



# BENCHMARKING TOOL for Sport Facilities

Josep Maria Granollers  
Catalan Institute for Energy  
(ICAEN)



Generalitat de Catalunya  
**Institut Català d'Energia**

**Final Dissemination Event**  
**21 February 2017, Brussels**



Co-funded by the Intelligent Energy Europe  
Programme of the European Union

step by step  
renovation  
towards nearly  
zero energy  
**SPORT** buildings

## Definition and Target

Tool for tracking energy performance of European Sport Centers.

Friendly and easy to use.

Login through:

<http://step2sport.eu/>



The screenshot shows the homepage of the step2sport website. The header features the step2sport logo and the text "step by step renovation towards nearly zero energy SPORT buildings". A navigation menu includes "GENERAL INFORMATION", "KEY RESOURCES REPOSITORY", "PROJECT OUTPUTS", "INTRANET", "CONFERENCES EVENTS", "USEFUL TOOLS", and "CONTACT". The "USEFUL TOOLS" menu is circled in red, with a sub-menu showing "Useful Tools", "BENCHMARKING TOOL", and "ADVISORY PLATFORM". The main content area is titled "GENERAL INFORMATION" and features a large video player showing an interior view of a modern sports facility. Below the video, there is a text block describing the project's goal: "In Europe, there are around one million and half sports facilities, which represents 8% of the overall building stock. Most of them were built before 1980 and need refurbishment because no considerable changes have been made to the initial conditions. The STEP-2-SPORT project aims to support the refurbishment of the existing sport buildings through step by step renovation towards Nearly Zero Energy Buildings (NZEB), contributing to the EU energy objectives. The project covers the field Integrated Initiatives, focused on energy efficiency and renewable energy use in buildings." Below this text, it states: "The pilot sport buildings represent the following two types of sport facilities in different climatic conditions:"

## TOOL'S STRUCTURE

The Tool has 2 parts:

### **Calculator**

Input DATA to obtain an assessment of which is the degree of performance of the Sport Center in terms of efficiency and demand to have a vision on how far are from NZEB state.

### **Toolbox**

Qualitative part of the Tool.

Contains very useful information for Sport Centers willing to improve its performance.

Linked from the Calculator (the results part)



# TOOL CALCULATOR: DATA INPUT

## ENERGY DATA Input:

### ENERGY DATA

#### CONSUMPTION (CONSUM)

	year -1	year -2 (Optional)	year -3 (Optional)
YEAR			
ELECTRICITY (kWhe/y)			
NATURAL GAS (kWht/y)			
NATURAL GAS (m <sup>3</sup> /y)			
FUEL OIL (liters/y)			
WOOD Chips (Biomass chips) (Tons/y)			
WOOD Pellets (Biomass Pellets)(Tons/y)			

#### PRODUCTION (Renewable). $P_{RES}$

PHOTOVOLTAIC, PV (kWhe/y)			
SMALL WIND (kWhe/y)			
SOLAR THERMAL (kWht/y)			
GEOTHERMAL (kWht/y)			

#### PRODUCTION (Use of Cogeneration, CHP) . $P_{CHP}$

ELECTRICITY (kWhe/y)			
HEAT (kWht)			
COOL (kWht)			

The more data provided the best results obtained

# TOOL CALCULATOR: DATA INPUT

## CLIMATE DATA Input:

WEATHER DATA			
	year -1	year -2	year -3
<b>YEAR</b>			
<b>Cooling Degree Day (CDD), BT=21°C</b>			
<b>Heating Degree day (HDD) BT=18°C</b>			
<b>Heating Degree day (HDD) BT=26°C *</b>			
<b>*: only for typology 4</b>			

