
# Introduction to Exercise 1: energy demand

ECREEE Regional Training of Trainers Workshop:
HOMER software for RE project design

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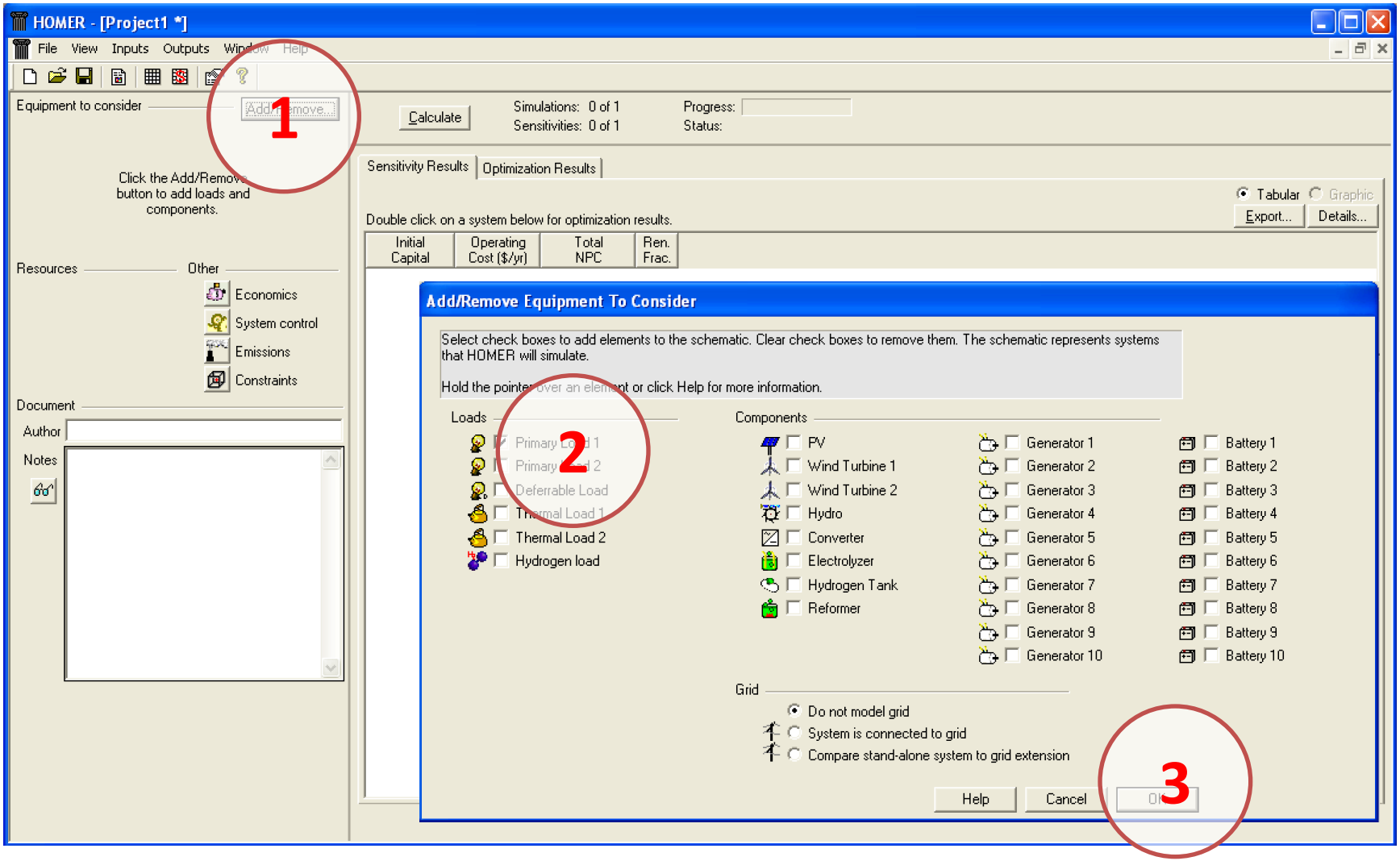
# ENERGY DEMAND

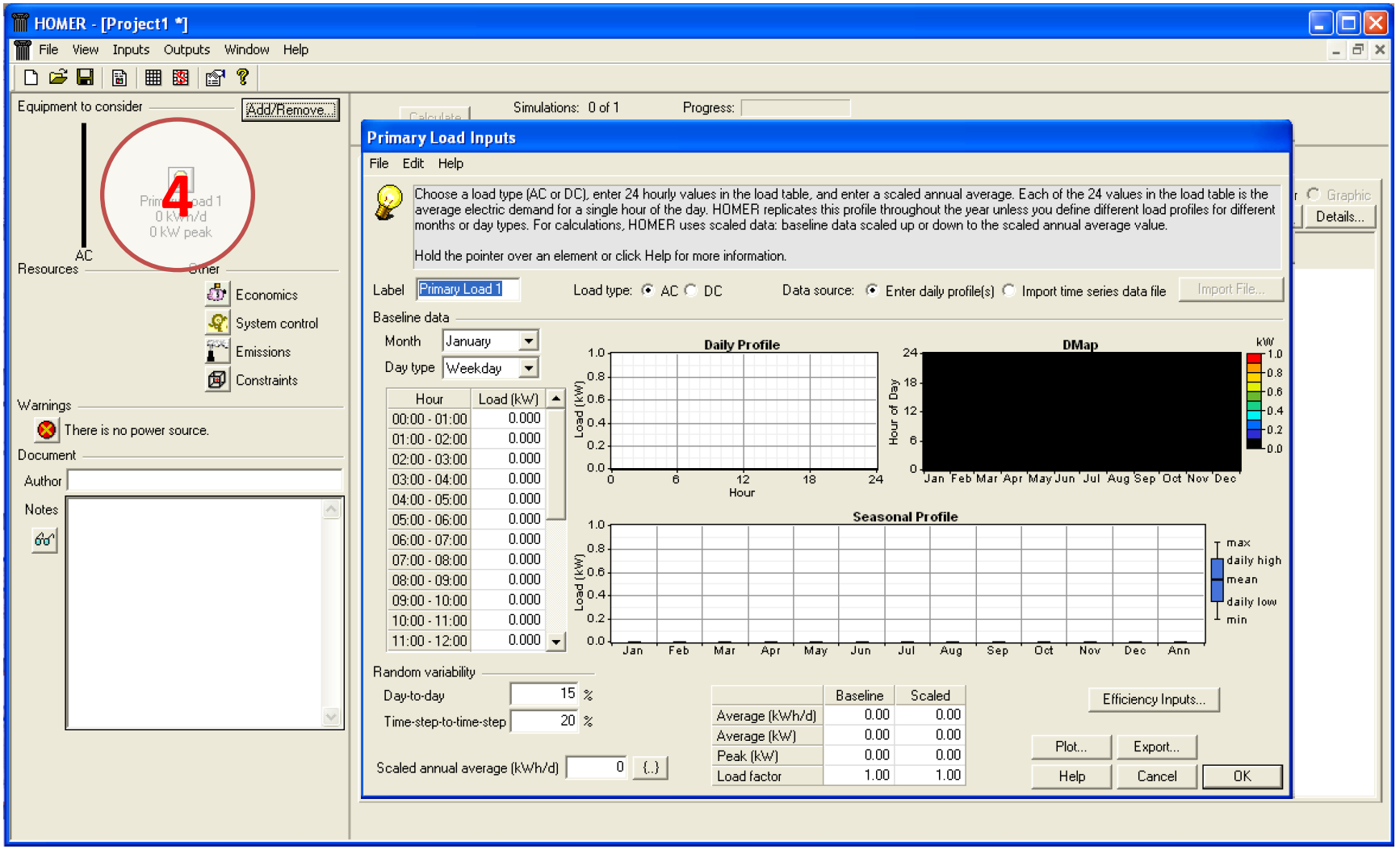
Elaborate an aggregated daily load profile from an existing energy demand, and input the load profile into a HOMER file

# Energy Demand

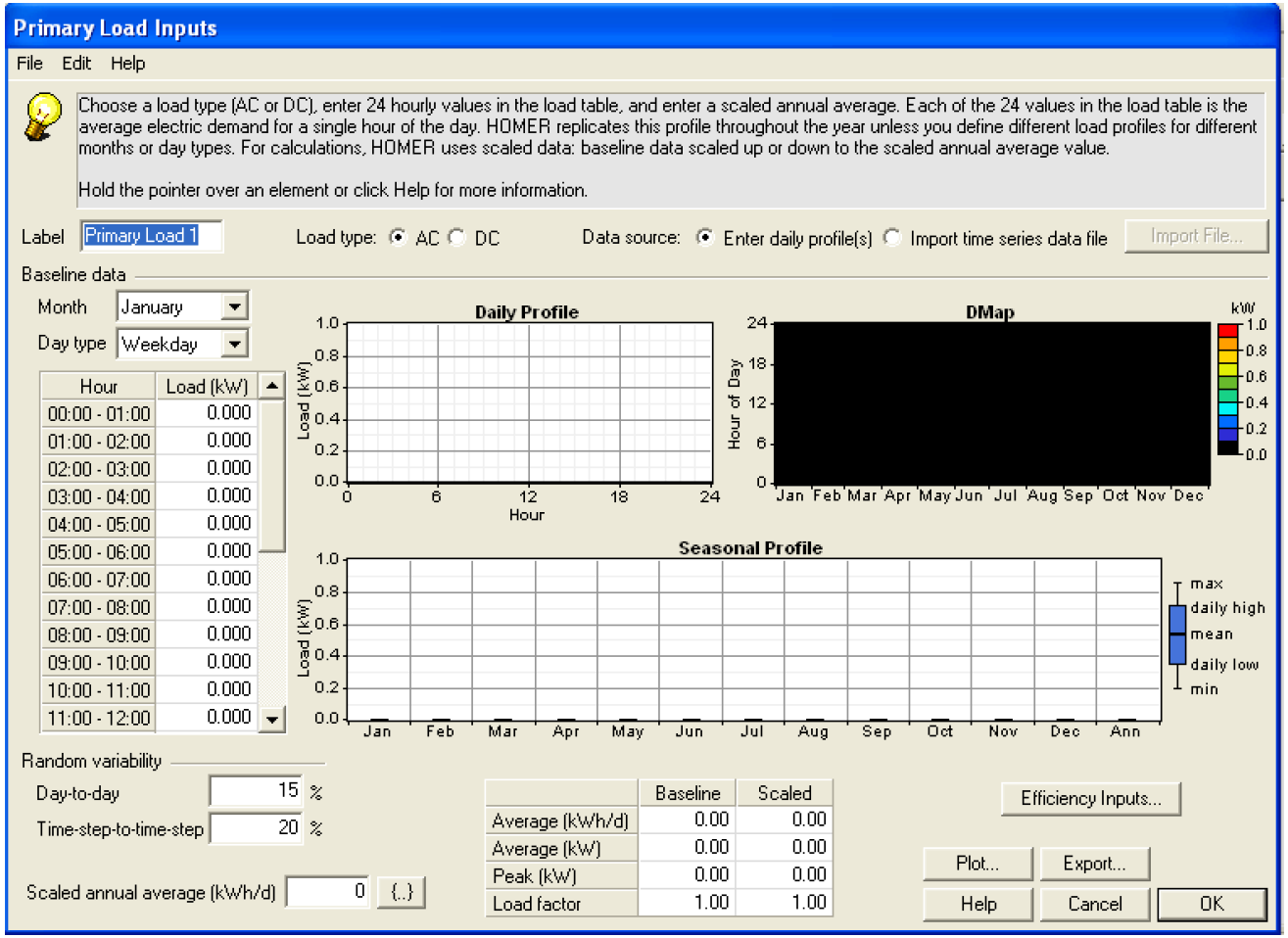
"PRIMARY LOAD INPUTS"

