

SERVE ENERGY MONITORING

Contract No.: TREN07/FP6EN/S07.71106/038382

SERVE Energy Week, 4th October 2012

Presented By:

Kaj Leonhart Petersen

ENERGY NSULTING NETWORK



SERVE Monitoring

- **Tipperary Energy Agency:** Development of Monitoring system, Data collection and data collection analysis
- **Episensor:** Supply and installation of monitoring system (hardware and software devices)
- **Energy Consulting Network:** Development of Monitoring system, Data Analysis
- The SERVE Energy monitoring system for retrofitted houses is financed by **Sustainable Energy Authority of Ireland (SEAI)** and **EU Concerto** (50% / 50%)

SERVE core project activities

- Retrofitting for Existing Houses and Buildings
 - Target 400 homes and 20 non-residential buildings
 - Reduce Energy Consumption by 30-40%
 - Increase use of renewables by 100%
- New Buildings
 - Build 132 highly efficient new buildings in eco-village
 - A new sustainable community
 - 100% Supply of Heat from Renewables
- Monitor what we do and prove results



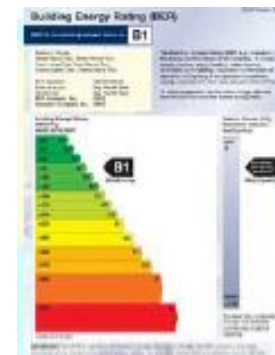
SERVE Monitoring Objectives

- Prove results - you cannot change what you cannot measure
- Monitor results towards targets
- Provide evidence for assumptions used for data modeling, e.g. BER
- Detailed knowledge of usage patterns
- Track and optimise the energy performance of the buildings and their occupants use of energy
 - using the results to advice homeowners (homeowner reports)



SERVE Targets

- Through upgrade programmes reduce energy consumption by **5,000 MWh**
- Through insulation, heating and lighting upgrades achieve average of C1 in 400 existing dwellings (from E1/E2)
- Install approx 400 renewable energy heating systems
- Develop 1,100kWth of biomass district heating
- Build 132 homes in the eco-village all heated by a biomass and solar district heating system
- CO2 savings of **3,880 Tonnes** annum



Challenges

- Designing a cost effective monitoring system which will
 - Allow comparison with DEAP
 - Provide valuable data on behavioural aspects
 - Allow data to be accessed easily by the homeowner and communicated cheaply
 - Link with EU Commission Requirements



The Monitoring Task of SERVE

ECO Village:

Buildings	Electricity	Monitored	From Nov. 2011	Hourly
		Bills	From 2010	Monthly
	Heating	Bills	From 2010	Monthly
		Manually reported (4 houses)	From Dec 2011	Daily
		Monitored	From June 2012	Every 10 min.
District Heating	Heat production	Manually reported	From Feb 2010	Daily
		Monitored	From June 2010	Every 10 min.
	Electricity	Manually reported	From Feb. 2010	Daily

The Monitoring Task of SERVE

Energy Performance Indicators:

- Impact of energy saving measures –
 - kWh & % Reduction in **heat consumption**: Heat energy delivered compared with baseline data
 - kWh & % Reduction in **electricity consumption**: Electricity delivered compared with baseline data
 - % Increase of share of **renewable energy sources** in fuel consumption
 - **CO2** reductions (Tonnes CO2)
 - **BER** before and after renovation (kWh/m²/yr)