**BT** is the Base Temperature at which degree days are calculated.

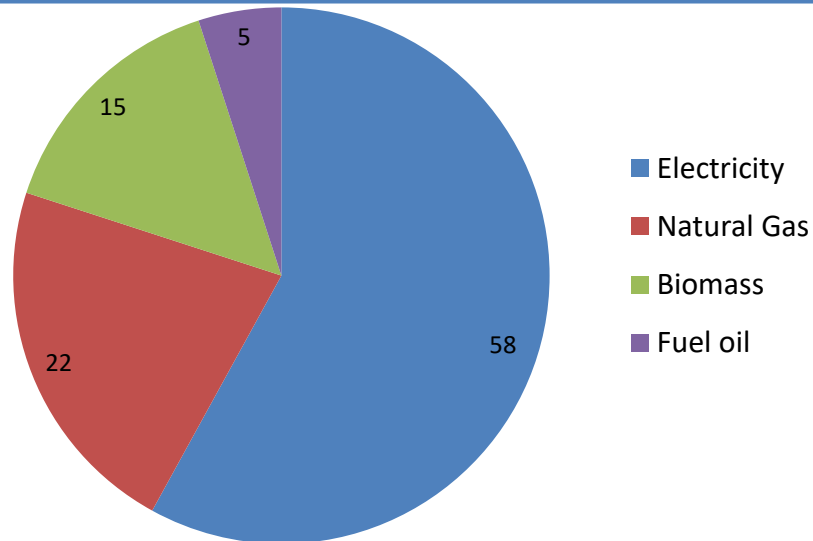
How to obtain Degree Days Guide:

[Tool Box \(1\)](#)

# TOOL CALCULATOR: RESULTS

## Energy Distribution

This is your ENERGY USE distribution



# TOOL CALCULATOR: RESULTS

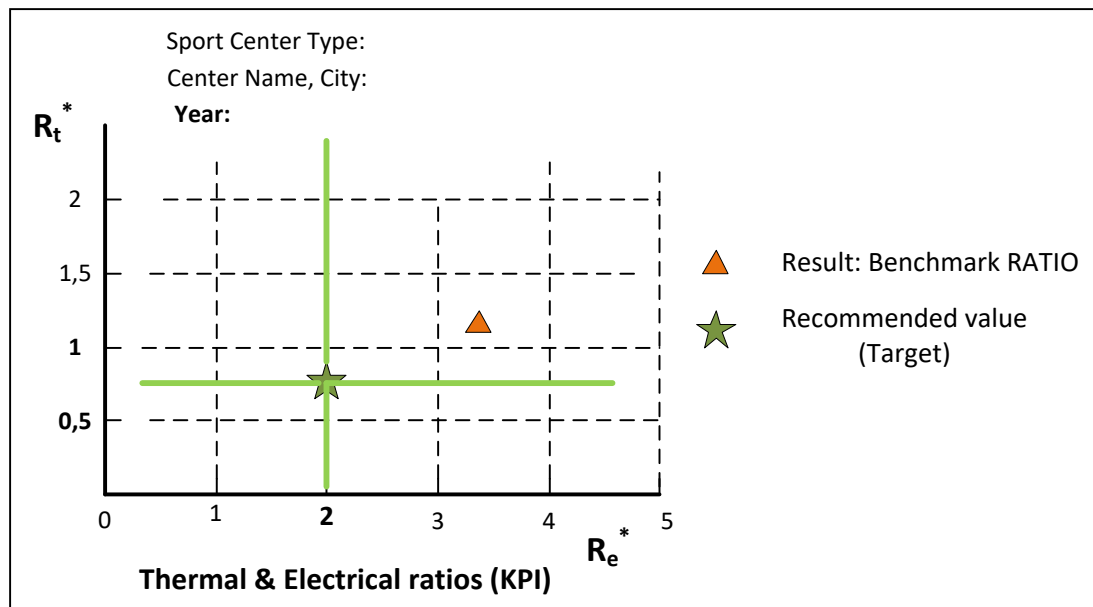
## Thermal and electrical energy ratios

The following graphic will be displayed for : Sport Complexes, Sport Halls & Gymnasiums

Applicable when  $CDD_{21} > 100^{\circ}\text{C}$ .

$$R_t^* = 10 \cdot \frac{kWh_{thermal}}{m^2 \cdot HDD_{18}}$$

$$R_e^* = 10 \cdot \frac{kWh_{elec}}{m^2 \cdot CDD_{21}}$$



Energy Efficiency Ratio	Current Ratio	Target Ratio	Recommended Improvement (%)	Check for energy efficiency measures
<b>Rt*</b> (Thermal Performance)	1,01	0,8	21	<a href="#">Tool BOX (2)</a>
<b>Re*</b> (Electrical Performance)	3,18	2	37	<a href="#">Tool BOX (3)</a>