Description of the interface to input the ENERGY DEMAND in HOMER Software


HOMER - [Project1 *]
File View Inputs Outputs Window Help
Equipment to consider
Add/Remove
1
Calculate
Simulations: 0 of 1
Sensitivities: 0 of 1
Progress:
Status:
Click the Add/Remove button to add loads and components.
Sensitivity Results
Optimization Results
Tabular
Graphic
Export...
Details...
Double click on a system below for optimization results.
Initial Capital
Operating Cost ($/yr)
Total NPC
Ren. Frac.
Resources
Other
Economics
System control
Emissions
Constraints
Document
Author
Notes
Add/Remove Equipment To Consider
Select check boxes to add elements to the schematic. Clear check boxes to remove them. The schematic represents systems that HOMER will simulate.
Hold the pointer over an element or click Help for more information.
Loads
2
Primary Load 1
Primary Load 2
Deferrable Load
Thermal Load 1
Thermal Load 2
Hydrogen load
Components
PV
Wind Turbine 1
Wind Turbine 2
Hydro
Converter
Electrolyzer
Hydrogen Tank
Reformer
Generator 1
Generator 2
Generator 3
Generator 4
Generator 5
Generator 6
Generator 7
Generator 8
Generator 9
Generator 10
Battery 1
Battery 2
Battery 3
Battery 4
Battery 5
Battery 6
Battery 7
Battery 8
Battery 9
Battery 10
Grid
Do not model grid
System is connected to grid
Compare stand-alone system to grid extension
Help
Cancel
OK
3

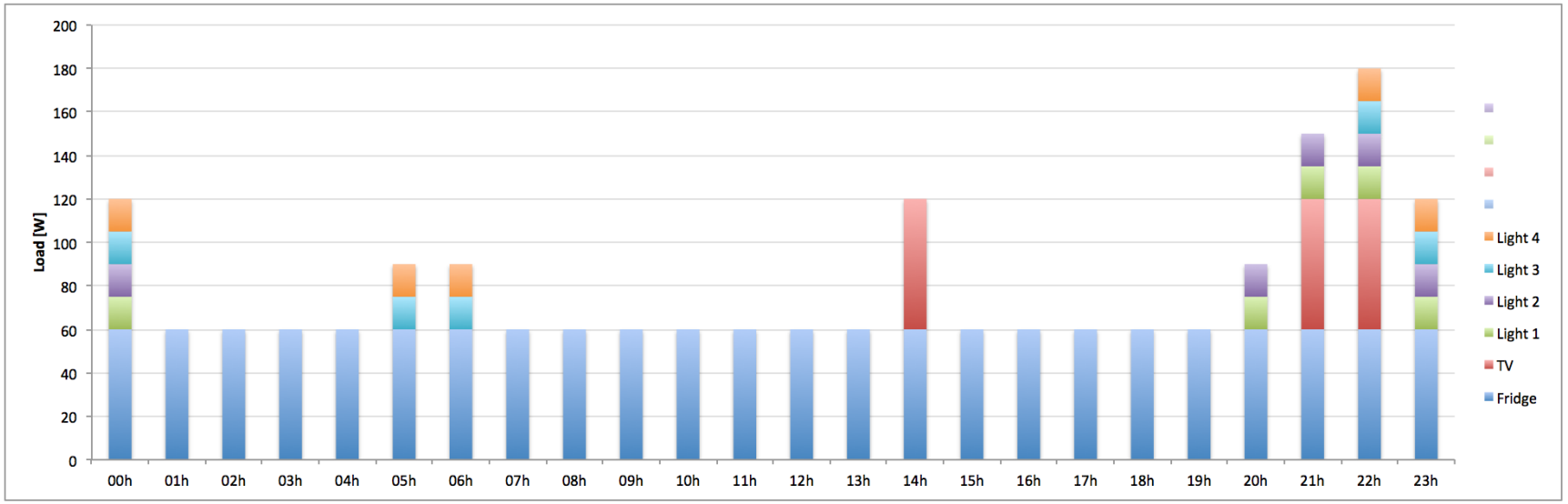

HOMER - [Project1 *]
File View Inputs Outputs Window Help
Equipment to consider
Add/Remove
Simulations: 0 of 1
Progress:
Primary Load Inputs
File Edit Help
Choose a load type (AC or DC), enter 24 hourly values in the load table, and enter a scaled annual average. Each of the 24 values in the load table is the average electric demand for a single hour of the day. HOMER replicates this profile throughout the year unless you define different load profiles for different months or day types. For calculations, HOMER uses scaled data: baseline data scaled up or down to the scaled annual average value.
Hold the pointer over an element or click Help for more information.
Label
Primary Load 1
Load type: AC DC
Data source: Enter daily profile(s) Import time series data file
Import File...
Baseline data
Month
January
Day type
Weekday
Hour
Load (kW)
00:00 - 01:00 0.000
01:00 - 02:00 0.000
02:00 - 03:00 0.000
03:00 - 04:00 0.000
04:00 - 05:00 0.000
05:00 - 06:00 0.000
06:00 - 07:00 0.000
07:00 - 08:00 0.000
08:00 - 09:00 0.000
09:00 - 10:00 0.000
10:00 - 11:00 0.000
11:00 - 12:00 0.000
Daily Profile
Load (kW)
Hour
DMap
Hour of Day
kW
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Seasonal Profile
max
daily high
mean
daily low
min
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Ann
Random variability
Day-to-day 15 %
Time-step-to-time-step 20 %
Scaled annual average (kWh/d) 0 {..}
Baseline Scaled
Average (kWh/d) 0.00 0.00
Average (kW) 0.00 0.00
Peak (kW) 0.00 0.00
Load factor 1.00 1.00
Efficiency Inputs...
Plot... Export...
Help Cancel OK
Resources
Other
Economics
System control
Emissions
Constraints
Warnings
There is no power source.
Document
Author
Notes
Graphic
Details...
AC
0 kWh/d
0 kW peak

# Check the interface and variables
# Primary Load Inputs



# Load profile for one user

# How to create a daily load profile?

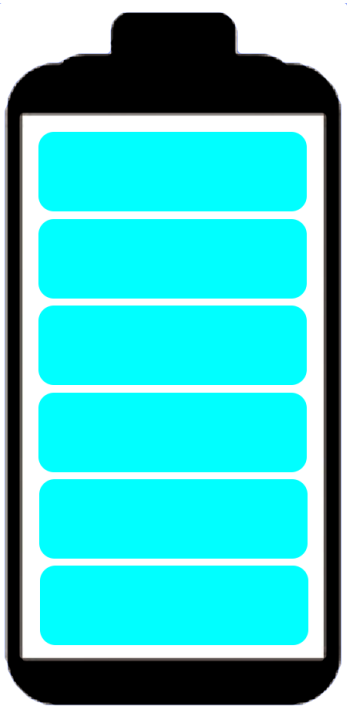



| HOURLY LOAD [W] | 00h | 01h | 02h | 03h | 04h | 05h | 06h | 07h | 08h | 09h | 10h | 11h | 12h | 13h | 14h | 15h | 16h | 17h | 18h | 19h | 20h | 21h | 22h | 23h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fridge | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| TV | | | | | | | | | | | | | | | 60 | | | | | | | 60 | 60 | |
| Light 1 | 15 | | | | | | | | | | | | | | | | | | | | 15 | 15 | 15 | 15 |
| Light 2 | 15 | | | | | | | | | | | | | | | | | | | | 15 | 15 | 15 | 15 |
| Light 3 | 15 | | | | | 15 | 15 | | | | | | | | | | | | | | | | 15 | 15 |
| Light 4 | 15 | | | | | 15 | 15 | | | | | | | | | | | | | | | | 15 | 15 |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| TOTAL [W] | 120 | 60 | 60 | 60 | 60 | 90 | 90 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 120 | 60 | 60 | 60 | 60 | 60 | 90 | 150 | 180 | 120 |

# Storage: Energy Daily Allowance and Demand Factor

- In order to aggregate the users' demand we have to introduce **energy demand management concepts and a corrector factor**.
  - Normally hybrid energy systems use storage of energy, in order to fulfill the energy demand when the stochastic energy resources are not available
  - The energy of the system is a finite resource (since it is stored in a finite "tank")
  - Every user may contract an amount of energy (related to the tariff) in kWh: Energy Daily Allowance
  - Not all the users are going to consume the 100% of their Energy Daily Allowance
  - So, the real daily energy demand that we use to dimension an hybrid system is scaled-down by a Demand Factor.

