Welcome and Agenda

03.00-03.05	Introduction to the meeting
	PART 1: the streamSAVE methodologies and Training Module
03.05-03.20	Presentation by Kelsey van Maris (VITO) and Carlos Patrão (ISR-UC) about the final streamSAVE methodologies for BACS and Road lighting
03.20-03.25	Preview of the **streamSAVE Training Module**
03.25-03.30	Q & A
	PART 2: Experience sharing about energy savings from BACS
03.30-03.45	Presentation by Hadrien Serougne (ADEME) about the French standardised calculation methods for energy savings from BACS
03.45-03.55	Presentation by Bonnie Brook (eu.bac) on the BAC classes
03.55-04.05	Open discussions about energy savings calculations for BACS, and about BAC classes *moderated by Kelsey van Maris (VITO, Belgium)*
	PART 3: Experience sharing about energy savings from Road Lighting
04.05-04.20	Monitoring and verification of energy savings due to renovation of outdoor lighting systems – case study Slovenia Presentation by Dr. Boris Sucic (Jozef Stefan Institute)
04.20-04.30	Open discussions about energy savings calculations for Road Lighting Moderated by Carlos Patrão (ISR-University of Coimbra) and Wrap-Up

Note: Discussions will be under Chatham House Rule: the minutes will not mention any name or country. All discussion points included in the minutes will be anonymized.

PART 1: the streamSAVE methodologies and Training Module

Building Automation and Control Systems

Kelsey van Maris, VITO/EnergyVille

BACS Dialogue web-meeting – 9th November 2021

This project has received funding from the Horizon 2020 programme under grant agreement n°890147. The content of this presentation reflects only the author's view. The European Commission is not responsible for any use that may be made of the information it contains.

Methodology

- Detailed method vs. **BACS factor method**

- BACS factors:
  - Rough estimation of impact of BACS on thermal and electrical energy demand of the building according to the BACS efficiency classes A, B, C and D

- Combining the *BACS efficiency classes* with the *end use* and the *building type* → BACS efficiency factor
  - e.g.: heating BACS, efficiency class C, in an office building → BACS factor of 1

Formula

- Using the BACS factor method, the formula we propose, is:

$$\boxed{TFES_x} = (FEC_{before,x} - FEC_{after,x}) \cdot f_{BEH} \cdot cf_x$$

$$FEC_{before,x} = FEC_{floor,before,x} \cdot A$$

$$FEC_{after,x} = \boxed{\frac{BAC_{after,x}}{BAC_{before,x}}} \cdot FEC_{floor,before,x} \cdot A$$

TFES	Total final energy savings for end-use type x [kWh/a]
$FEC_{before,x}$	Final energy consumption for end-use x, before implementation of the action [kWh/a]
$FEC_{after,x}$	Final energy consumption for end-use x after implementation of the action [kWh/a]
f_{BEH}	Factor to calculate behavioural effects for end-use type x [dmnl]
cf_x	Regional or climate factor for end-use type x [dmnl]
$FEC_{floor,before,x}$	Final energy consumption for end-use, before implementation of the action, per unit floor area [kWh/m²/a]
A	Total floor area of building [m²]
$BAC_{after,x}$	BAC energy efficiency factor after BACS upgrade for end-use type x [%], based on EN15232
$BAC_{before,x}$	BAC energy efficiency factor before BACS upgrade for end-use type x [%], based on EN15232

End-uses: heating, cooling, DHW, lighting, ventilation

BAC factor *before* versus *after*

Costs

- Indicative costs (excl. VAT) of BACS as function of the building type and BACS class A and C. The lower bound represents renovation of existing buildings; upper bound of new buildings

Upgrade to BACS class C	SFH	MFH	Offices	Wholesale/ Retail	Other non-residential
Product cost [€2020/m² floor area]	1.5-3.0	1.5-3.0	9.0	7.0	NA
Investment costs, incl. installation [€2020/m²]	2.8-5.6	2.8-5.6	21.2	16.5	NA
Maintenance & repair [% per year]	3%	3%	3%	3%	3%
Upgrade to BACS class A					
Product cost [€2020/m² floor area]	4.7-7.1	4.3-7.0	13.3-14.7	12.0-13.2	NA
Investment costs, incl. installation [€2020/m²]	11.1-16.8	10.1-16.5	31.2-34.6	28.2-31.1	30 (6-60)
Maintenance & repair [% per year]	3%	3%	3%	3%	3%