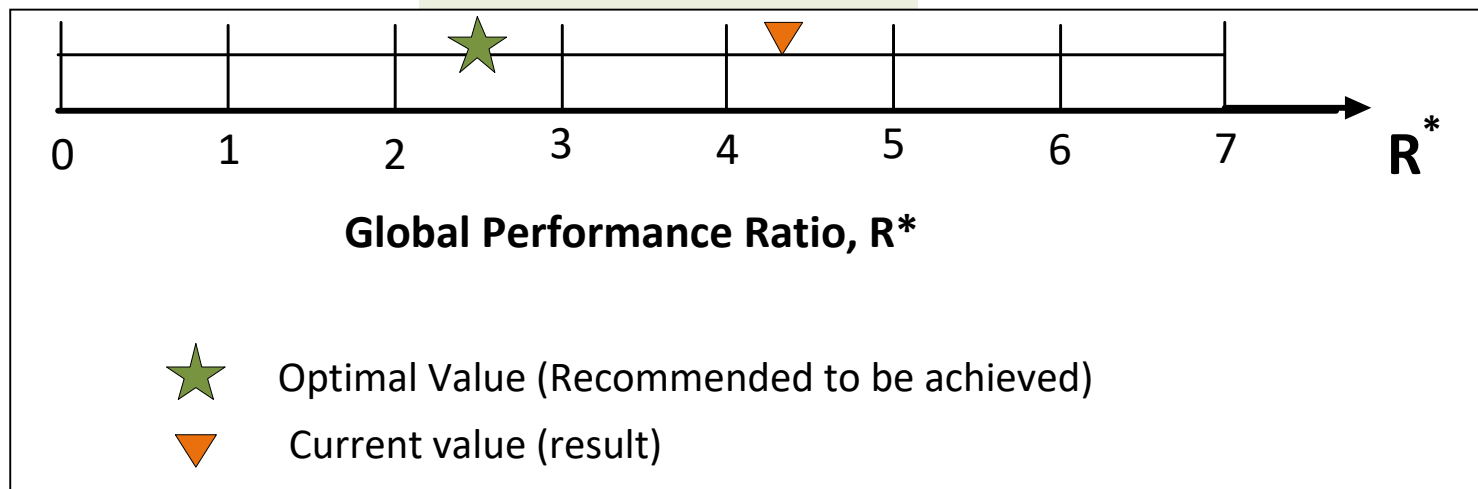


# TOOL CALCULATOR: RESULTS

## Overall Performance ratio

For the following facilities : Sport Complexes, Sport Halls & Gymnasiums

Validity when  $CDD_{21} > 100^{\circ}\text{C}$ .



Overall Energy Efficiency Ratio	Current Ratio	Target Ratio	Recommended Improvement (%)	Check for energy efficiency measures
R*	4,19	3	28	<a href="#">Tool BOX (4)</a>

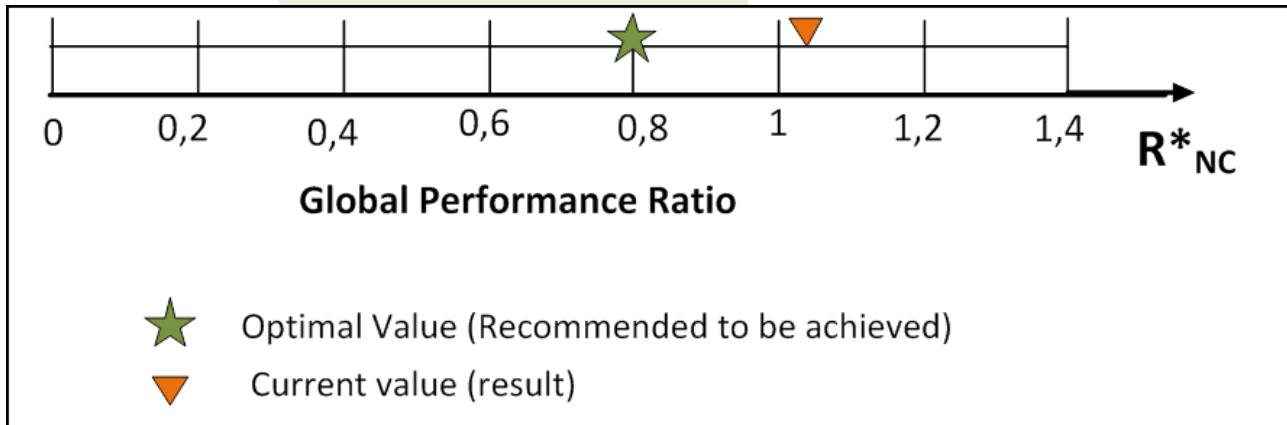
$$R^* = 10 \cdot \frac{kWh_e \cdot HDD_{18} + kWh_t \cdot CDD_{21}}{m^2 \cdot CDD_{21} \cdot HDD_{18}}$$

# TOOL CALCULATOR: RESULTS

## Overall Performance ratio

For the following facilities : Sport Complexes, Sport Halls & Gymnasiums

Validity when  $CDD_{21} < 100^{\circ}C$ .