# “Water Tank Example”



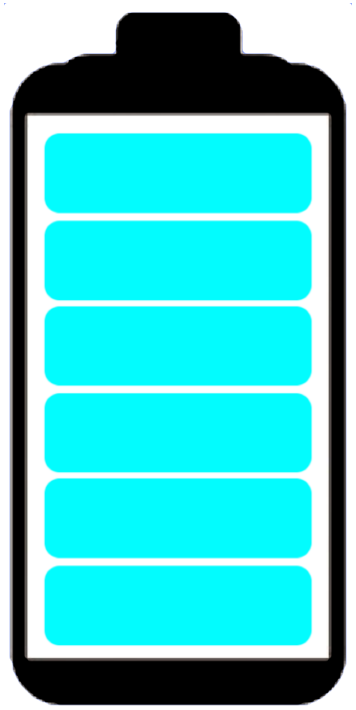
*Source: TTA*

# “Water Tank Example”

2000 Wh

2000 Wh

2000 Wh



6,000 Wh

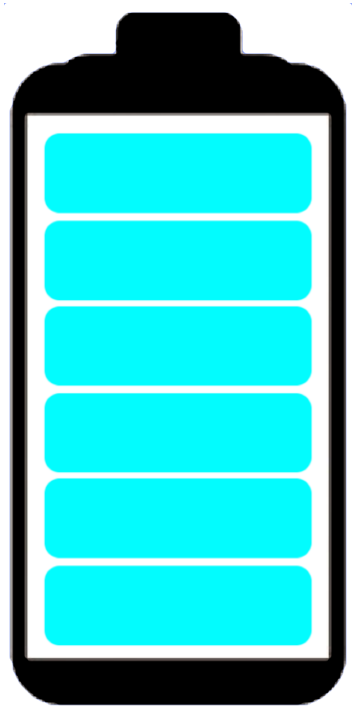
# “Water Tank Example” (100% daily consumption)

EX. 1

2000 Wh

2000 Wh

2000 Wh



6,000 Wh

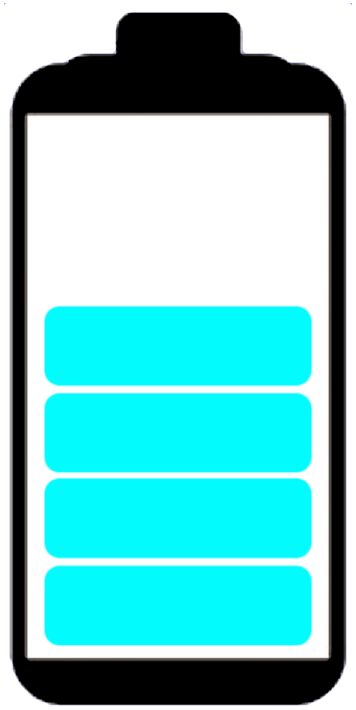
User 1

User 2

User 3

# “Water Tank Example” (100% daily consumption)

EX. 1



2000 Wh

2000 Wh

4,000 Wh

2000 Wh

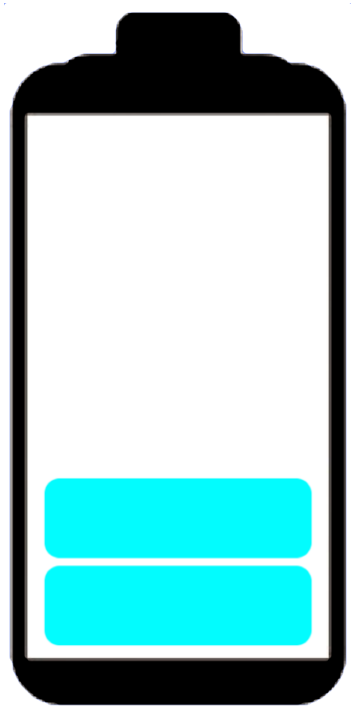
User 1

User 2

User 3

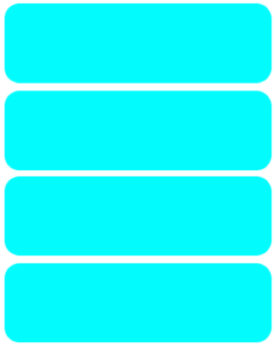
# “Water Tank Example” (100% daily consumption)

EX. 1



2000 Wh

2,000 Wh



2000 Wh

User 1

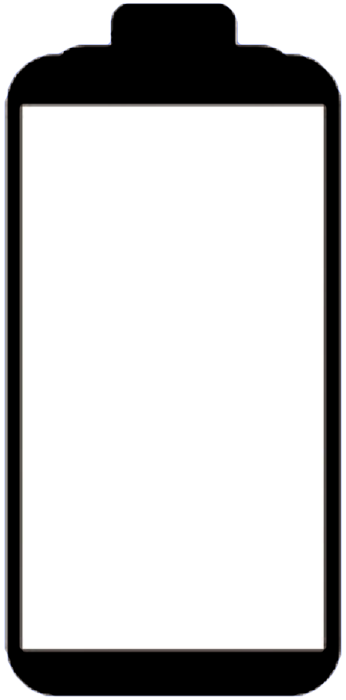
2000 Wh

User 2

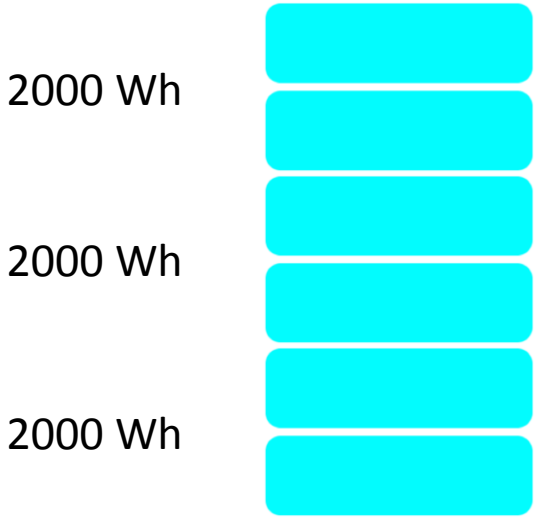
User 3

# “Water Tank Example” (100% daily consumption)

EX. 1



0,000 Wh




100% of consumption was 6,000Wh
The users consumed 100% of the daily energy available

# Reflection on variability in energy consumption

- As humans, our activities and needs are not exactly the same from day-to-day.
- So, it is “probable”, from day-to-day, not to consume the same amount of energy (80%, 93%, 100%, 91%, 99% …).
- Since our collective behavior is not an exact equation, it is “probable” that not all the users behave the same way.
- So, we can set the hypothesis that some users will not consume the 100% of their own Energy Daily Allowance during a day.

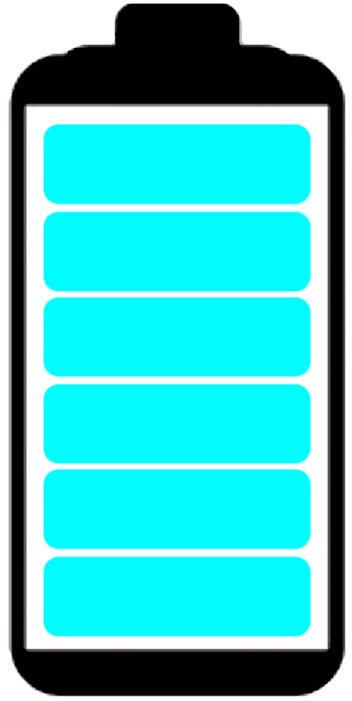
# “Water Tank Example” (**REAL** daily consumption)