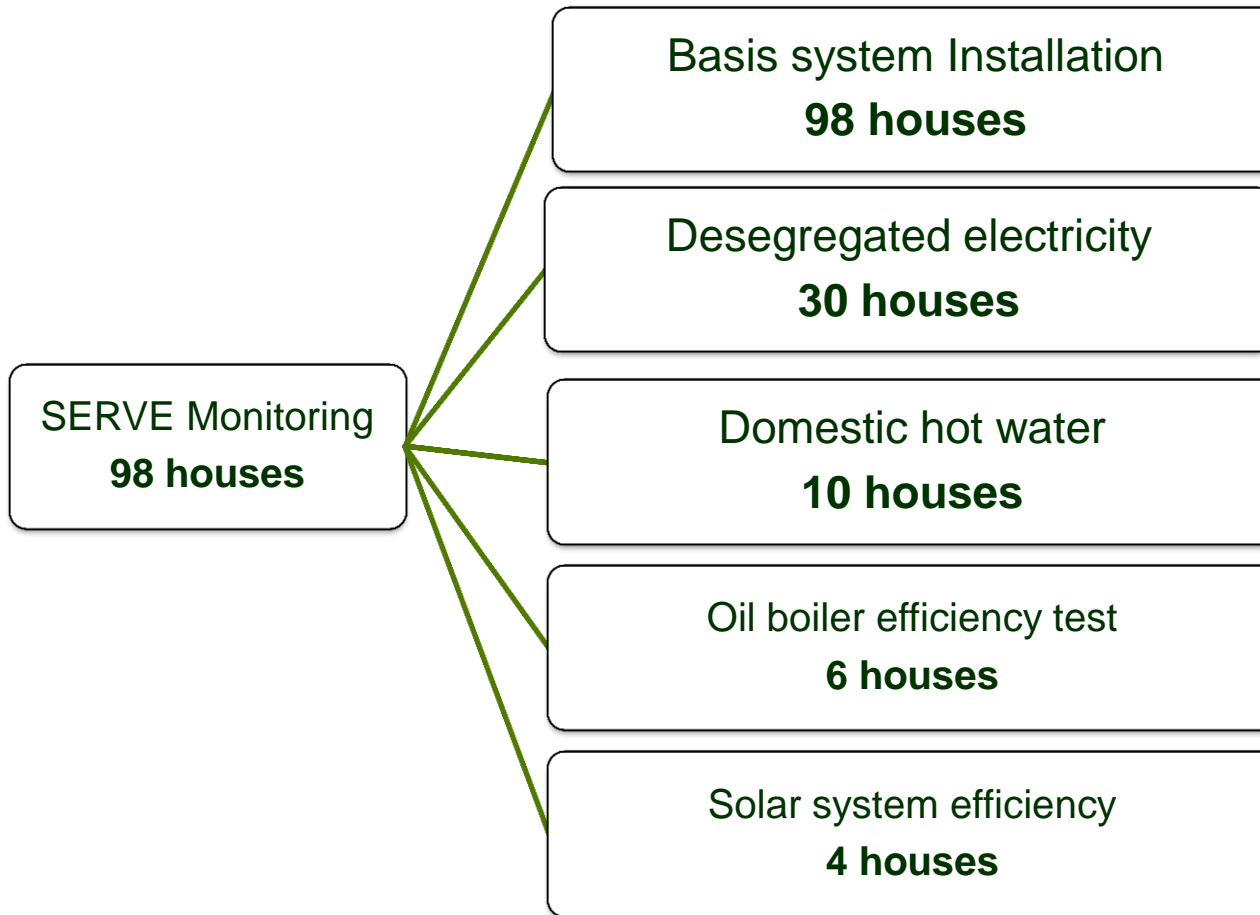


The Monitoring Task of SERVE

SEAI requirements:

- Energy performance of dwellings post upgrade
- Breakdown of Electricity use in a typical dwelling
- Examination of potential monitoring system for domestic hot water system
- Examination of verified boiler efficiency for condensing and non condensing boilers in a typical domestic setting
- Examination of yields of a small number of solar systems
- Examination of fuel use and frequency of use of secondary heating systems

SERVE Monitoring Sub Systems



Monitoring of retrofitted buildings

- Monitored data through meters and sensors installed in 98 houses (20 % of all houses)
- Monitored data only available for 2011/12 - therefore no baseline from monitored data
- Bill data Analysis:
 - To Establish the baseline for analysis
 - To provide fuel conversion factors for monitored data
 - The Bill data collected are: Oil Bill records, Electricity Bill records and Secondary Source Bills
- BER (Building Energy Rating) is calculated for all buildings, pre and post, using National energy rating software (DEAP)

Desegregated Electricity Houses

Measurement	Unit	Period	Comments
Three channel electricity meter	kWh	15 minutes	Can monitor three circuits in the domestic consumer unit
Three in-line single channel meters	kWh	15 minutes	Can be used on any three domestic electrical items

- Total Electrical energy use per annum, per month and per 24h period
- Electrical energy use per hour, day and annum for appliances

