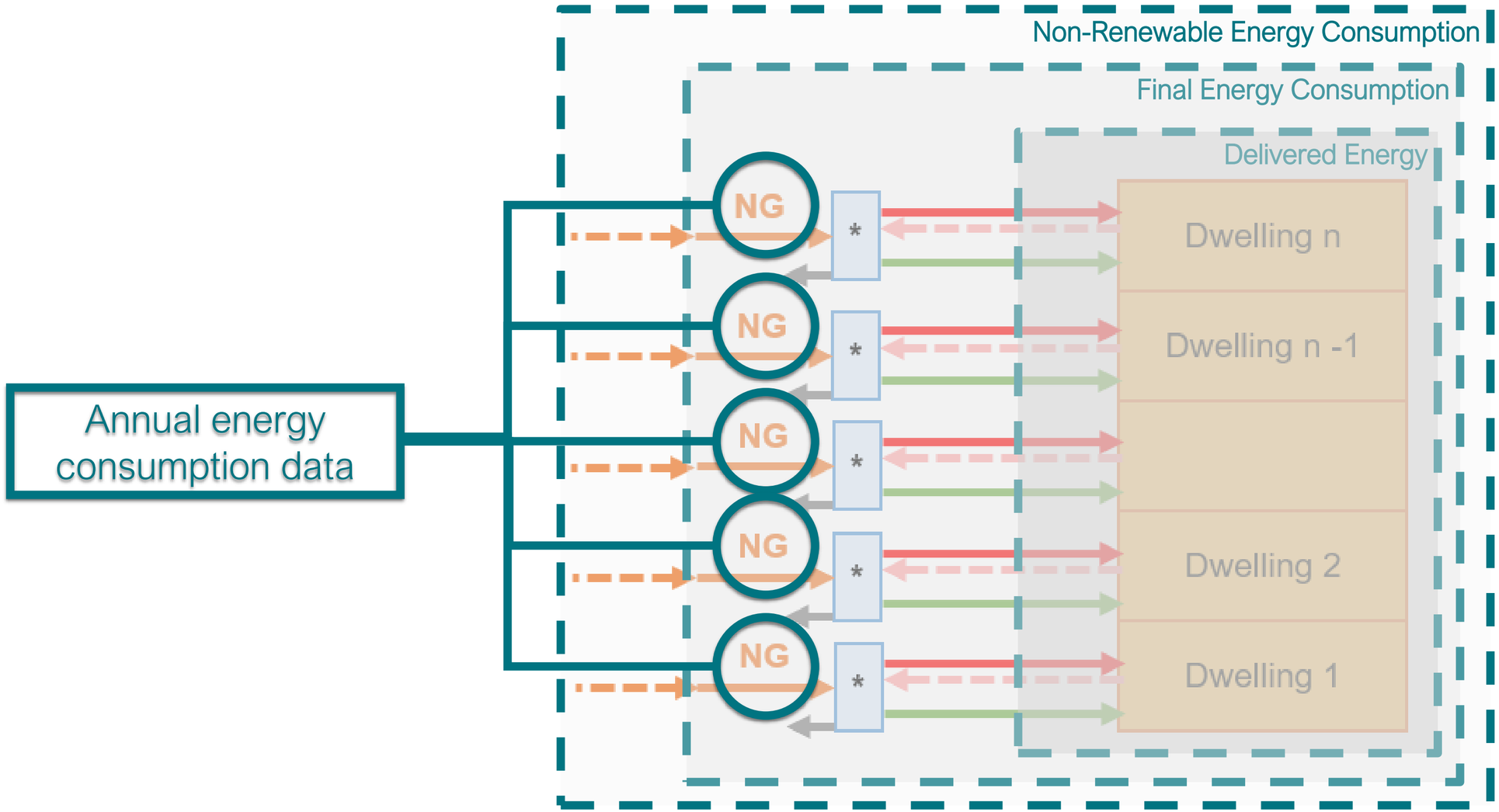
# Energy balance

## Building A – Centralized system



# Energy balance

## Building B – Individual boilers



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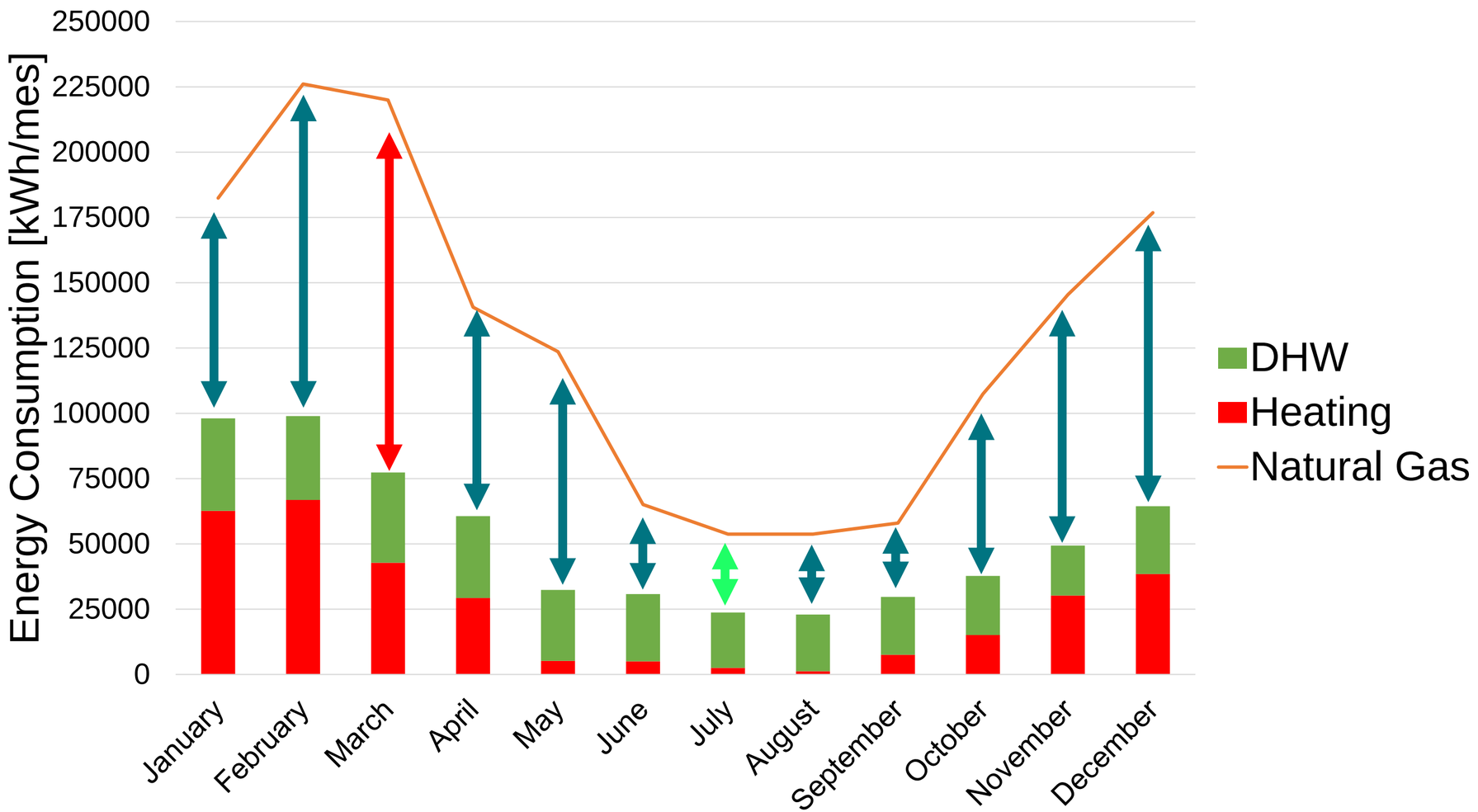
# Results