EX. 2

2000 Wh

2000 Wh

2000 Wh



6,000 Wh

User 1

User 2

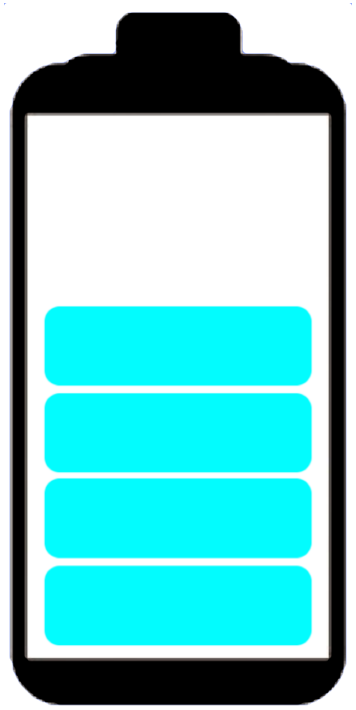
User 3

# “Water Tank Example” (**REAL** daily consumption)

EX. 2

2000 Wh

2000 Wh



6,000 Wh

2000 Wh

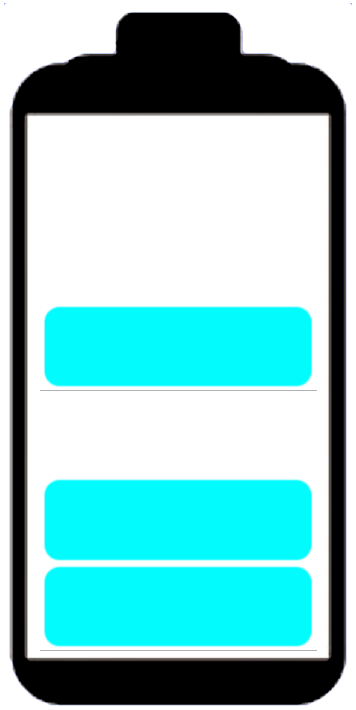
User 1

User 2

User 3

# “Water Tank Example” (**REAL** daily consumption)

EX. 2



1000 Wh

2000 Wh

6,000 Wh

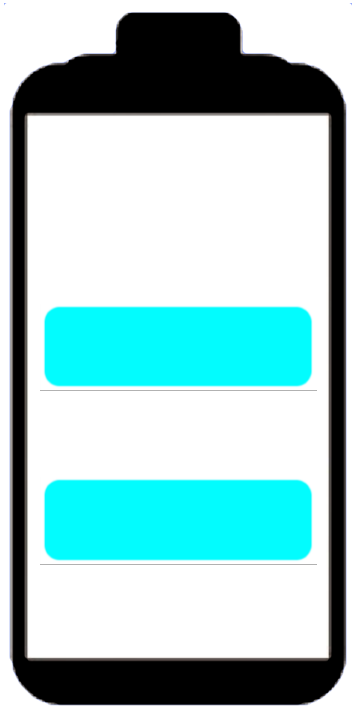
2000 Wh — User 1

1000 Wh — User 2

User 3

# “Water Tank Example” (**REAL** daily consumption)

EX. 2



1000 Wh

1000 Wh

2,000 Wh

2000 Wh — User 1

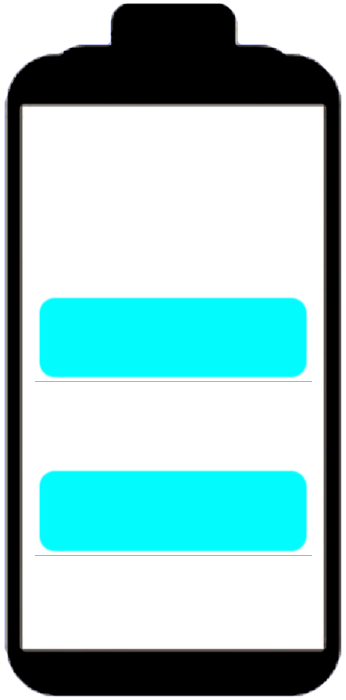
1000 Wh — User 2

1000 Wh — User 3

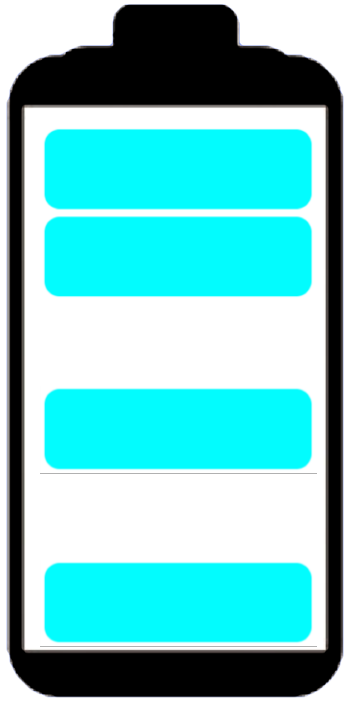
100% of consumption would be 6,000Wh but
the users consumed 67% of the daily energy available

# “Water Tank Example” (**REAL** daily consumption)

EX. 2



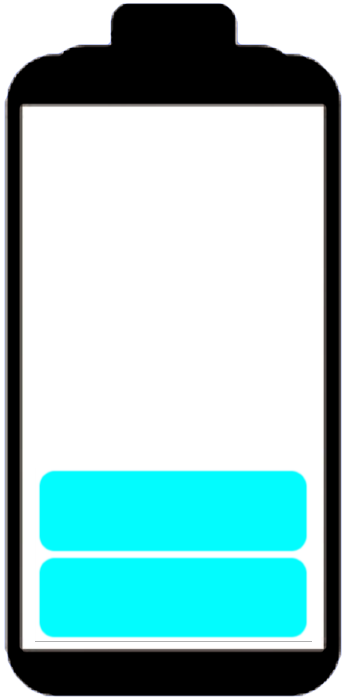
2,000 Wh



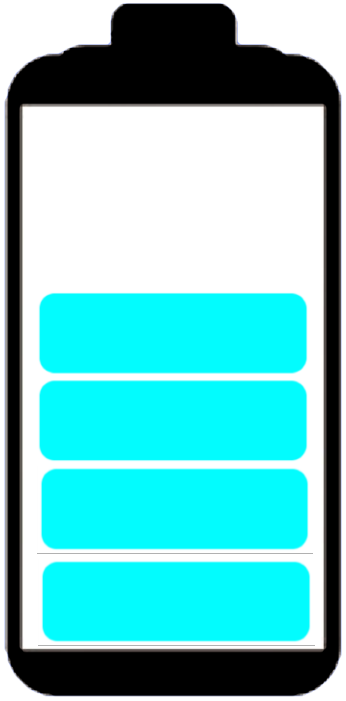

4,000 Wh

# “Water Tank Example” (**REAL** daily consumption)

EX. 2



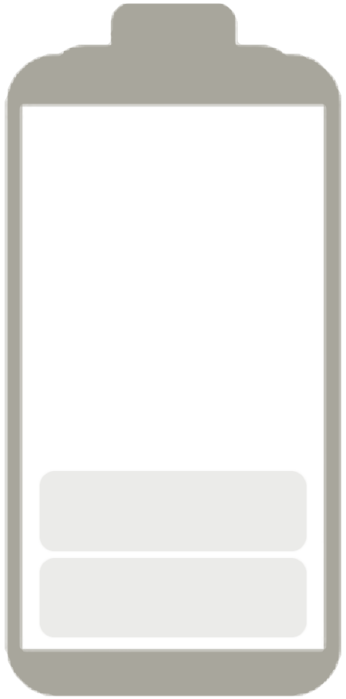
DAILY REMAINS

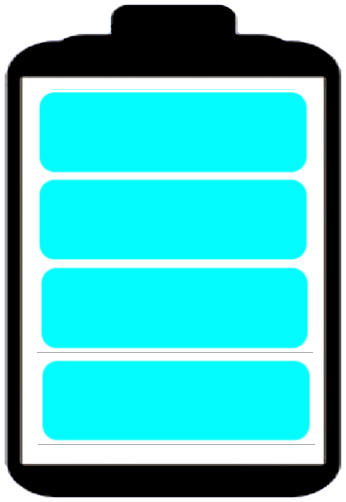


REAL DAILY CONSUMPTION

# “Water Tank Example” (**REAL** daily consumption)

EX. 2





2,000 Wh
6,000 Wh

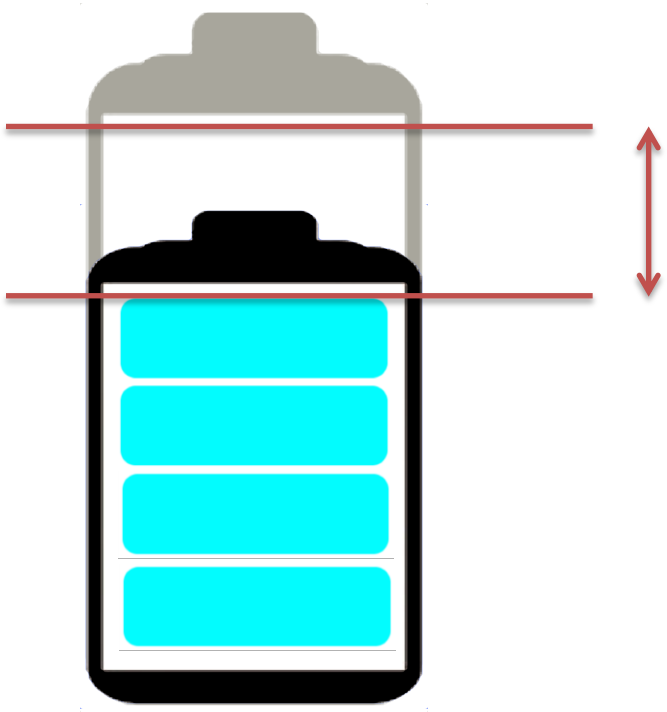
DEMAND FACTOR = 0,67

4000/6000 = 0,67

4,000 Wh

# “Water Tank Example” (**REAL** daily consumption)

EX. 2



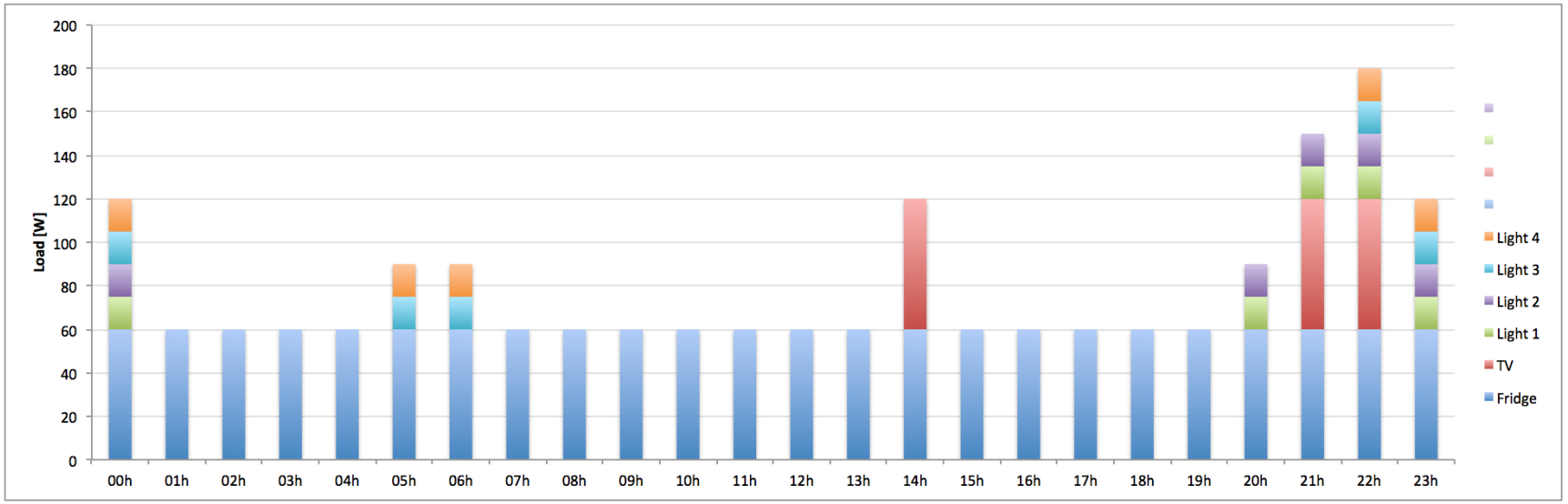
DEMAND FACTOR = 0,67

With a corrected size of the Energy Demand input, we optimize the size of the Hybrid Energy System and will fulfill the users needs.