Measurements, Basic installations

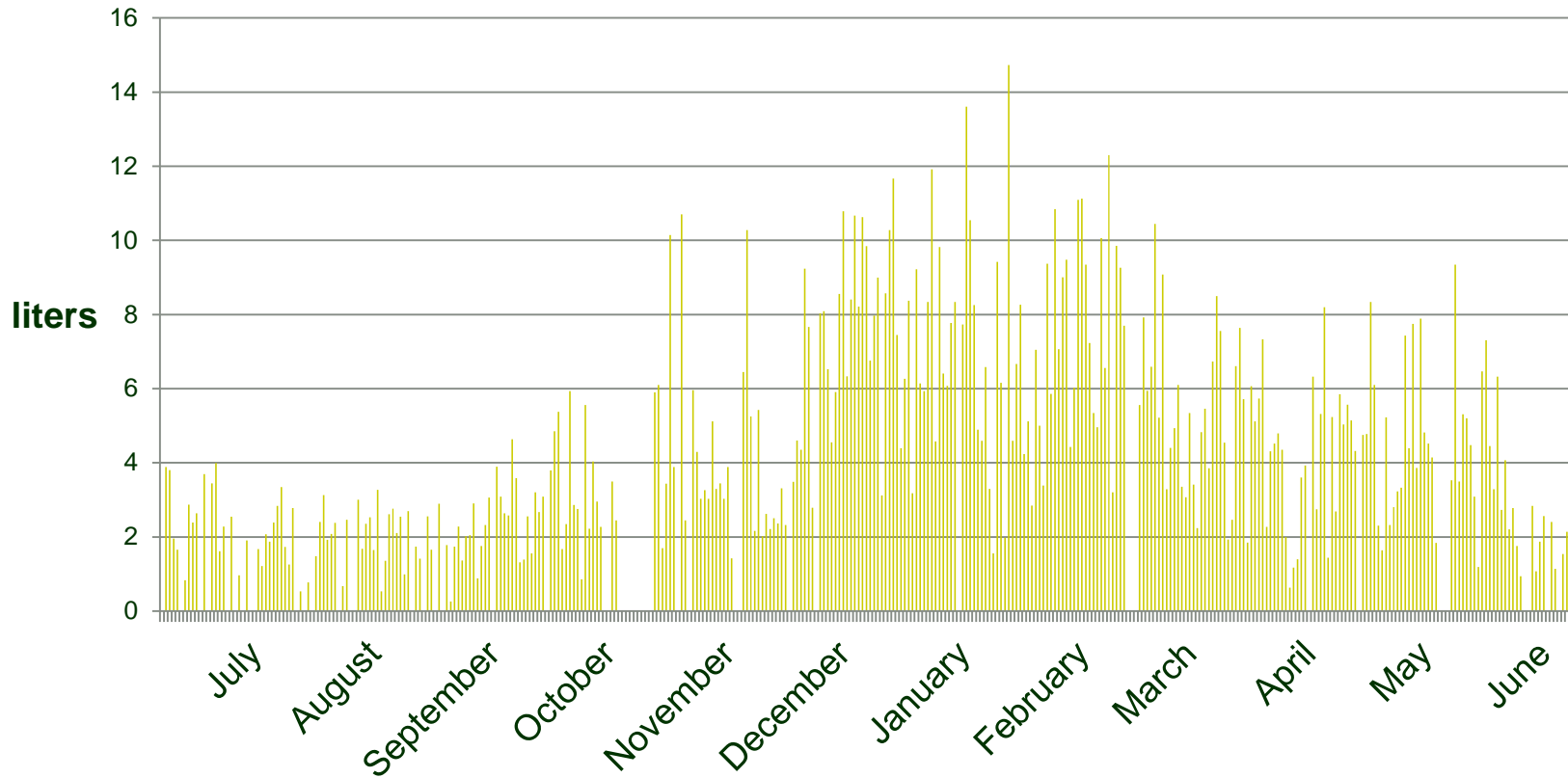
Measurement	Unit	Period
Electricity, oil burner	kWh	1 hour
Electricity, whole house	kWh	15 minutes
Temperature, secondary heating	°C	30 minutes
Temperature, remainder of house	°C	1 hour

Analysis	Conversion factor	
Oil bill analysis	l/kWh	litres of oil to equivalent in kWh
Secondary heat source analysis	kWh /lighting instance	Number of instances determined in relation to temperature, secondary heating

SERVE – Data for Building 566

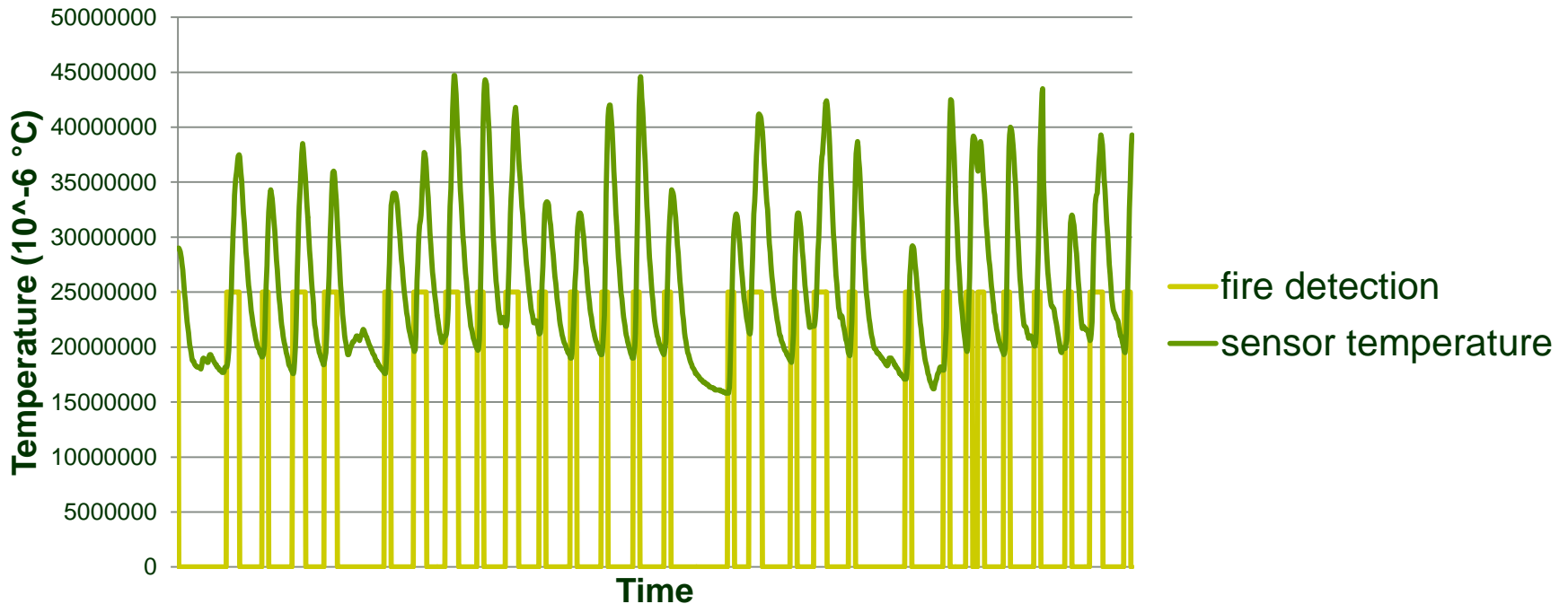
:

Boiler oil consumption



SERVE – Data for Building 566

November 2011 fire detection

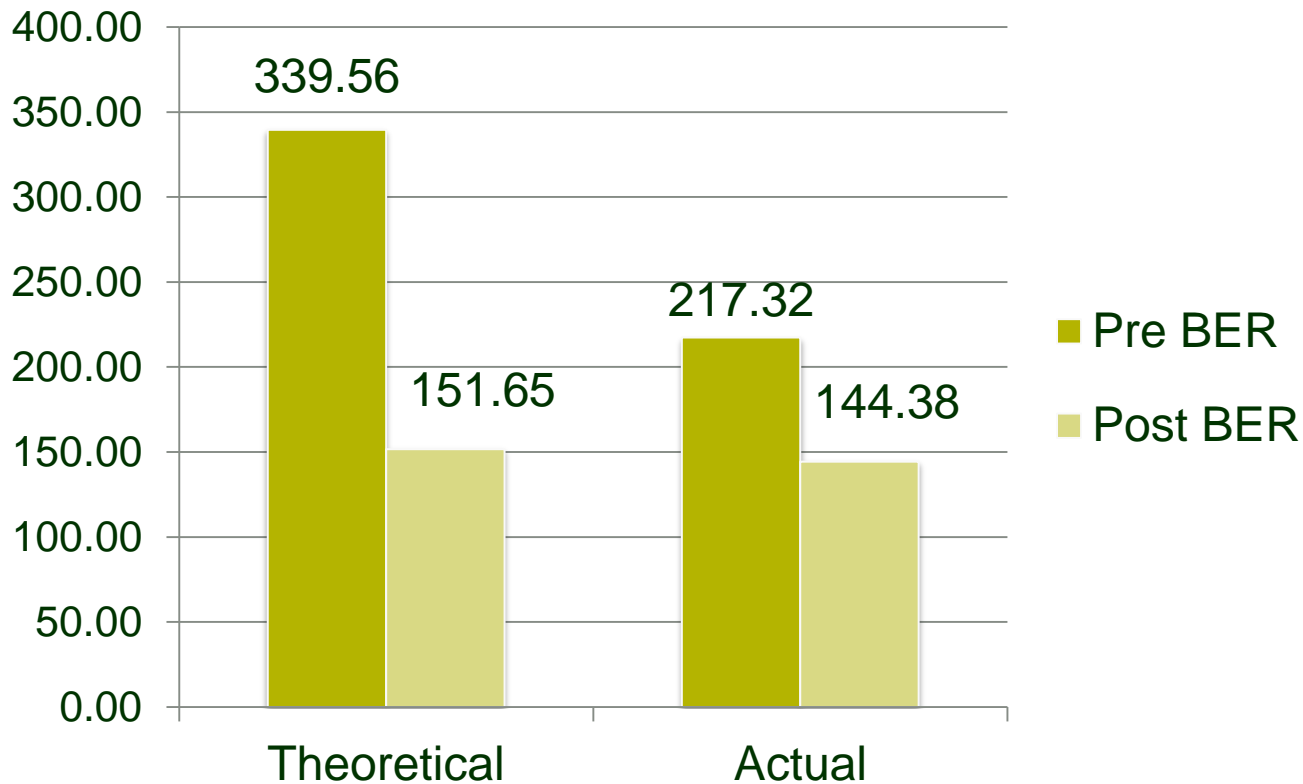


Number of fire appliances 2011/2012: **268 times**