## Building A – Centralized system

Energy performance
37,3 %

Energy delivered
Gas Consumption

Energy losses:
150.000 kWh in March
45.000 kWh in July



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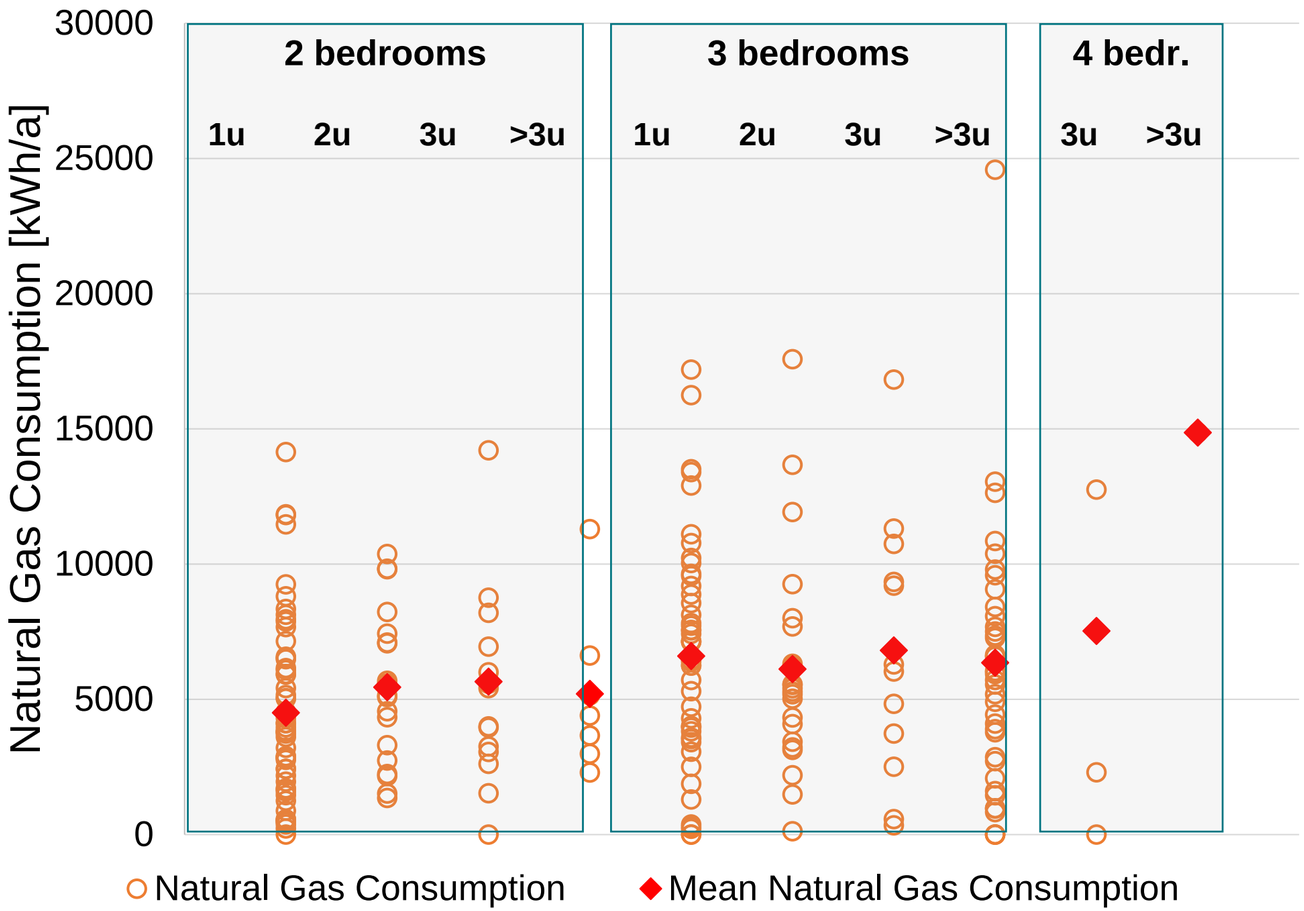
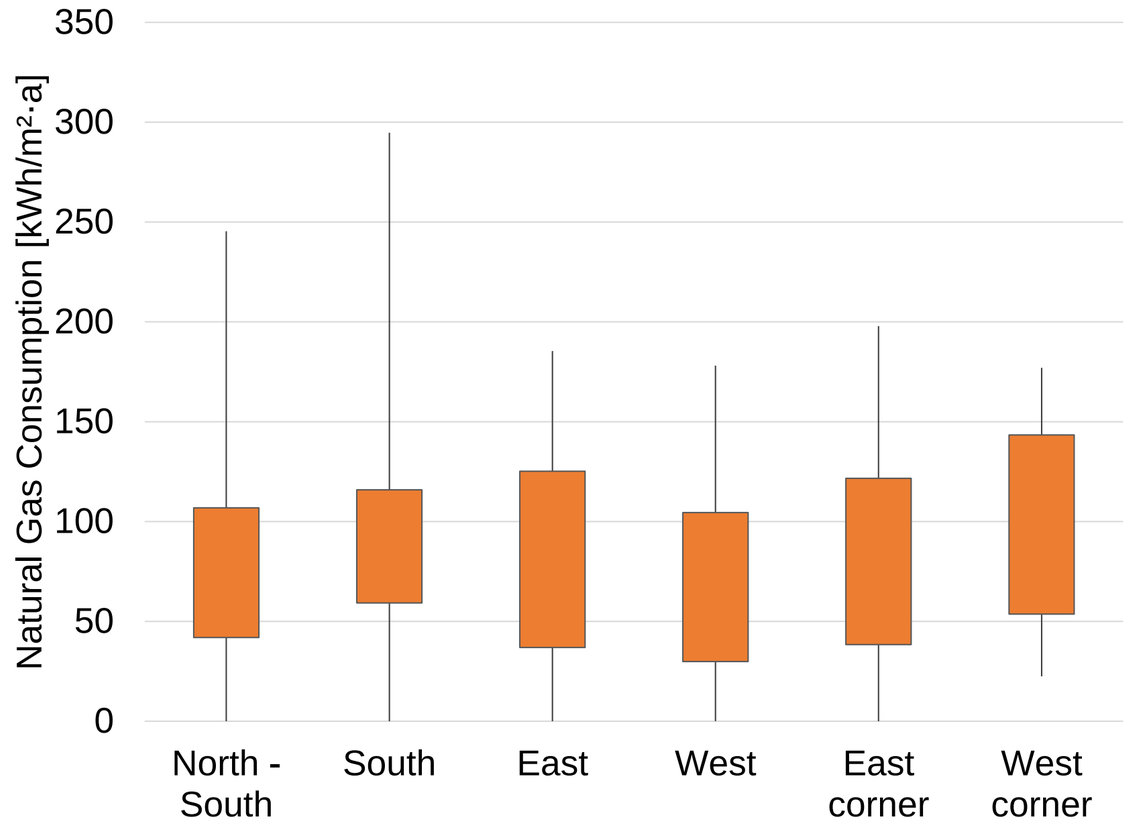
# Results