Lighting systems including public lighting

Methodologies for "Road Lighting Systems"

Carlos Patrão, Paula Fonseca, Pedro Moura

carlospatrao@isr.uc.pt / pfonseca@isr.uc.pt / pmoura@isr.uc.pt

3rd PA Dialogue Group, 9 November 2021

streamSAVE

INSTITUTE OF SYSTEMS AND ROBOTICS
UNIVERSITY OF COIMBRA

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Presentation outline

- Calculation of final energy savings (Article 7)
- Calculation of impact on energy consumption (Article 3)
- Calculation of greenhouse gas savings
- Overview of costs related to the action
- Open debate / Q&A

Calculation of final energy savings (Article 7)

Calculation of final energy savings (Article 7)

- First formula follows a *“Project-based approach”*:

$$TFES = \left[\left(N_{ref} \times \sum_{i=0}^{n} \frac{(P_{ref} \times t_{ref\,i} \times D_{ref\,i})}{1000}\right) - \left(N_{eff} \times \sum_{i=0}^{n} \frac{(P_{eff} \times t_{eff\,i} \times D_{eff\,i})}{1000}\right)\right] \times f_{BEH}$$

- Second formula a more *“Simplified approach”*:

$$TFES = \left[\sum_{j=1}^{n} (N_j \times ES_j \times LC_j)\right] \times f_{BEH}$$

Calculation of final energy savings (Article 7)

"Project-based approach":

$$TFES = \left[\left(N_{ref} \times \sum_{i=0}^{n} \frac{(P_{ref} \times t_{ref\ i} \times D_{ref\ i})}{1000}\right) - \left(N_{eff} \times \sum_{i=0}^{n} \frac{(P_{eff} \times t_{eff\ i} \times D_{eff\ i})}{1000}\right)\right] \times f_{BEH}$$

Baseline system data

New system data

effects

TFES	Total final energy savings [kWh/a]
N_{ref}	Number of light points in the old/inefficient system
N_{eff}	Number of light points in the new/efficient system
P_{ref}	Power of each light point of the old/inefficient system, including lamp and other components on the luminaire (e.g.: control gear and communication/control units) (W)
P_{eff}	Power of each light point of the new/efficient system, including lamp and other components on the luminaire (e.g.: control gear and communication/control units) (W)
$t_{ref\ i}$	Annual operating time (h/a) of light points of the old/inefficient system in diming level "i" ($D_{ref\ i}$)
$D_{ref\ i}$	Percentage of working light points power, of the old/inefficient system, during the diming level "i"
$t_{eff\ i}$	Annual operating time (h/a) of light points of the new/efficient system in diming level "i" ($D_{ref\ i}$)
$D_{eff\ i}$	Percentage of working light points power, of the new/efficient system, during the diming level "i"
f_{BEH}	Factor for correction of behavioural effects (rebound, spill-over effect and free-rider effect)
i	Diming levels "i", being "0" the lighting full power mode
n	Total number of diming levels

Calculation of final energy savings (Article 7)

- *"Project-based approach"*:

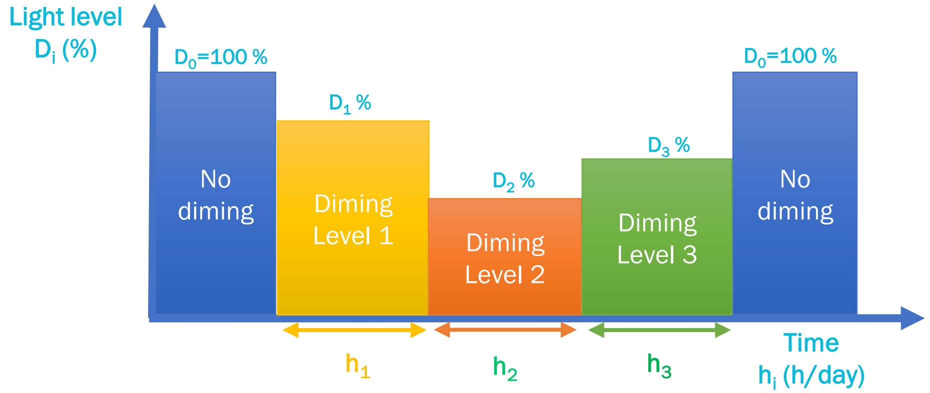
$$TFES = \left[\left(N_{ref} \times \sum_{i=0}^{n} \frac{(P_{ref} \times t_{ref\,i} \times D_{ref\,i})}{1000}\right) - \left(N_{eff} \times \sum_{i=0}^{n} \frac{(P_{eff} \times t_{eff\,i} \times D_{eff\,i})}{1000}\right)\right] \times f_{BEH}$$

Baseline system data

New system data

effects

- *Diming/Lighting controls strategies:*
  - Defined by each MS for old and new technology.