# From one user to many users

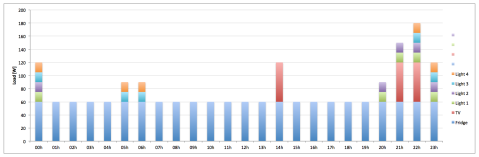
Aggregated daily load profile

# One user consumption




| HOURLY LOAD [W] | 00h | 01h | 02h | 03h | 04h | 05h | 06h | 07h | 08h | 09h | 10h | 11h | 12h | 13h | 14h | 15h | 16h | 17h | 18h | 19h | 20h | 21h | 22h | 23h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fridge | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| TV | | | | | | | | | | | | | | | 60 | | | | | | | 60 | 60 | |
| Light 1 | 15 | | | | | | | | | | | | | | | | | | | | 15 | 15 | 15 | 15 |
| Light 2 | 15 | | | | | | | | | | | | | | | | | | | | 15 | 15 | 15 | 15 |
| Light 3 | 15 | | | | | 15 | 15 | | | | | | | | | | | | | | | | 15 | 15 |
| Light 4 | 15 | | | | | 15 | 15 | | | | | | | | | | | | | | | | 15 | 15 |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| TOTAL [W] | 120 | 60 | 60 | 60 | 60 | 90 | 90 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 120 | 60 | 60 | 60 | 60 | 60 | 90 | 150 | 180 | 120 |

# Total users consumption vs. total demand



| HOURLY LOAD [W] | 00h | 01h | 02h | 03h | 04h | 05h | 06h | 07h | 08h | 09h | 10h | 11h | 12h | 13h | 14h | 15h | 16h | 17h | 18h | 19h | 20h | 21h | 22h | 23h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fridge | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| TV | | | | | | | | | | | | | | | 60 | | | | | | | 60 | 60 | |
| Light 1 | 15 | | | | | | | | | | | | | | | | | | | | 15 | 15 | 15 | 15 |
| Light 2 | 15 | | | | | | | | | | | | | | | | | | | | 15 | 15 | 15 | 15 |
| Light 3 | 15 | | | | | 15 | 15 | | | | | | | | | | | | | | | | 15 | 15 |
| Light 4 | 15 | | | | | 15 | 15 | | | | | | | | | | | | | | | | 15 | 15 |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| TOTAL [W] | 120 | 60 | 60 | 60 | 60 | 90 | 90 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 120 | 60 | 60 | 60 | 60 | 60 | 90 | 150 | 180 | 120 |

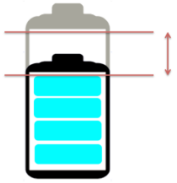
| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of users | 117 | | | | | | | | | | | | | | | | | | | | | | | |
| TOTAL USERS [kW] | 14,04 | 7,02 | 7,02 | 7,02 | 7,02 | 10,53 | 10,53 | 7,02 | 7,02 | 7,02 | 7,02 | 7,02 | 7,02 | 7,02 | 14,04 | 7,02 | 7,02 | 7,02 | 7,02 | 7,02 | 10,53 | 17,55 | 21,06 | 14,04 |
| Demand factor | 0,6 | | | | | | | | | | | | | | | | | | | | | | | |
| **TOTAL DEMAND [kW]** | 8,424 | 4,212 | 4,212 | 4,212 | 4,212 | 6,318 | 6,318 | 4,212 | 4,212 | 4,212 | 4,212 | 4,212 | 4,212 | 4,212 | 8,424 | 4,212 | 4,212 | 4,212 | 4,212 | 4,212 | 6,318 | 10,53 | 12,64 | 8,424 |

224,64 [kWh]

134,78 [kWh]

One user = 1,920 Wh  Total users = 117

Total users consumption = 1,920 Wh · 117 = 224,640 Wh = **224.64 kWh**



TOTAL DEMAND = Total users consumption · (DEMAND FACTOR)

**TOTAL DEMAND** = REAL CONSUMPTION = DESIGN DEMAND = 224,64 · (0,6) = **134.78 kWh**

# How to set a demand factor

- Experienced estimations
- Monitoring and follow up of operational systems
- Research on demand management

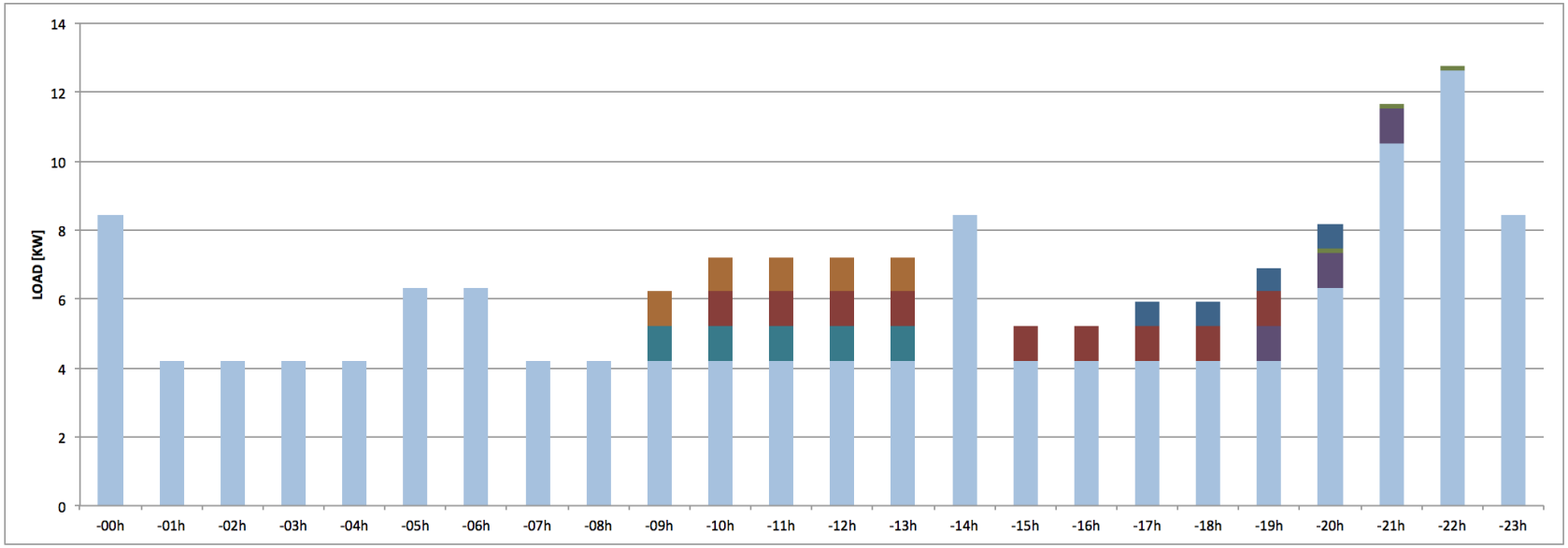
Just as a reference idea:
*“The more the users, the lower the demand factor…”*

*(only for the total users’ demand)*

# Aggregated daily profile (table of consumptions)

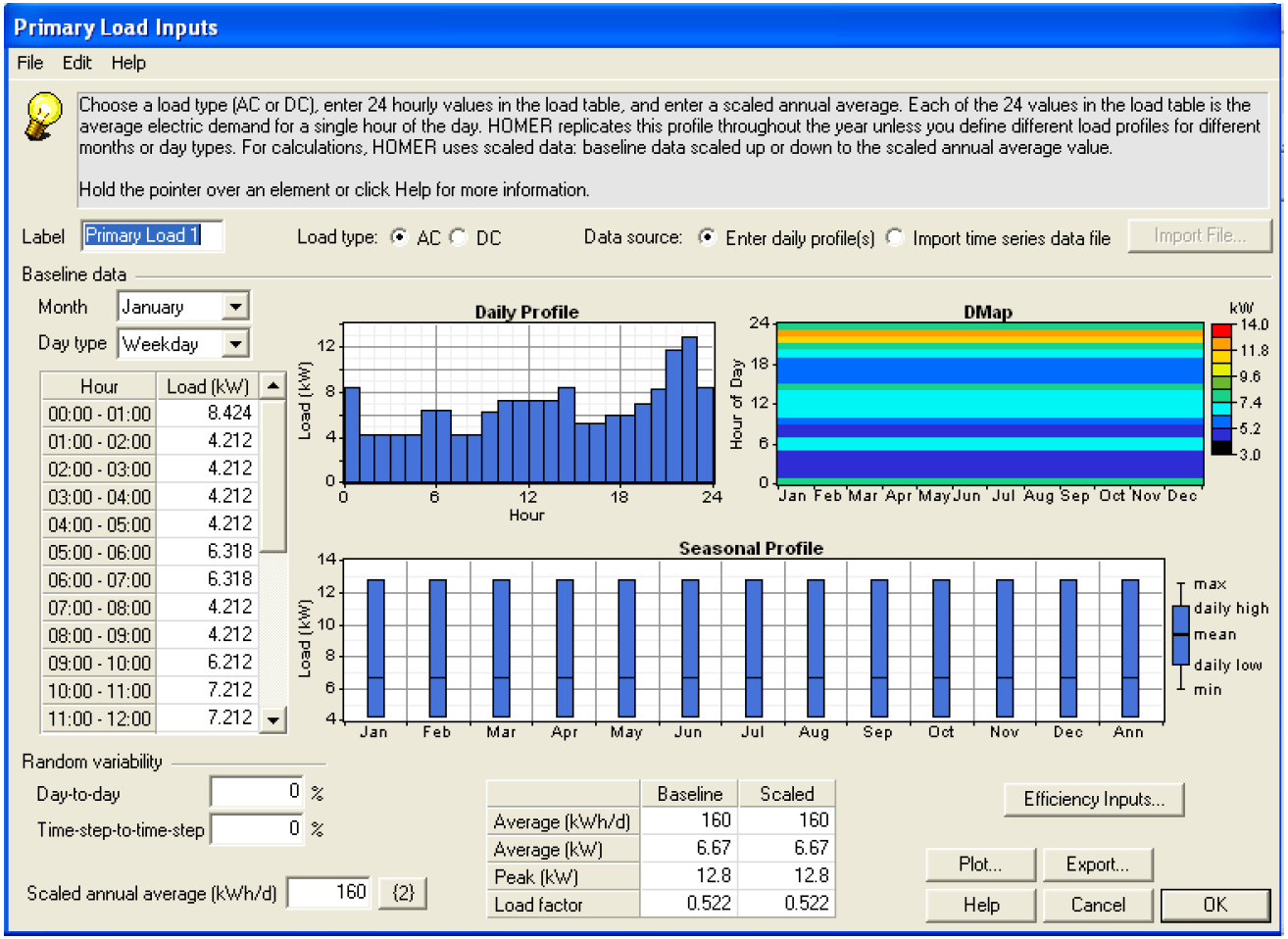
| HOURLY LOAD [kW] | 00h | 01h | 02h | 03h | 04h | 05h | 06h | 07h | 08h | 09h | 10h | 11h | 12h | 13h | 14h | 15h | 16h | 17h | 18h | 19h | 20h | 21h | 22h | 23h | ENERGY [kWh] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL DEMAND | 8,42 | 4,21 | 4,21 | 4,21 | 4,21 | 6,32 | 6,32 | 4,21 | 4,21 | 4,21 | 4,21 | 4,21 | 4,21 | 4,21 | 8,42 | 4,21 | 4,21 | 4,21 | 4,21 | 4,21 | 6,32 | 10,5 | 12,6 | 8,42 | 134,784 |
| SCHOOL- MEETING ROOM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0,15 | 0,15 | 0,15 | 0 | 0,45 |
| ENTERTAINTMENT CENTRE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0,7 | 0,7 | 0,7 | 0,7 | 0 | 0 | 0 | 2,8 |
| PLACE OF WORSHIP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 3 |
| PUBLIC LIGHTING | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MACHINE WORKSHOP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| STORES | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 9 |
| HAIR SALON | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| | | | | | | | | | | | | | | | | | | | | | | | | | 0 |
| | | | | | | | | | | | | | | | | | | | | | | | | | 0 |
| | | | | | | | | | | | | | | | | | | | | | | | | | 0 |
| | | | | | | | | | | | | | | | | | | | | | | | | | |