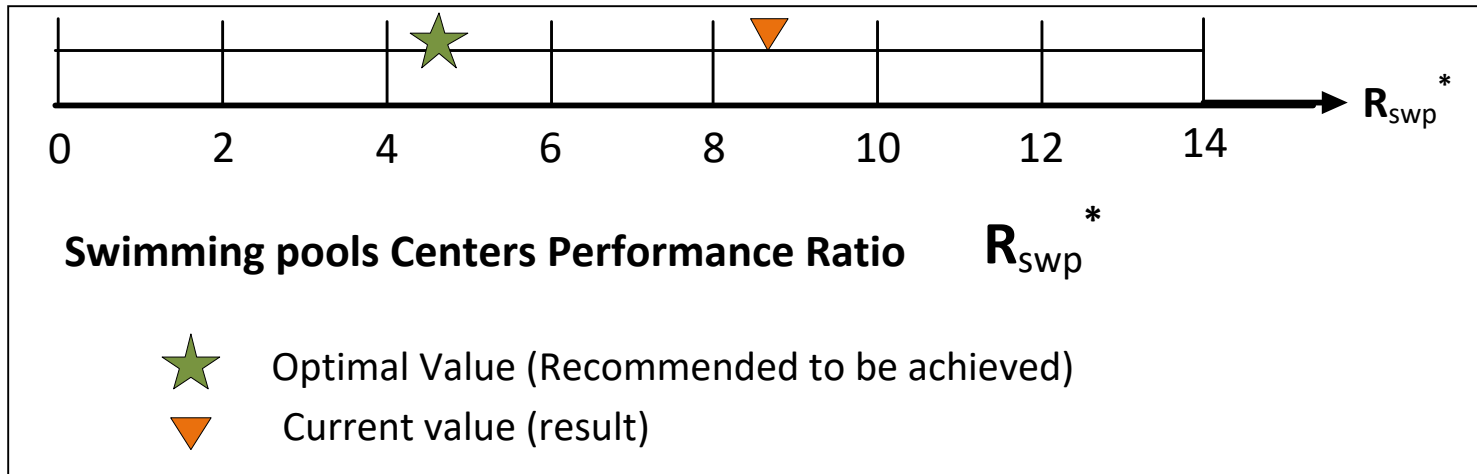
Overall Energy Efficiency Ratio	Current Ratio	Target Ratio	Recommended Improvement (%)	Check for energy efficiency measures
R*		0,8		<a href="#">Tool BOX (5)</a>