- in average using 34,5 kWh of fuel = in total 9,244 kWh/year

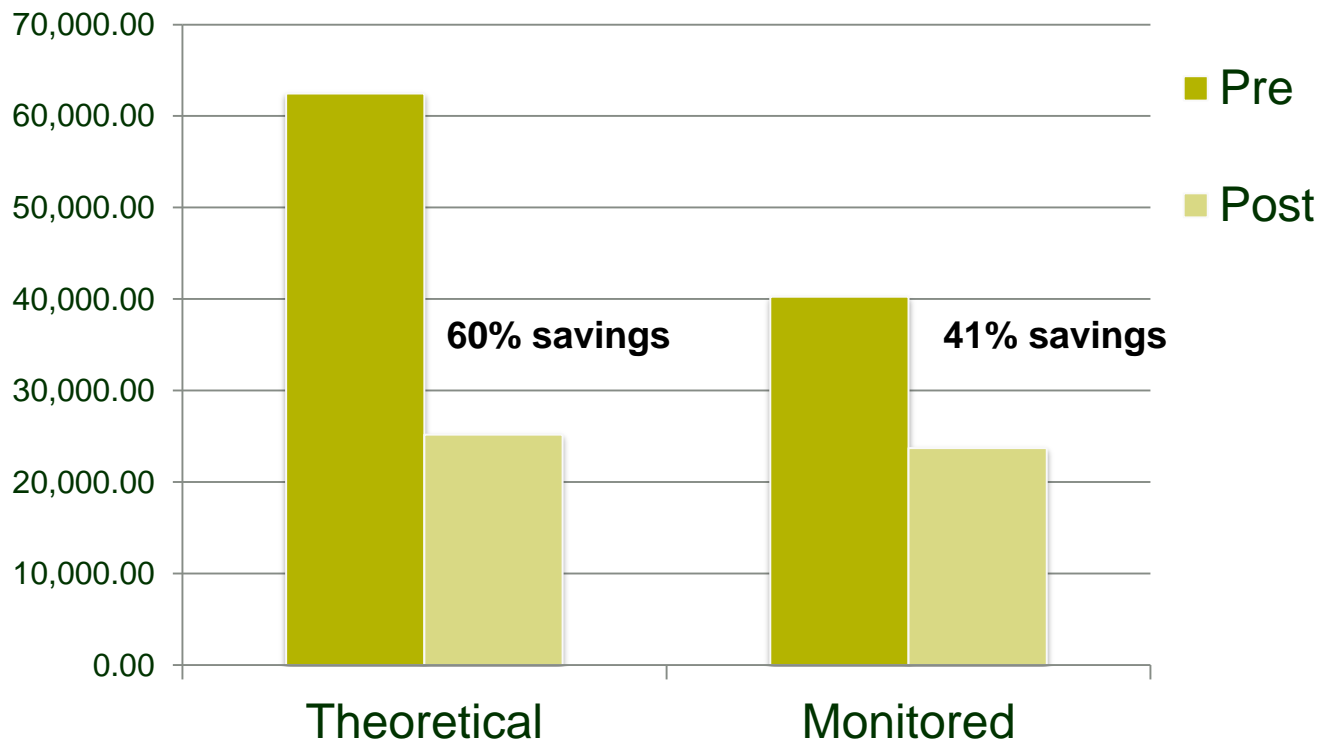
SERVE – Data for Building 566

BER - Kwh/m2/year