# Aggregated daily profile many users and consumptions




| Row Labels | Values -00h | -01h | -02h | -03h | -04h | -05h | -06h | -07h | -08h | -09h | -10h | -11h | -12h | -13h | -14h | -15h | -16h | -17h | -18h | -19h | -20h | -21h | -22h | -23h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL DEMAND | 8,424 | 4,212 | 4,212 | 4,212 | 4,212 | 6,318 | 6,318 | 4,212 | 4,212 | 4,212 | 4,212 | 4,212 | 4,212 | 4,212 | 8,424 | 4,212 | 4,212 | 4,212 | 4,212 | 4,212 | 6,318 | 10,53 | 12,636 | 8,424 |
| STORES | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| SCHOOL- MEETING ROOM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0,15 | 0,15 | 0,15 | 0 |
| PLACE OF WORSHIP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| MACHINE WORKSHOP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HAIR SALON | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENTERTAINTMENT CENTRE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0,7 | 0,7 | 0,7 | 0,7 | 0 | 0 | 0 |

# Primary Load Inputs interface



# Link between knowing about technology and knowing how to simulate

Hypothesis, uncertainty and imperfect behavior

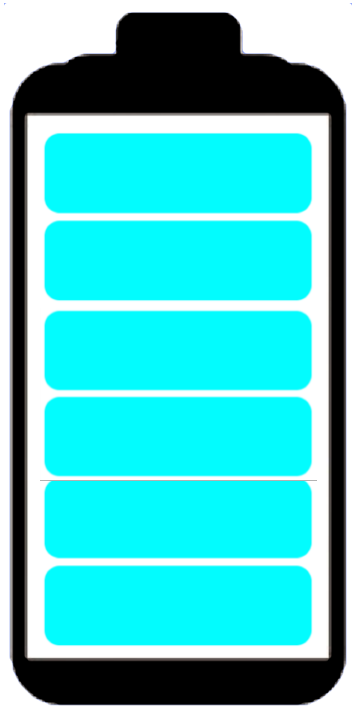
# “Water Tank Example” (CONFLICT of consumption)

EX. 3

2000 Wh

2000 Wh

2000 Wh



6,000 Wh

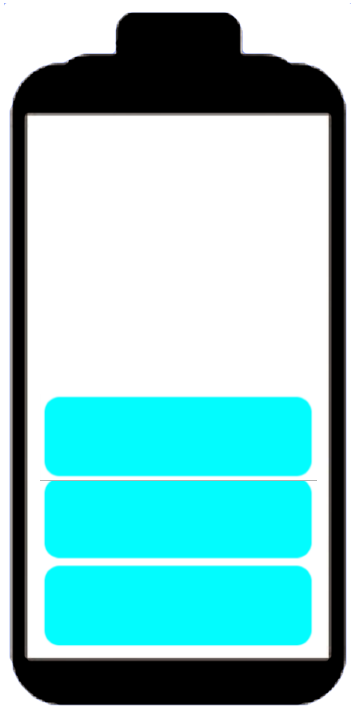
User 1

User 2

User 3

# “Water Tank Example” (CONFLICT of consumption)

EX. 3

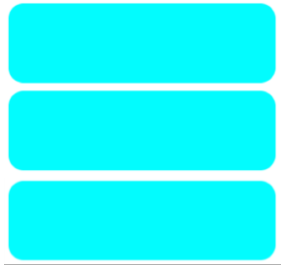


1000 Wh

2000 Wh

3,000 Wh

3000 Wh



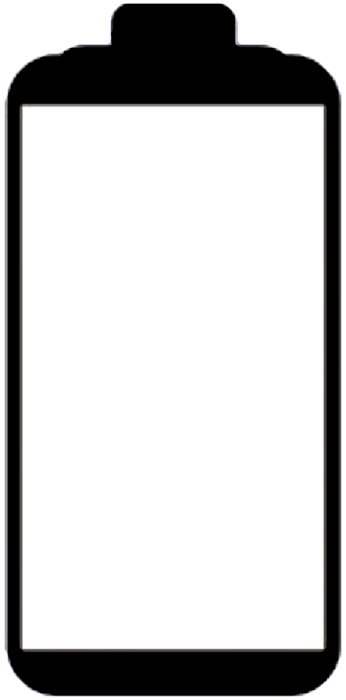
User 1

User 2

User 3

# “Water Tank Example” (CONFLICT of consumption)

EX. 3



**0,000 Wh**

3000 Wh

User 1

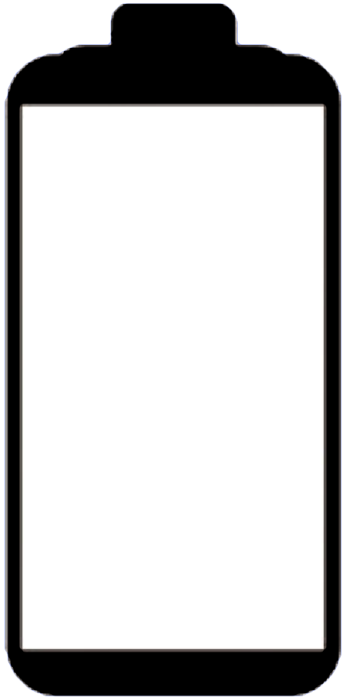
3000 Wh

User 2

User 3

# “Water Tank Example” (CONFLICT of consumption)

EX. 3



**0,000 Wh**

3000 Wh

User 1

3000 Wh

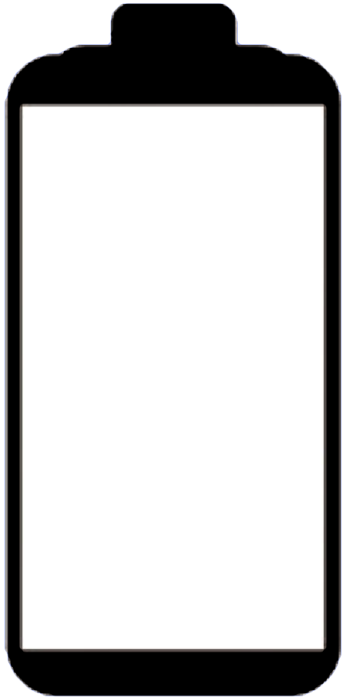
User 2

0 Wh

**User 3**

# “Water Tank Example” (CONFLICT of consumption)

EX. 3



**0,000 Wh**

3000 Wh

User 1

3000 Wh

User 2

0 Wh

U 3

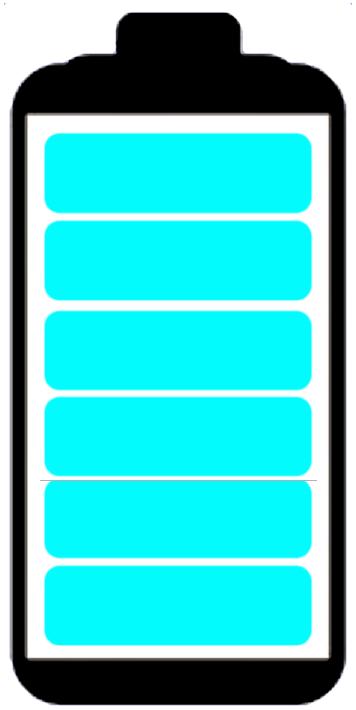
# “Water Tank Example” (**MANAGED** daily demand)