Calculation of final energy savings (Article 7)

"Project-based approach" – Indicative values

Total annual operating time	[h/a]
Total annual operating hours of lighting system (sum of time with and without diming, that must be equal to $\sum_{i=0}^{n} t_{ref\ i}$ and $\sum_{i=0}^{n} t_{eff\ i}$)	4015
Factor for correction of behavioural effects	**[no dimension]**
Factor for correction of behavioural effects (f_{BEH})	1
Lifetime of savings	**[years]**
Lifetime of savings	13 years

Power of the light source (P_{ls}) W	Minimum control gear efficiency ($\eta_{control\ gear}$) %
$P_{ls} \leq 30$	78
$30 < P_{ls} \leq 75$	85
$75 < P_{ls} \leq 105$	87
$105 < P_{ls} \leq 405$	90
$P_{ls} > 405$	92

Indicative values for the control gear efficacy according to Ecodesign

$$P_{ref} = \left(\frac{P_{ls}}{\eta_{control\ gear}}\right)$$

Calculation of final energy savings (Article 7)

“Simplified approach”:

$$TFES = \left[\sum_{j=1}^{n} N_j \times ES_j \times LC_j\right] \times f_{BEH}$$

Pre-calculated savings effects

TFES	Total final energy savings (kWh/a)
N_j	Number of light points in the lighting system “j”
ES_j	Indicative value for the Energy Savings of each light point in the lighting system “j”, according to the table below (kWh/a)
LC_j	Factor to account for the savings according to the lighting control strategy used in the lighting system “j”, according to the table below. In the absence of light control technologies, this factor is “1”.
f_{BEH}	Factor for correction of behavioural effects (rebound, spill-over effect and free-rider effect)
j	Lighting system “j”
n	Total number of lighting systems

Indicative values

Old/inefficient light point		New/efficient light point		Energy savings (ES_j) [kWh/a]	Value for the ratio (LC_j)	
Technology	Lamp power (W)	Technology	Light point power (W)		Diming to 50% for 7 h/day	Diming to 50% for 5 h/day
High-Pressure Sodium (HPS)	400	Light Emitting Diode (LED) with at least 120lm/W	250	777.76	1.41	1.29
	250		160	471.12	1.43	1.31
	200		125	388.88	1.41	1.29
	150		95	286.68	1.42	1.30
	100		60	219.76	1.35	1.25
	70		40	169.40	1.30	1.22
	50		30	115.28	1.33	1.24
Metal-Halide (MH)	400	Light Emitting Diode (LED) with at least 120lm/W	300	577.76	1.66	1.47
	250		180	391.12	1.59	1.42
	175		125	277.76	1.57	1.41
	150		110	226.68	1.62	1.44
	70		50	129.40	1.49	1.35
Factor for correction of behavioural effects				[no dimension]		
Factor for correction of behavioural effects (f_{BEH})				1		
Lifetime of savings				[years]		
Lifetime of savings				13 years		

Calculation of impact on energy consumption (Article 3)

Calculation of impact on energy consumption (Article 3)

- Formula:

$$\text{APES} = TFES \times PEF_{Electricity}$$

APES	Annual primary energy savings [kWh/a]
TFES	Total final energy savings [kWh/a]
$PEF_{Electricity}$	Primary Energy Factor for electricity

- Indicative values for the PEF are prepared for EU level, but national values can be used.

Primary Energy Factor ($PEF_{Electricity}$)	[-]
Electricity (EU value)	2.281

Calculation of greenhouse gas savings

Calculation of greenhouse gas savings

- Formula:

$$GHGSAV = TFES \times f_{GHG,electricity} \times 10^{-6}$$

GHGSAV	Greenhouse gas savings [t CO_2e p.a.]
TFES	Total final energy savings (kWh/a)
$f_{GHG,electricity}$	Emission factor for electricity [g CO_2e/kWh]

- Indicative values for the “emission factor for electricity” are prepared for EU level, but national values can be used.