$$R_{NC}^* = 10 \cdot \frac{kWh_{TOT}}{m^2 \cdot HDD_{18}}$$

# TOOL CALCULATOR: RESULTS

## Energy Performance Ratio for indoor Swimming Pools

Facilities : Indoor swimming Pools



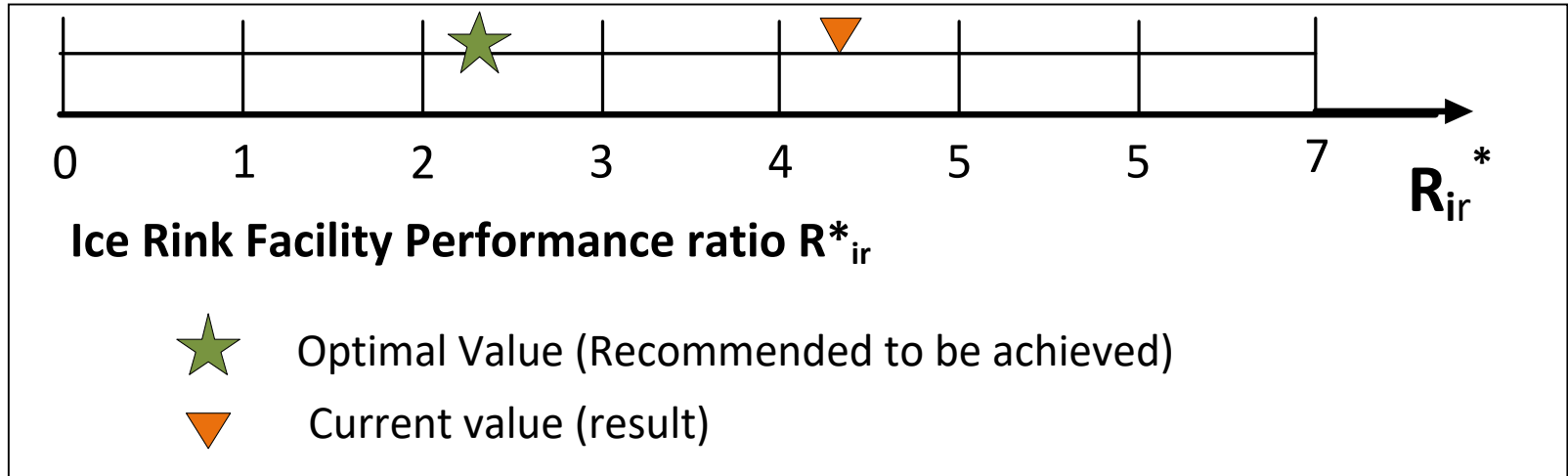
Overall Energy Efficiency Ratio	Current Ratio	Target Ratio	Recommended Improvement (%)	Check for energy efficiency measures on swimming pools
$R_{swp}^*$		4,25		<a href="#">Tool BOX (6)</a>
$R_m = kWh_e/m^2$		Only for comparison to other local swimming pool facilities		

$$R_{swp}^* = 10 \cdot \frac{kWh_{TOT}}{m_{swp}^2 \cdot HDD_{26}}$$

# TOOL CALCULATOR: RESULTS

## Energy Performance Ratio for Ice Rinks

Facilities : Ice Rinks

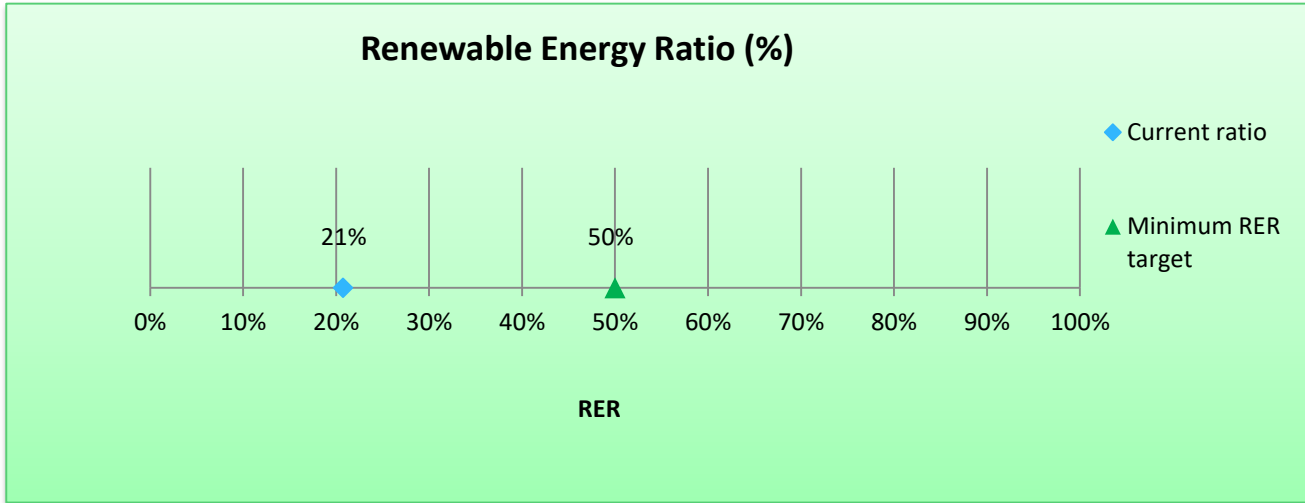


Energy Efficiency Ratio	Current Ratio	Target Ratio	Recommended Improvement (%)	Check for energy efficiency measures on ice-rinks
$R_{ir}^*$		2,5		<a href="#">Tool BOX (7)</a>
$R_m = kWh_e/m^2$		Only for comparison to other local ice rinks facilities		