EX. 4

2000 Wh

2000 Wh

2000 Wh



6,000 Wh

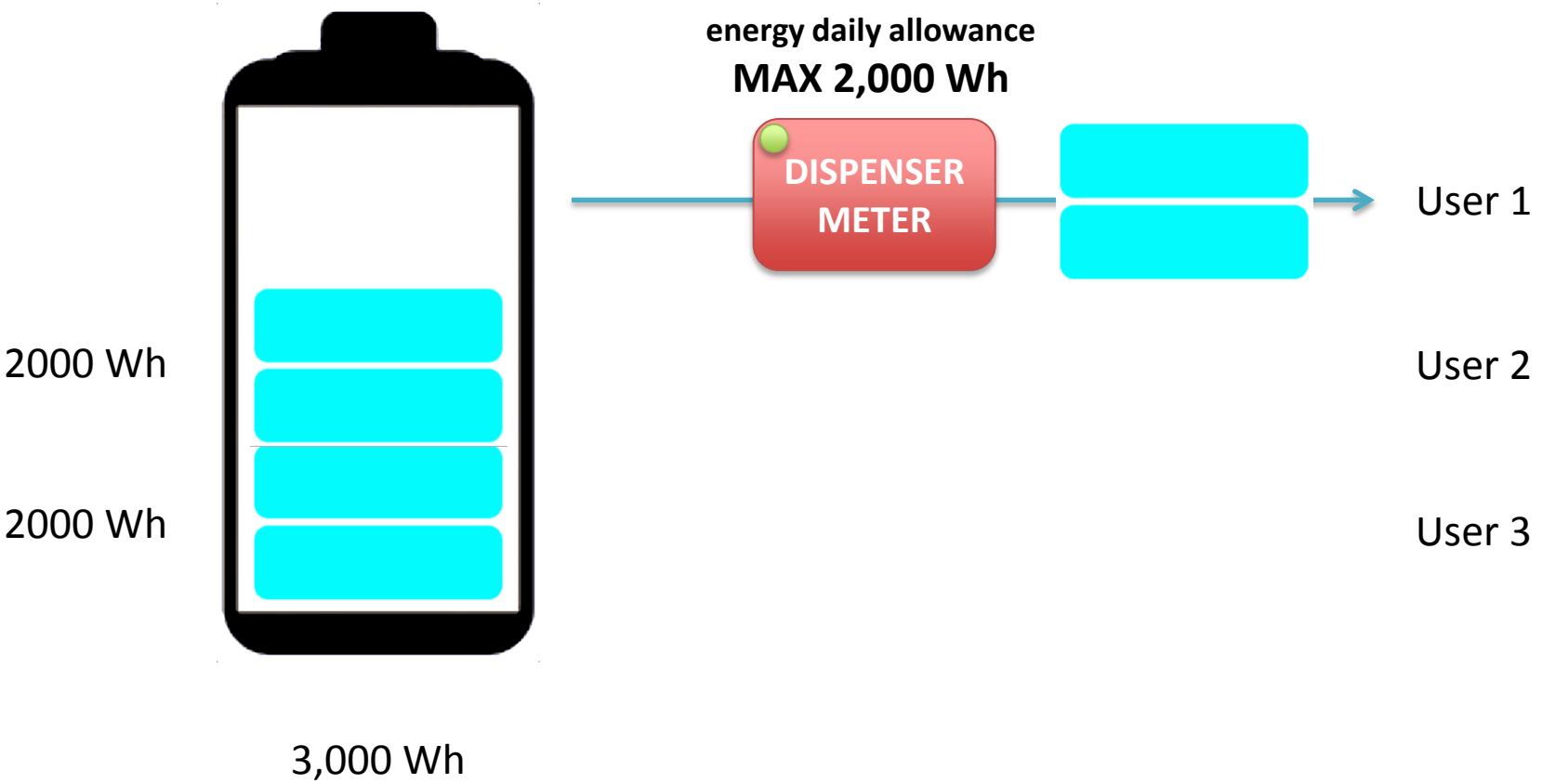
User 1

User 2

User 3

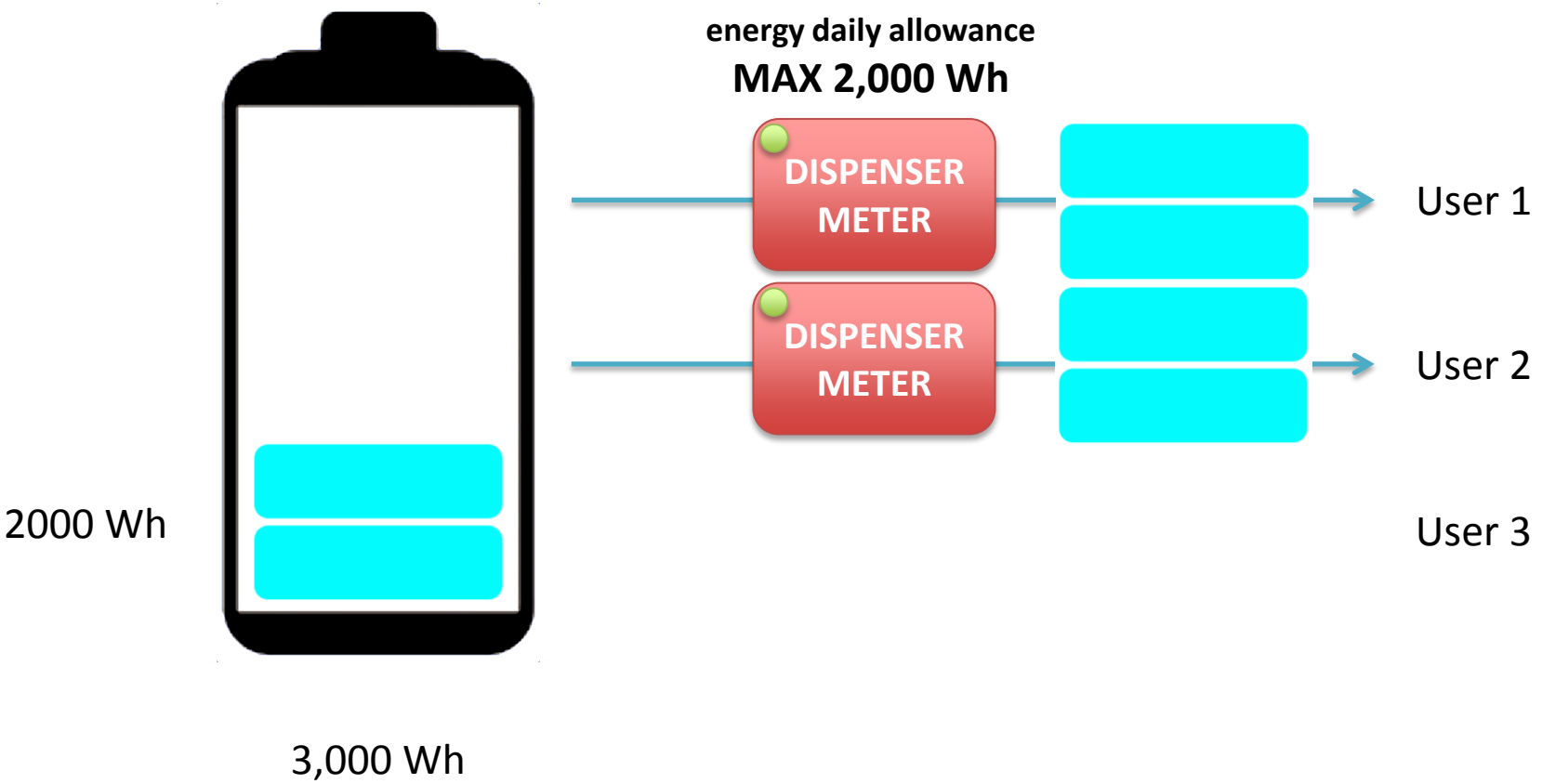
# “Water Tank Example” (**MANAGED** daily demand)

EX. 4



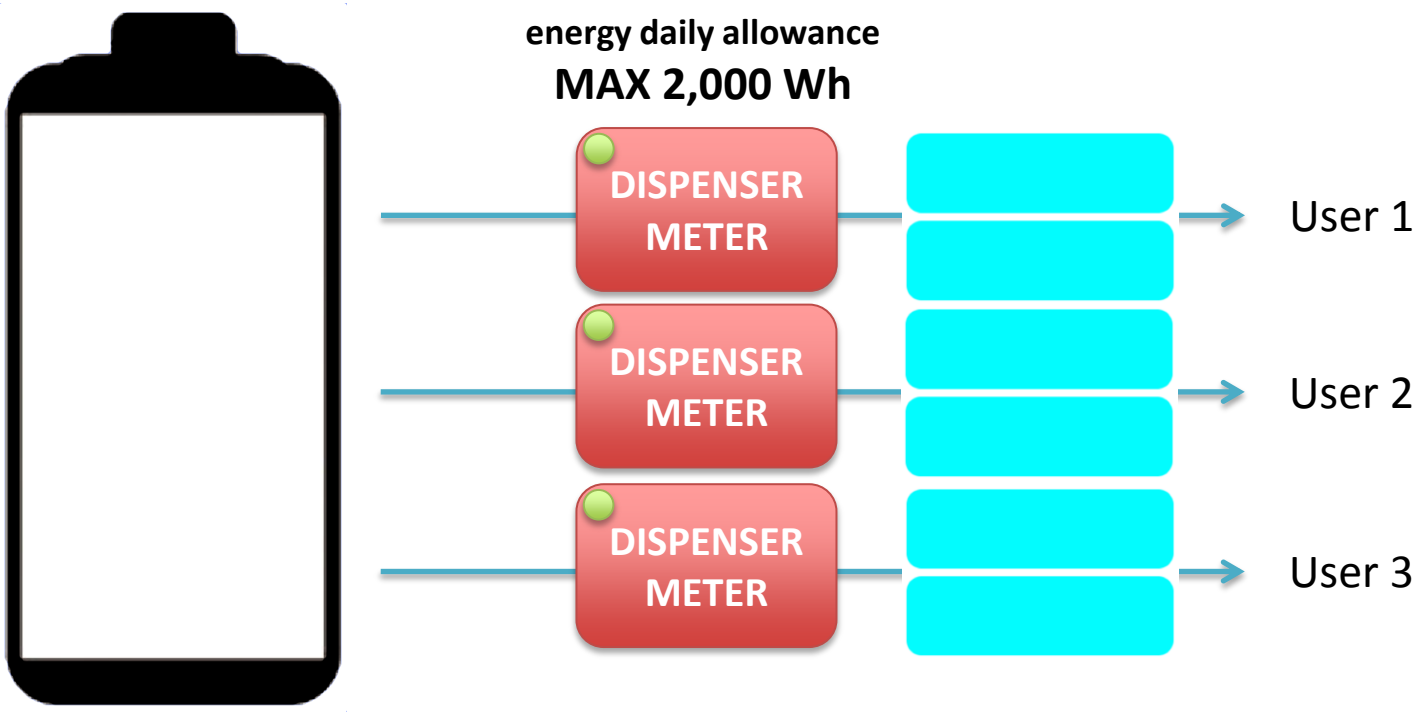
# “Water Tank Example” (**MANAGED** daily demand)