SERVE – Data for Building 566

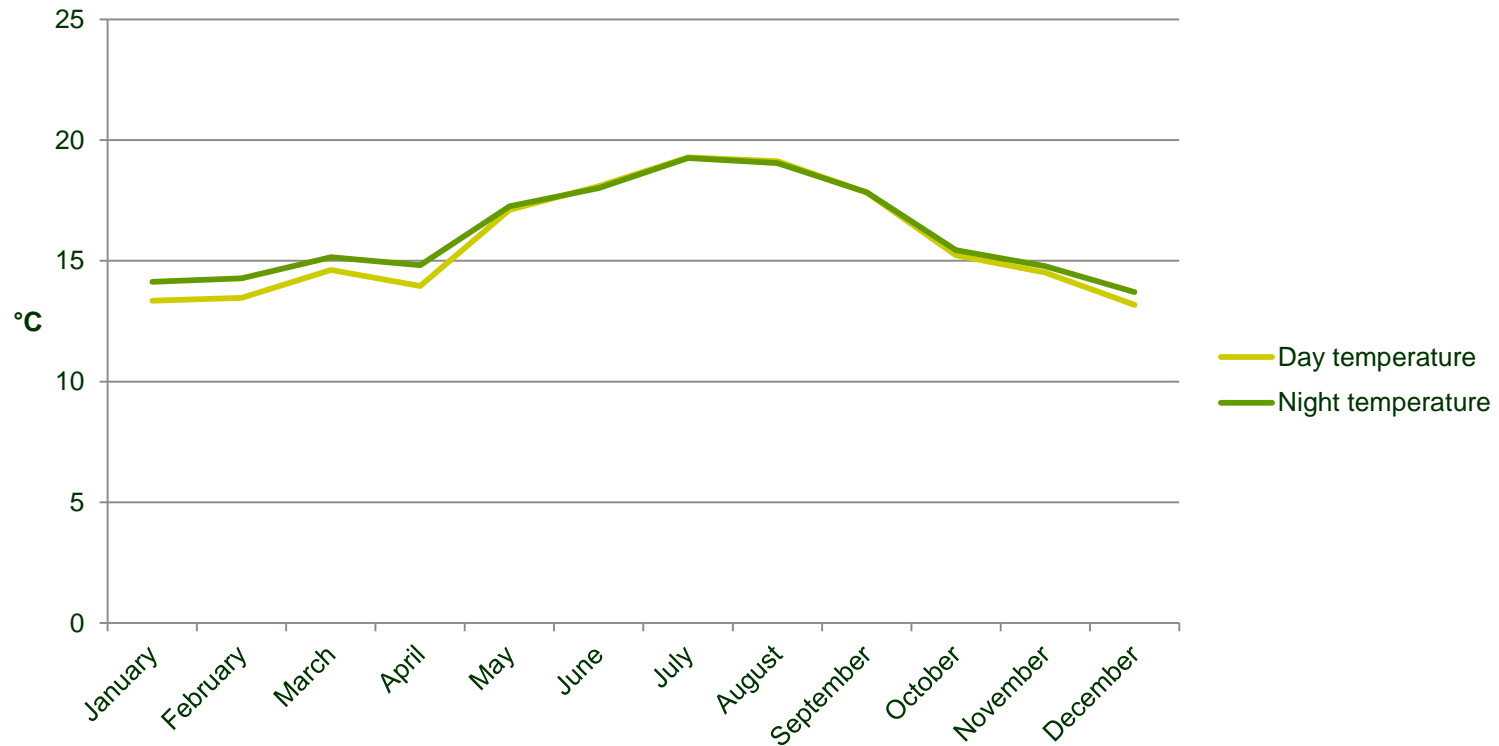
Fuel consumption (kWh/year)



SERVE – Data for Building 566

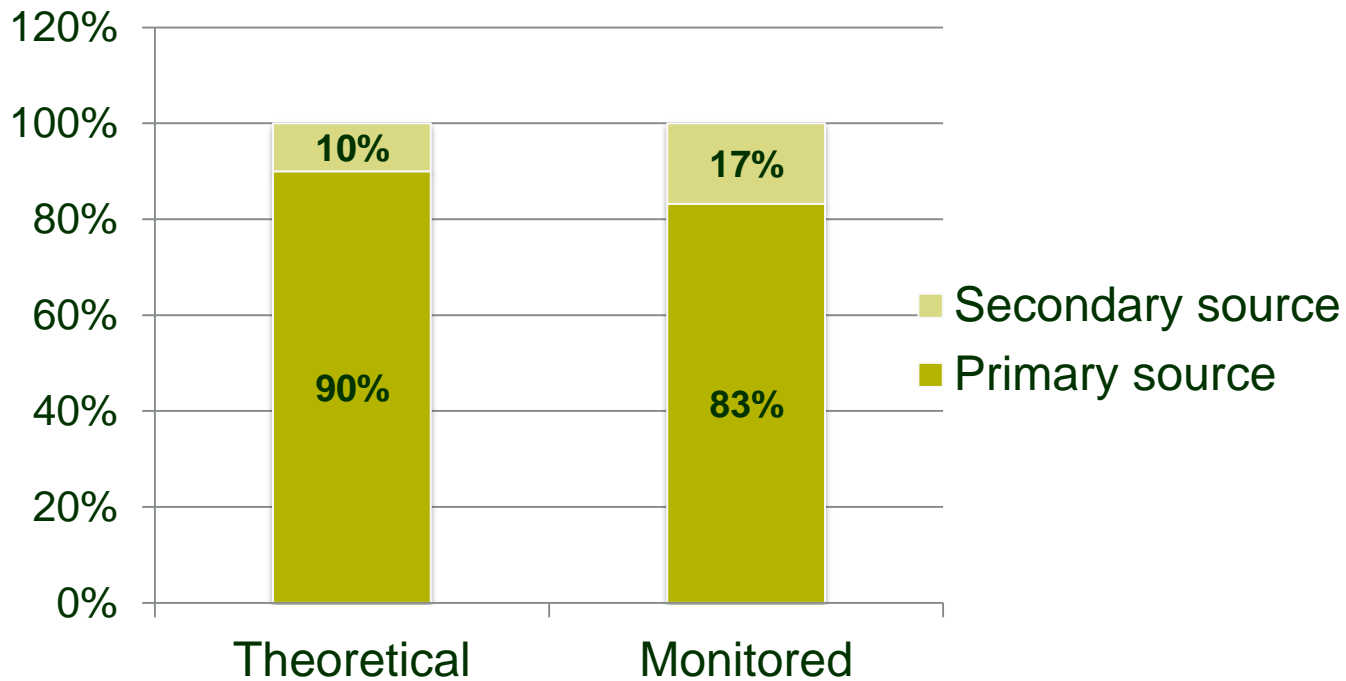
:

Average months temperature (day and night)



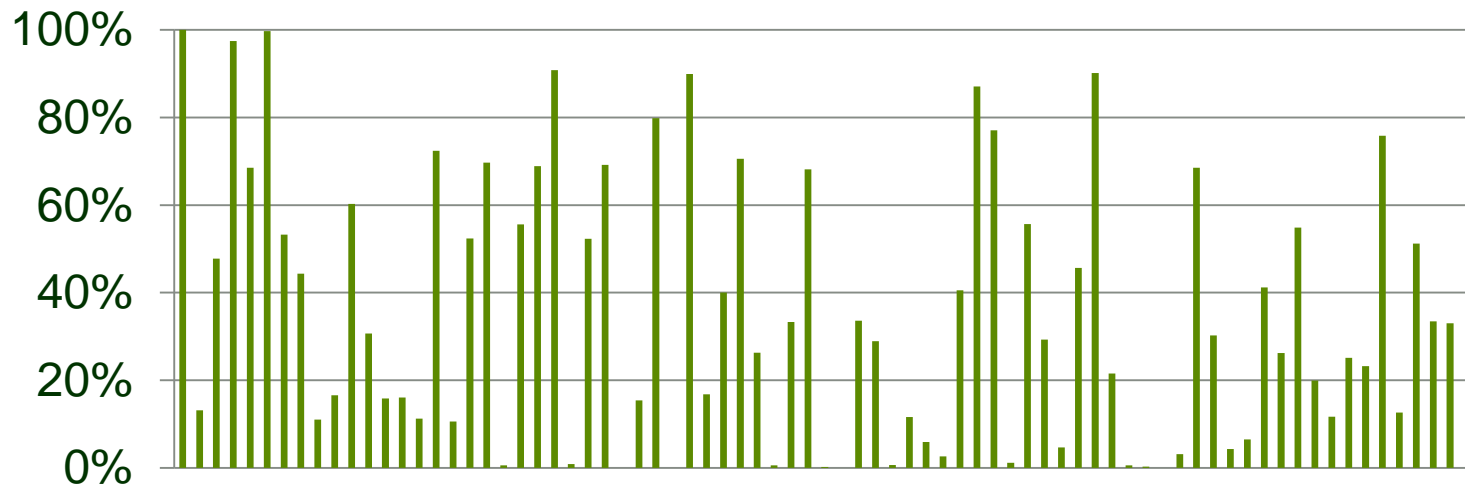
SERVE – Data for Building 566

Distribution between energy sources (heat load)