$f_{GHG,electricity}$	[g CO_2e/kWh]
Electricity (EU value)	133.3

Overview of costs related to the action

Overview of costs related to the action

- Indicative values for costs:

Cost category	Range of the costs per light point (EURO2015/2016/2017 incl. VAT)
Investment costs	[235 to 764] €/ light point
Operating costs	[6 to 50] €/ light point/year
Maintenance costs	[12 to 31] €/ light point/year

Factors with direct on costs: light source power, design, quality aspects and level of added features (intelligence, communications, constant light output), need for new poles and new power connections establishment.

Source: Streetlight-EPC European Project, www.streetlight-epc.eu

Preview of the streamSAVE Training Module

Refrigeration systems

Calculate

This methodology is valid for new installations of air- or water chilled central compression refrigeration units in compliance with the new Ecodesign regulations. It is based on the Seasonal Energy Performance Ratio (SEPR) of high-temperature process chillers at the rated refrigeration capacity of the unit.

Building Automation & Control Systems

Calculate

This methodology is valid for calculating the impact of installing or upgrading BACS on the energy demand of building(s). It is based on the BAC factor method and can be used for calculating savings in residential and non-residential buildings, for five types of end-use (heating, cooling, domestic hot water, ventilation and lighting) and for the three climate regions. A factor for rebound effects is foreseen.

Electric vehicles

Calculate

This methodology targets the fuel switching between conventional and electric vehicles. The conventional options include vehicles using diesel, petrol and LNG, as well as hybrid options. The more efficient options include electric vehicles. Therefore, the savings are not only ensured with higher conversion efficiency but also with the ensured fuel switching between the use of fossil fuels and electricity, which is increasingly generated based on renewable resources. Therefore, such fuel switching is able to ensure a reduction of fossil fuel consumption, with the associated primary energy savings and reduction of GHG emissions.

Lighting systems

Simplified Approach | Engineering Approach

This methodology deals with the replacement of existing road lighting systems to more energy efficient technologies. It provides two different formulas for the calculation of energy savings of the implementation of measures that account not only for the replacement of existing light points but also for the installation of lighting control technologies. The methodology can be applied in all Member States, following the provided indicative values and indications.

My results

Heat recovery

On-site applications | On-site process | District heating

Savings calculation methodologies covered by this Priority Action focus on heat recovery from industrial processes used on-site and in district heating grids. There is a wide spectrum of heat consuming applications in industry that are suitable for heat recovery actions; therefore, it is not feasible to define one representative application. Methodologies have been prepared for the following three cases:

- Heat recovery for on-site use in industry - use of excess heat for on-site applications
- Heat recovery for on-site use in industry - feedback of excess heat into a process
- Heat recovery for feed-in to a district heating grid

https://streamsave.flexx.camp/training

Q&A

Methodologies for “BACS” and “Road Lighting Systems”

3rd Dialogue Group meeting

9 November 2021

PART 2: Experience sharing about energy savings from BACS

Presentation by Hadrien Serougne (ADEME) about the French standardised calculation methods for energy savings from BACS

Your contact :

Hadrien Serougne
Coordinateur CEE– ADEME
+33 (0)1 47 65 22 74
Hadrien.SEROUGNE@ademe.fr

Agenda of the day

1. **Introduction : Présentation of ADEME**

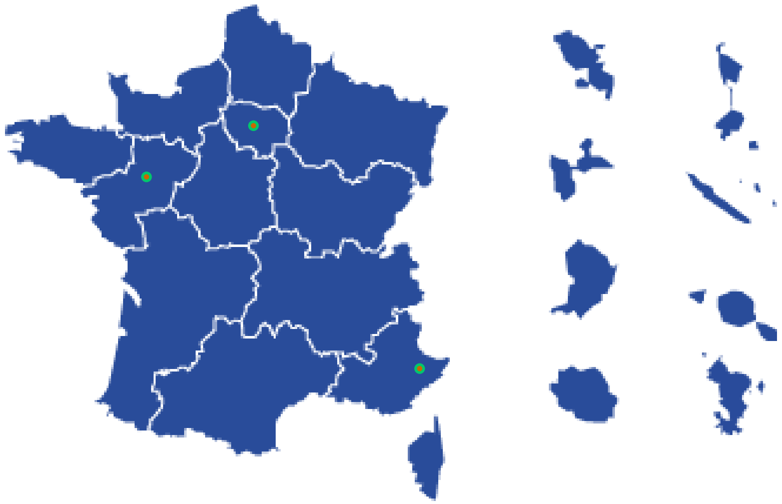
2. Technical building management system for heating and domestic hot water