## Building B – Individual boilers

### Dwelling typology




### Dwelling orientation



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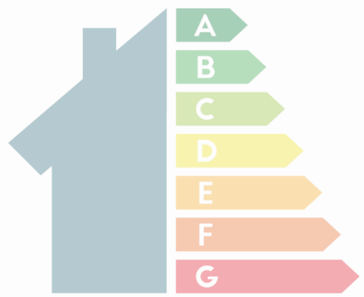
# Results

## Building A & B vs EPC

| | Building A | | | Building B | | |
|---|---|---|---|---|---|---|
| | Measured | | EPC | Measured | | EPC |
| Non-Renewable Primary Energy Consumption (CEPNR) [kWh/m²·a] | 153,7 | > | 99,8 | 98,3 | < | 260,9 |
| Final Energy Consumption (CEF) [kWh/m²·a] | 139,6 | > | 89,0 | 82,6 | < | 219,2 |
| Heating consumption (CEPNR) [kWh/m²·a] | 25,5 | < | 55,1 | 39,5 | < | 140,3 |



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# Conclusions

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## Current results

- ✓ Building A – Centralized system low performance
- ✓ High dispersion of energy consumption among users
- ✓ Low heating consumption when compared to EPC


## Next steps

Complete energy audit

Monitor & analyse user behaviour and thermal comfort

Energy poverty

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# Thanks for your attention!

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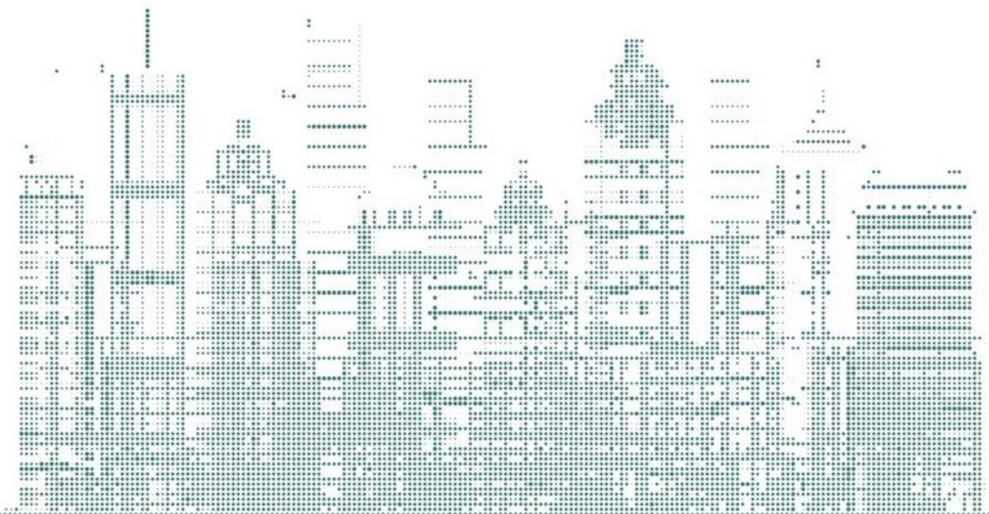

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