Format 2

# Preparation of Abstract for
# 2014 IERE-GDF SUEZ Brussels Workshop
# "Energy at home"

## Micro Energy Storage in Buildings

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Abstract:

With the growing use of intermittent energy sources in power grids, there is a growing mismatch between when energy is produced and when it is consumed. This has led to the need of energy storage or demand-response systems in order to use the energy in a balanced and efficient way. Given this context, the Micro Energy Storage in Buildings (MESB) project intends to parameterize and assess the feasibility of small-scale energy storage in buildings. This project is innovative as small-scale energy storage in buildings has not been properly studied before and information on the subject is scarcely available.
In the first phase, five technologies were analyzed: Compressed air energy storage (CAES), pumped hydro energy storage (PHES), electrochemical batteries, hydrogen and hot water sensible heat for thermal storage. For each technology, a database was built with data (such as mass and cost) for each one of its components. This data was later assembled allowing a detailed parameterization of each energy storage technology. An example is shown in Figure 1 for a CAES system.

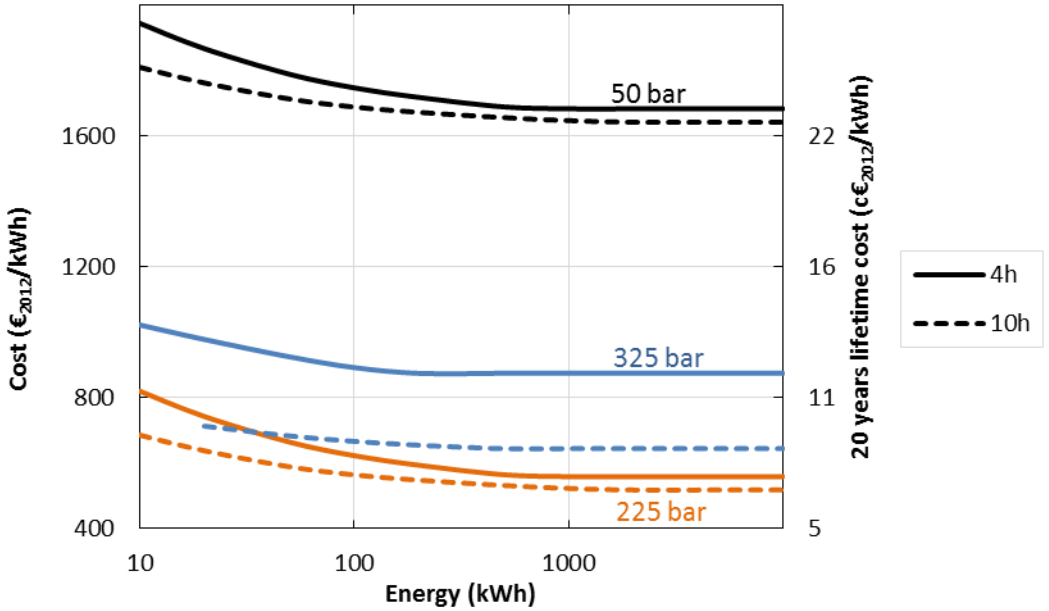


**Figure 1 – Investment and lifetime cost for a compressed air energy system considering the cost of the compressed air tank, the air compressor and the heat storage system. Values are depicted for 3 working pressures (50 to 325 bar) and 2 power-to-energy ratios (4h to 10h system).**

The characteristics obtained for these five systems are resumed in Figure 2.

| | | Lifetime cost (c€$_{2012}$/kWh) | | | | Mass (kg/kWh) | | | | Volume (l/kWh) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Energy (Wh) | | 2k | 10k | 100k | 1M | 2k | 10k | 100k | 1M | 2k | 10k | 100k | 1M |
| Technology | PHES | - | 72 | 58 | - | - | 37k | 37k | - | - | 37k | 37k | - |
| | CAES | - | 11 | 9 | 8 | - | 88 | 88 | 88 | - | 106 | 106 | 106 |
| | Hydrogen | - | 40 | 22 | 12 | - | 24 | 19 | 17 | - | 102 | 101 | 101 |
| | Lead acid flooded | 54 | 46 | 46 | 46 | 53 | 53 | 53 | 53 | 24 | 24 | 24 | 24 |
| | Lead acid sealed | 75 | 68 | 68 | 68 | 62 | 62 | 62 | 62 | 27 | 27 | 27 | 27 |
| | Lithium-ion | 22 | 22 | 22 | 22 | 14 | 14 | 14 | 14 | 9 | 9 | 9 | 9 |
| | Thermal | - | 0,9 | 0,6 | 0,4 | - | 14 | 14 | 14 | - | 14 | 14 | 14 |

**Figure 2 - Cost, mass and volume of energy storage technologies for a 4h system.**

From the results obtained, thermal storage reveals to be the best choice when the energy will be used for thermal purposes. For electricity storage, compressed air presents the lowest costs but given the lack of maturity of this technology, there is a low confidence in the results obtained. Ignoring compressed air, the most suitable technology for electricity storage is lithium-ion batteries.

For the second phase, which started in 2014, five case studies are being analyzed: a residence, a student residence, a university campus, an office building and a city neighborhood. The goal is to have a broad view of the application of energy storage systems for different types of buildings.

In the third phase, energy storage systems are intended to be developed, installed and tested in some of these sites.

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