$$R_{ir}^* = 10^4 \cdot \frac{kWh_{TOT}}{m_{ice}^2 \cdot N_d \cdot HDD_{18}}$$

# TOOL CALCULATOR: RESULTS

## Renewable Ratio (whole facility)



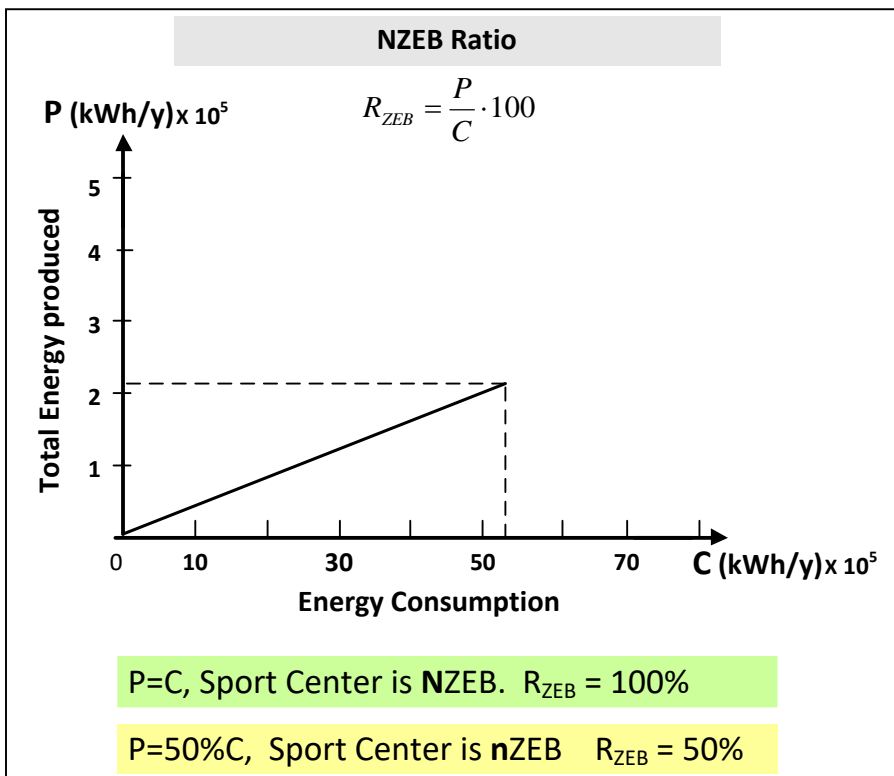
Renewable Energy Ratio	Current Ratio	Target Ratio	Check for measures on RES
RER		50%	<a href="#">Tool BOX (8)</a>

$$R_{RES} (\%) = \frac{P_{RES} (total\_renewable\_production)}{C(TotalConsumption.)} \cdot 100$$

# TOOL CALCULATOR: RESULTS

## Ratio on (nearly) Zero Energy Building , nZEB

That's the Ratio of **0** consumption:



nZEB Ratio	Current Ratio	Target Ratio	GAP to nZEB	Check for measures on Renovations
$R_{TOT}$				<a href="#">Tool BOX (9)</a>

$$R_{TOT} (\%) = \frac{P_{RES} + P_{CHP}}{C(\text{Total Consumption.})} \cdot 100$$

**Note:** this graphic only makes sense if energy efficiency measures have been implemented. So, energy demand has been reduced and consumption optimized.

## TOOL BOX

### Linked documents

- Road map: Examples of Best Practices
- Different links: redirect to PDF documents explaining:
- Guide on how to obtain **Degree Days**
- Energy **Efficiency Measures** for Sport Complexes, Sport Halls and Gyms
- Energy Efficiency Measures for Swimming Pools
- Energy Efficiency Measures for Ice Rinks.
- RES** measures
- Summary LIST** of Energy **efficiency measures** (global one)
- All **KPIs** definition

## Suggestions on the use of the TOOL

- Focus on energy Ratios based on annual data. But, best results are achieved with monthly data which application is more complex and time consuming.
- Try to obtain energy data for more than one year (3 last years if possible) for better tracking and figure out trends.



## Apply the TOOL

Just go into the tool and use it:

[http://step2sport.eu/?page\\_id=1489](http://step2sport.eu/?page_id=1489)

# Thanks for your attention

## Questions ?

Josep M. Granollers  
ICAEN  
[jm.granollers@gencat.cat](mailto:jm.granollers@gencat.cat)