Presentation of ADEME => Environmental and Energy Management Agency

- **Created in 1990 to guarantee the conditions for sustainable economic and social development;**
- **State operator to support the ecological and energy transition;**
- **EPIC (public industrial and commercial establishment) placed under the supervision of the Ministries of Ecological Transition, and Higher Education, Research and Innovation.**

<u>Territorial organisation :</u>

- 3 central sites (Angers, Paris, Valbonne),
- 17 Regional Directorates (13 in metropolitan territory and 4 overseas, for a total of 26 locations)
- 3 territorial representations (Polynesia, New Caledonia and Saint-Pierre-et-Miquelon).



Presentation of ADEME Missions

What ? ADEME participates in the implementation of public policies in the fields of the environment, energy and sustainable development.

For who ? It makes its expertise and advisory capacities available to businesses, local authorities, public authorities and the general public, in order to enable them to **progress** in their environmental approach.

How? What ? The Agency also helps finance projects (from research to implementation) in 5 areas of intervention:

- Waste,
- Polluted soils
- Energy and climate,
- Air and noise,
- Cross-cutting actions (sustainable production and consumption, sustainable cities and territories).

ADEME = Environmental and Energy Management Agency
4 jobs

Awareness	Convince and mobilize
Advice	Help achieve

RÉPUBLIQUE FRANÇAISE

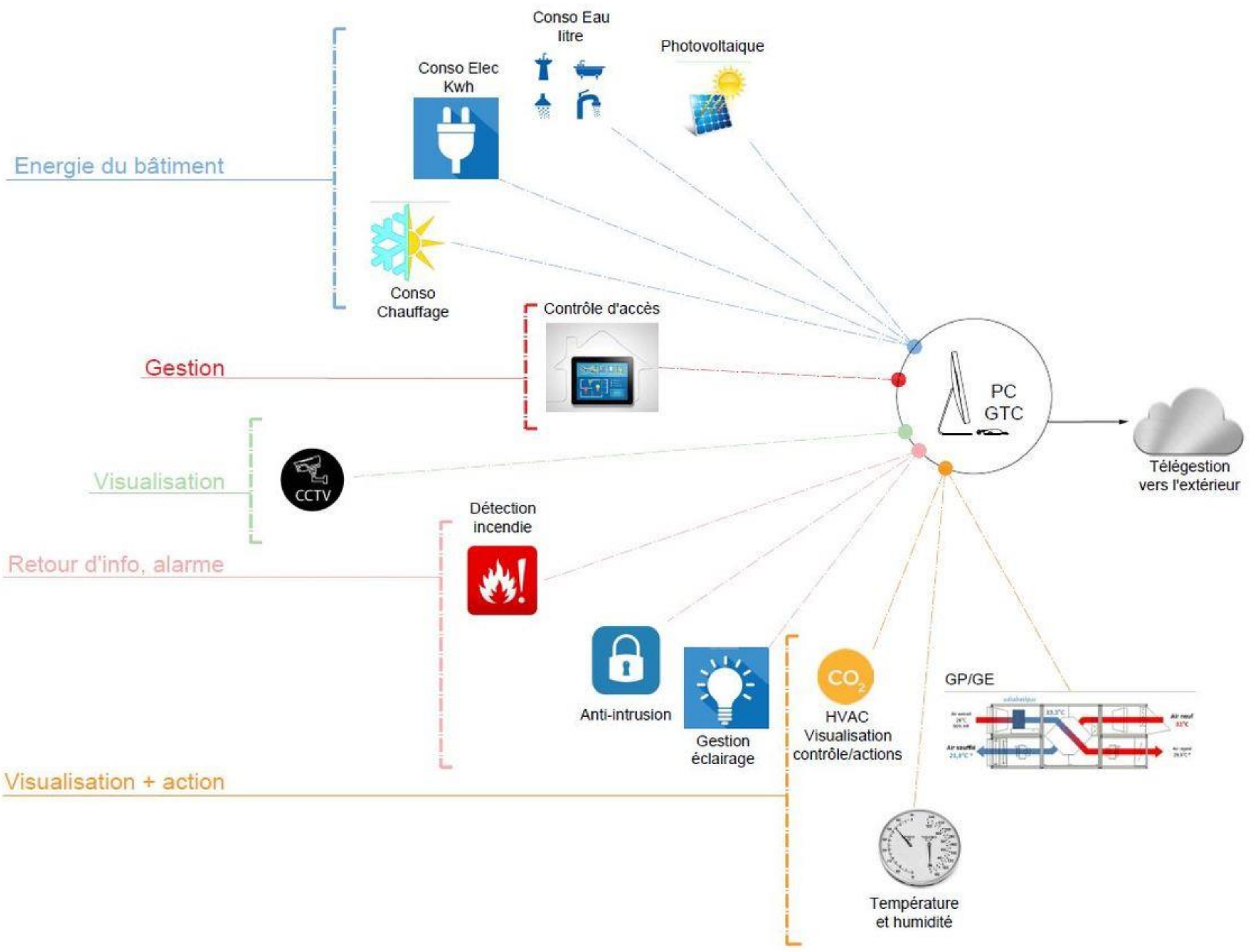
Liberté
Égalité
Fraternité

ADEME

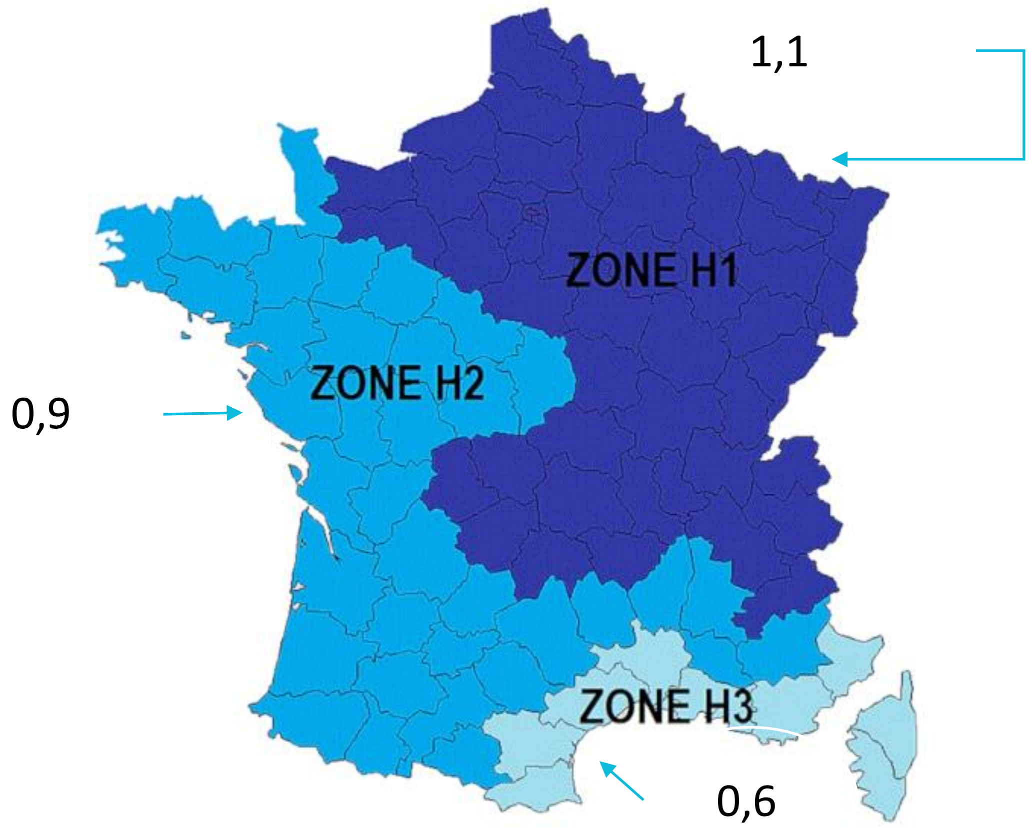
AGENCE DE LA TRANSITION ÉCOLOGIQUE

2. Technical building management system for heating and domestic hot water

Lighting
Prevent from fire
Security intrusion
Heating and cooling
management system
Temperature
Humidity
Manage renewable energy