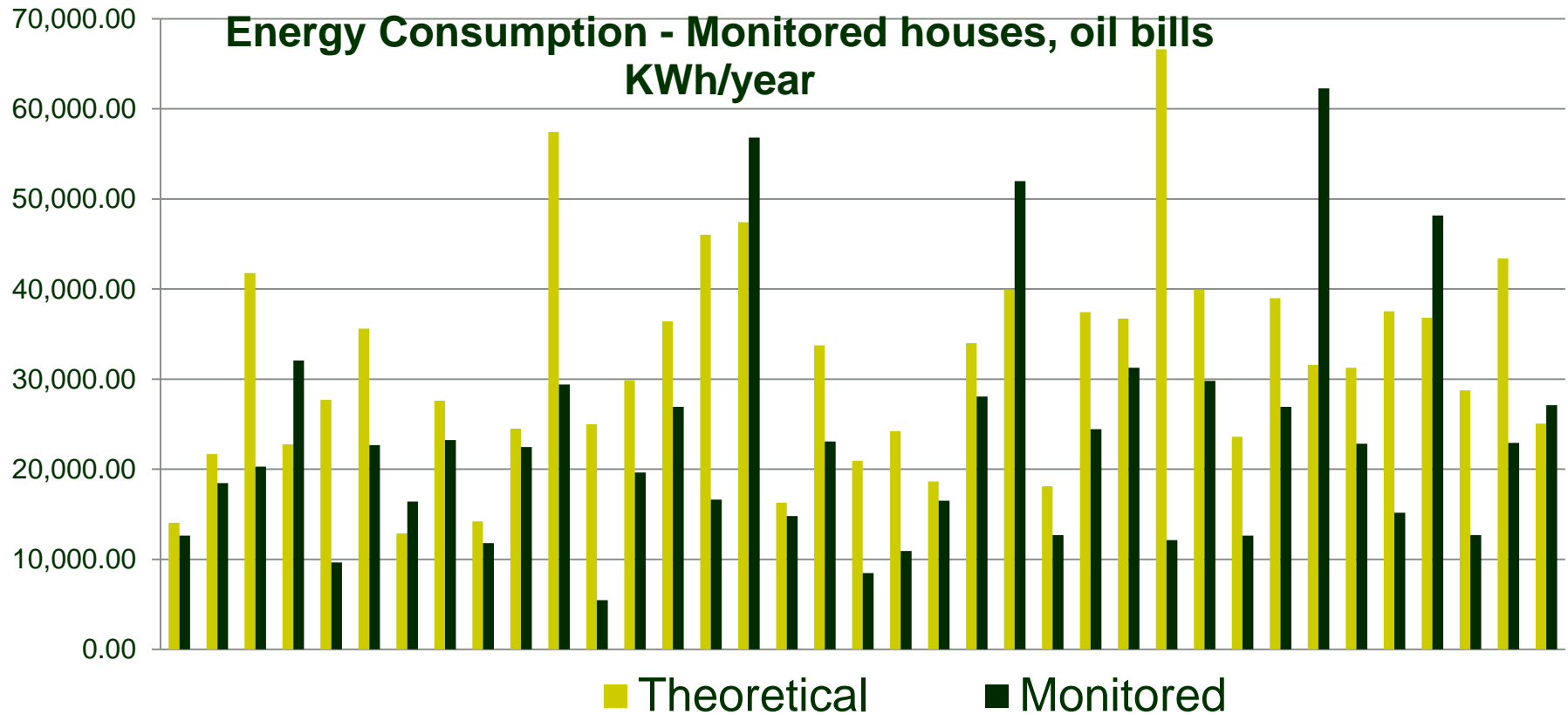
SERVE Monitoring System

Proportion of secondary source (heat load) 76 monitored houses



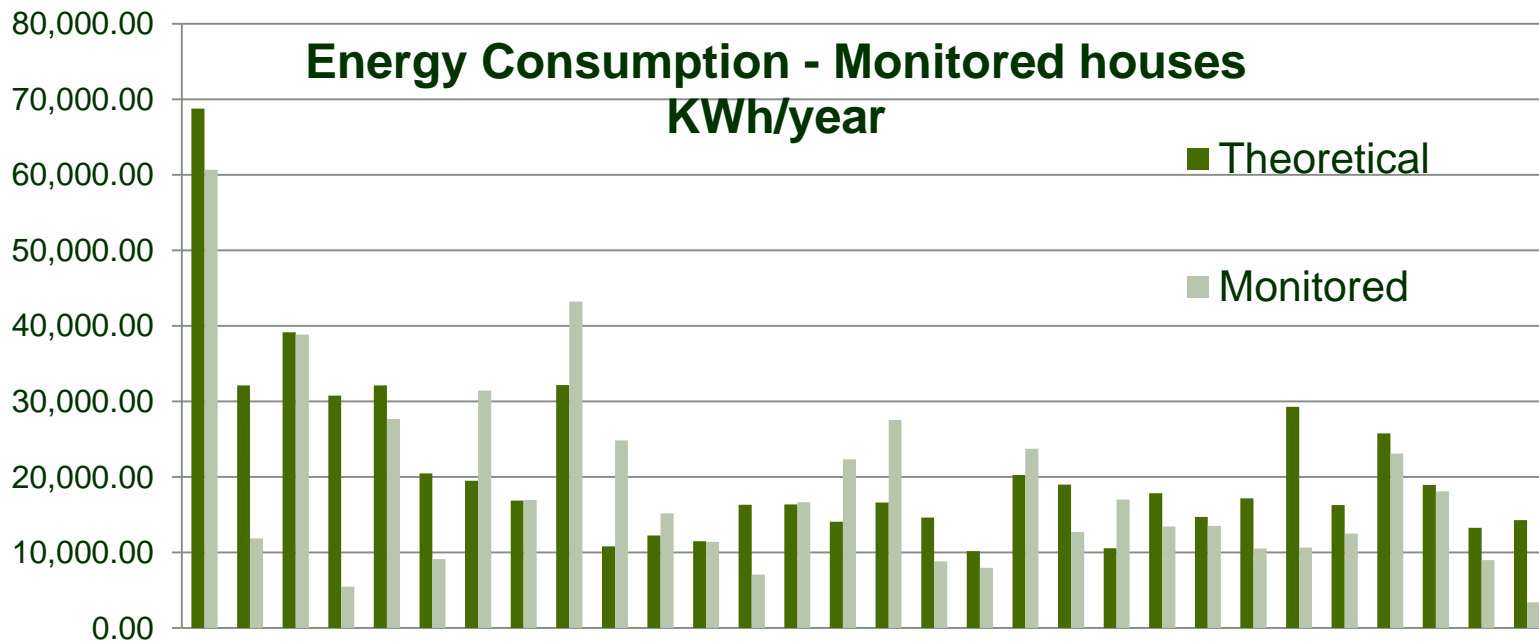
Average is 35%

SERVE Monitoring System



Monitored data are on average 33% lower

SERVE Monitoring System



Monitored data are on average 13% lower