EX. 4



# “Water Tank Example” (**MANAGED** daily demand)

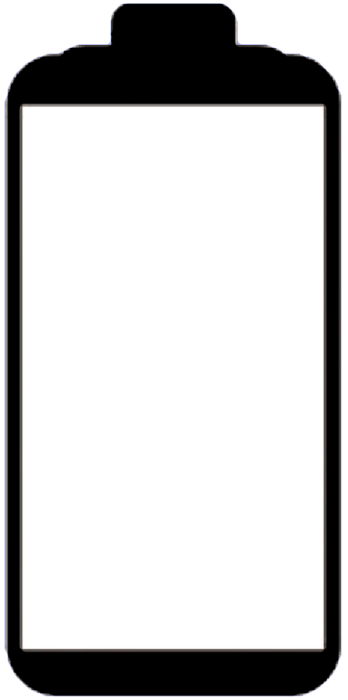
EX. 4




0,000 Wh

# “Water Tank Example” (**MANAGED** daily demand)

EX. 4



0,000 Wh

**energy daily allowance**
**MAX 2,000 Wh**

DISPENSER METER

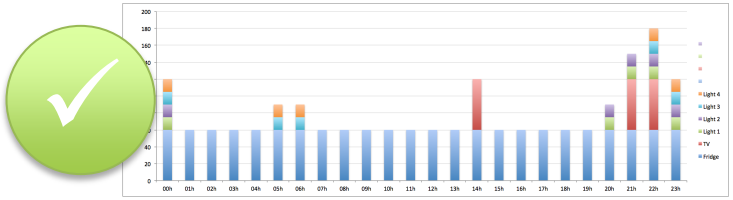
DISPENSER METER

DISPENSER METER

User 1

User 2

User 3

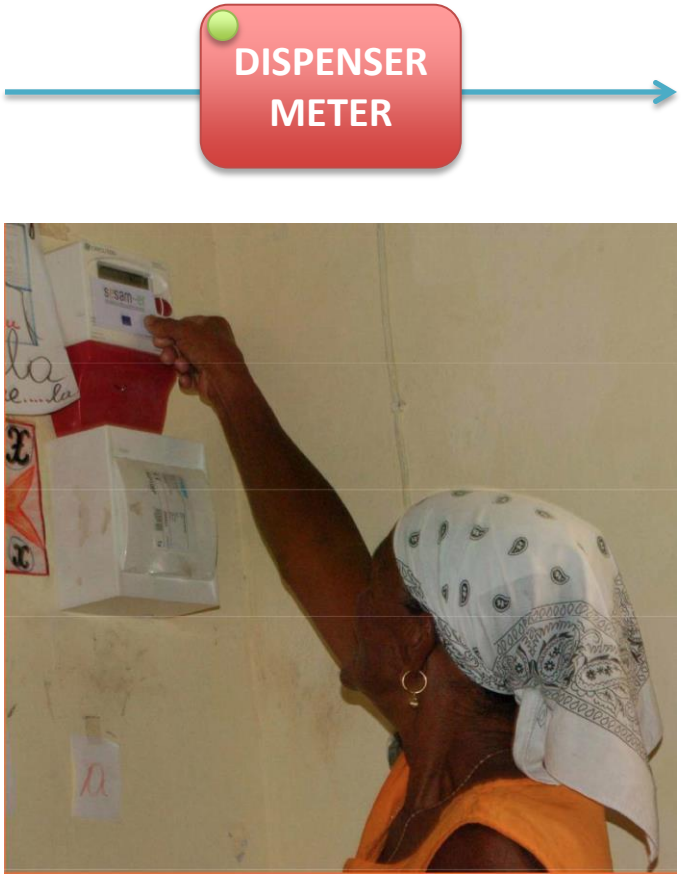


Hypothesis

# Recommendation on sizing and simulating RE hybrid systems with multiple users

- Users should have *dispenser meters* with Energy Daily Allowance (EDA) management, according to the contracted tariff (**limitations through smart devices that control the kWh of energy consumed**).

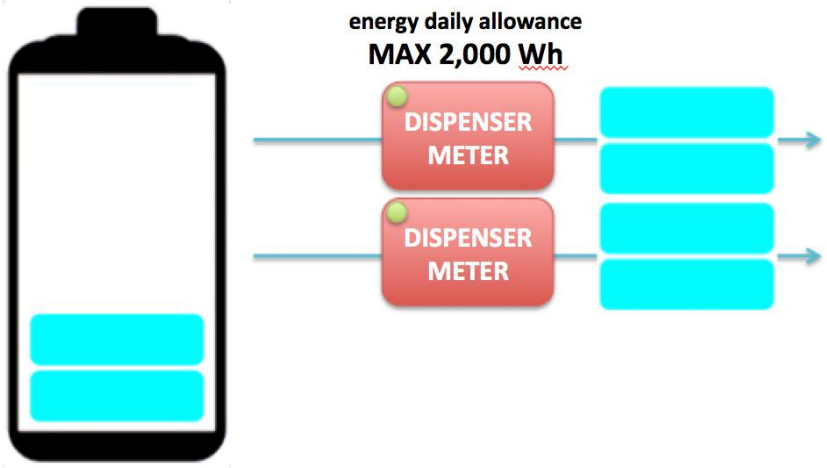
- (…) The concept of Energy Daily Allowance **introduces certainty in the most uncertain parameter when sizing and simulating** RE hybrid micro grids with multiple users.

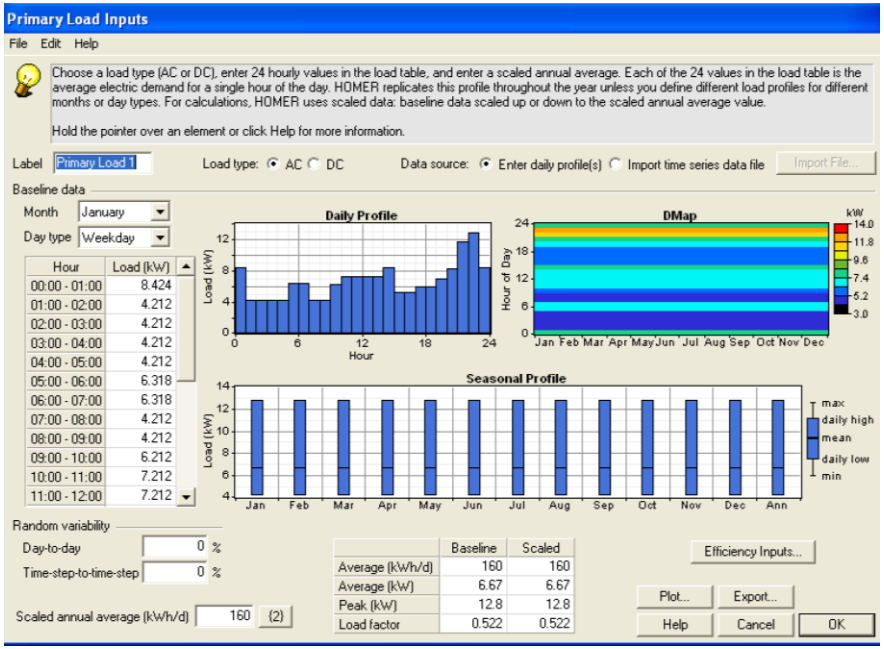



*Source: GRAILLOT et al, 2012*

# Storage, Energy Daily Allowance and Demand Factor

- The new paradigm of energy management is to manage not only the maximum LOAD (kW) but the ENERGY CONSUMPTION (kWh).

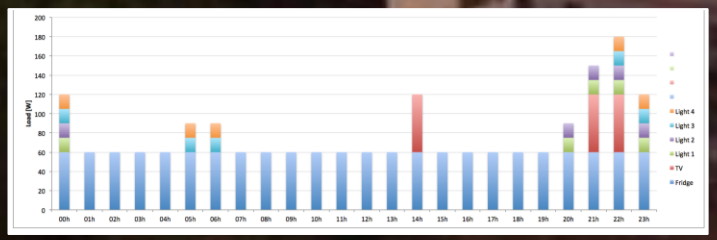


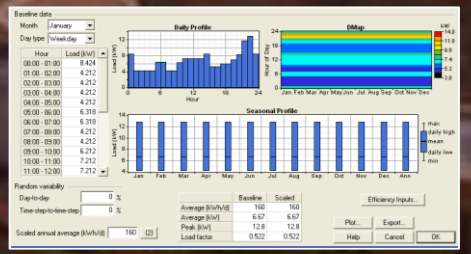



# Simulation models, criteria and available technology

- Social energy appraisal, demand studies and available technology for energy management, are interlinked knowledge

*Source: TTA*





# Data for Exercise 1: Input the energy demand in HOMER

| Daily INPUTS | Number | Value | Time |
|---|---|---|---|
| **DOMESTIC USES** | | | |
| Bulb | 4 | 15 W | 05 hours |
| TV | 1 | 60 W | 03 hours |
| Fridge | 1 | 60 W | 24 hours |
| *Number of users* | *117* | | |
| *Demand Factor* | *0.6* | | |
| **PRODUCTIVE USES** | | | |
| School – meeting room | | 150 W | 03 hours |
| Entertainment center | | 700 W | 03 hours |
| Place of worship | | 1 kW | 03 hours |
| Public Lighting | Not connected to the hybrid system (70W per unit) | | |
| Machine workshop | | 1 kW | 05 hours |
| Stores | | 1 kW | 09 hours |
| Hair Salon | | 1 kW | 05 hours |

# Data for Exercise 1: Other parameters

| Input | Value |
|---|---|
| Month variability (seasonal variability) | No |
| Weekend variability | No |
| Day to day variability | No |
| Time step to time step variability | No |

# References


- *GRAILLOT, A., BRIGANTI, M., SOLANO-PERALTA, M., VALLVÉ, X., (2012), "Daily Energy Allowance" concept in rural micro grids. 15 years of experience, 6th European PV-Hybrid and Mini-Grid Conference, Chambéry. http://www.ecowrex.org/document/15-years-field-experience-daily-energy-allowance-concept-basis-load-control-and-guide*

- *HOMER Energy (2011), Getting Started Guide for HOMER Legacy (Version 2.68), Homer Energy and National Renewable Energy Laboratory, Colorado. http://www.ecowrex.org/document/getting-started-guide-homer-legacy-version-268*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Centre Régional pour les Energies Renouvelables
et l'Efficacité Energétique de la CEDEAO

Centro Regional para Energias Renováveis e
Eficiência Energética da CEDEAO

# Merci! Thank you! Muito obrigado!

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