FOR THE FORMULA CALCULATION - REGIONS - COEFFICIENT



F – SITUATION DE REFERENCE

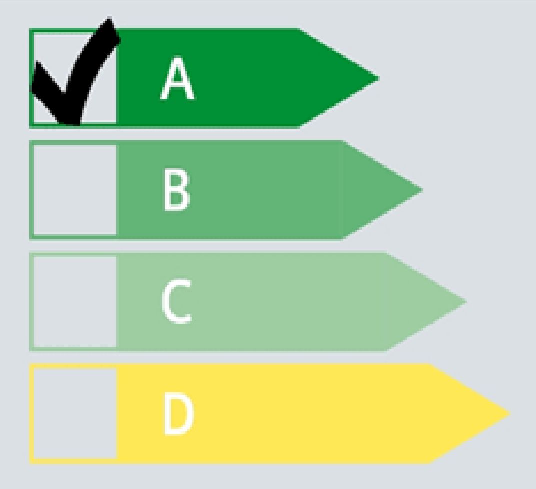
Les consommations de référence sont issues des données CEREN 2015 et CODA 2012 :

	Chauffage (kWef/m²)			ECS (kWef/m²)	Climatisation (Consommation en kWh/m²)	Eclairage(Consommation en KWh/m²)	Auxiliaire (Consommation en KWh/m²)
Branche	Gaz Naturel	Electricité	Toutes énergies	Electricité	Electricité	Electricité	Electricité
Bureaux	141	81	120	6,9	49,38	61,00	5,81
Enseignement	92	55	95	13,7	2,54	17,79	Absence de données
Santé	113	73	119	38,2	13,53	30,44	43,97
Commerces	110	62	90	14,6	29,89	110,70	6,66
Hôtellerie, restauration	156	49	106	40,5	17,45	50,22	Absence de données

Ces valeurs sont le reflet d'une performance intrinsèque moyenne des bâtiments (bâti et équipements) et d'un profil d'utilisation moyen.. En se référant à la typologie de la NF EN 15232:2017, on peut considérer que le profil est une moyenne pondérée des profils issus des 4 classes, décrits dans la norme, selon leur taux de pénétration actuel dans le parc tertiaire :

$$profil_{moyen} = d\% \times profil_{classe\ D} + c\% \times profil_{classe\ C} + b\% \times profil_{classe\ B} + a\% \times profil_{classe\ A}$$

Today, most commercial buildings are not equipped with BMS building automation, in particular small buildings. The experience of manufacturers tends to confirm that the current stock of buildings equipped with **class B or class A is almost non-existent.**



Classe A:
- Régulation et GTB à fort rendement énergétique

Classe B:
- Régulation et GTB avancée

Classe C:
- Régulation et GTB standard (prise habituellement comme référence)

Classe D:
- Régulation et GTB non rentable d'un point de vue énergétique

The average profile is :

• 0% of the class A profile;

• 15% of the class B profile (CODA data);

• 65% of the class C profile: rest of the subtraction (100-20-15).

• 20% of the profile according to class D: 31% (Observatory Office responsible data) reduced to 20% to take into account the imperfect manual management which does not make it possible to fulfill definitely the functions of class C

So we will focus on the A class and B class

The lifespan of BMS

- between 15 and 25 years.
- The conventional service life adopted is the minimum value provided for by the standard, ie 15 years.
- The discount coefficient is therefore: 11.563 years (we take in account the aging)

We deleted

- air conditioner => because it doesn't enter in the CEE system
- Lighting => because there is another form BAT-EQ-126 (depends on the intensity and the variation of light

Domestic hot water coefficient

The national standard : NF EN 15232-1.

Types de bâtiments	Facteurs d'efficacité pour l'eau chaude sanitaire			
	D	C	B	A
Bureaux, Enseignement Hôpitaux, Hôtels, Restaurants, Bâtiments abritant des services de vente en grandes et en petites surfaces	1,11	1	0,90	0,80

heating / cooling

The national standard : NF EN 15232-11.

Bureaux	1,44	1,57	1	1	0,79	0,80	0,70	0,57
Enseignement	1,20	–	1	1	0,88	–	0,80	–
Hôpitaux	1,31	–	1	1	0,91	–	0,86	–
Hôtels	1,17	1,76	1	1	0,85	0,79	0,61	0,76
Restaurants	1,21	1,39	1	1	0,76	0,94	0,69	0,6

[a] Ces valeurs dépendent fortement de la demande de chauffage/refroidissement par la ventilation.

lighting and auxiliary

Types de bâtiments non résidentiels	**Facteurs d'efficacité de BAC globaux (El,L – éclairage, El,Aux – auxiliaire)**							
	D		**C** (Référence)		**B**		**A**	
	$f_{BAC,el,L}$	$f_{BAC,el,aux}$	$f_{BAC,el,L}$	$f_{BAC,el,aux}$	$f_{BAC,el,L}$	$f_{BAC,el,aux}$	$f_{BAC,el,L}$	$f_{BAC,el,aux}$
Bureaux	1,1	1,15	1	1	0,85	0,86	0,72	0,72
Enseignement	1,1	1,12	1	1	0,88	0,87	0,76	0,74
Hôpitaux	1,2	1,1	1	1	1	0,98	1	0,96
Hôtels	1,1	1,12	1	1	0,88	0,89	0,76	0,78
Restaurants	1,1	1,09	1	1	1	0,96	1	0,92

Les coefficients d'économies d'énergie retenus sont basés sur les proportions détaillées dans la situation de référence, soit par exemple pour la classe B :

$$coef_{EE} = 1 - 20\% \times \frac{facteur\ B}{facteur\ D} - 65\% \times \frac{facteur\ B}{facteur\ C} - 15\% \times \frac{facteur\ B}{facteur\ B}$$

Les facteurs retenus pour hôtels- restaurants sont des moyennes pondérées à 50% pour les hôtels et 50% pour les restaurants.

Coefficients d'économies d'énergie de D à A

Branche	Chauffage	Climatisation	ECS	Eclairage	Auxiliaire
Bureau	0,297	0,450	0,203	0,274	0,281
Commerces	0,545	0,476	0,203	0,018	0,104
Enseignements	0,210	Absence de coefficient d'EE	0,203	0,238	0,259
Restaurant-Hôtel	0,346	0,352	0,203	0,128	0,156
Santé	0,168	Absence de coefficient d'EE	0,203	0,033	0,055

Coefficients d'économies d'énergie de D à B

Branche	Chauffage	Climatisation	ECS	Eclairage	Auxiliaire
Bureau	0,227	0,228	0,103	0,143	0,141
Commerces	0,297	0,191	0,103	0,018	0,064
Enseignements	0,131	Absence de coefficient d'EE	0,103	0,118	0,129
Restaurant-Hôtel	0,191	0,175	0,103	0,068	0,081
Santé	0,120	Absence de coefficient d'EE	0,103	0,033	0,035

B CLASS FROM D CLASS => EXAMPLE Office building with domestic hot water

- 0,8108 *0,2 = 0,16216
- 0,9*0,65 = 0,585
- 1*0,15 = 0,15
- 1- 0,16216 - 0,585 - 0,15 = 1,103

Les coefficients d'économies d'énergie retenus sont basés sur les proportions détaillées dans la situati
de référence, soit par exemple pour la classe B :

$$coef_{EE} = 1 - 20\% \times \frac{facteur\ B}{facteur\ D} - 65\% \times \frac{facteur\ B}{facteur\ C} - 15\% \times \frac{facteur\ B}{facteur\ B}$$

B CLASS calculation =>
The energy savings generated

	Economie d'énergie (kWh/m²) des fonctions de régulation de la classe B						
Branche	**Chauffage (kWh/m²)**			**Eau chaude sanitaire (kWh/m²)**	**Climatisation**	**Eclairage**	**Auxiliaire**
	Gaz	**Electricité**	**Toutes énergies**	**Electricité**	**Electricité**	**Electricité**	**Electricité**
Bureaux	32,0	18,3	27,2	1	11,3	8,7	0,8
Enseignement	12,1	7,2	12,5	1	Absence info	2,1	Absence info
Commerces	32,7	18,4	26,8	1	5,7	2,0	0,4
Hôtellerie-Restauration	29,8	9,4	20,9	2	3,1	3,4	Absence info
Santé	13,5	8,7	14,2	4	Absence info	1,0	1,5

A class calculation =>
The energy savings generated

	Economie d'énergie (kWh/m²) des fonctions de régulation de classe A						
Branche	**Chauffage (kWh/m²)**			**Eau chaude sanitaire (kWh/m²)**	**Climatisation**	**Eclairage**	**Auxiliaire**
	Gaz	**Electricité**	**Toutes énergies**	**Electricité**	**Electricité**	**Electricité**	**Electricité**
Bureaux	41,9	24,1	35,7	1,4	22,2	16,7	1,6
Enseignement	19	11,6	20,0	7,7	Absence info	4,2	Absence info
Commerces	59,9	33,8	49,0	2,7	14,2	2	0,7
Hôtellerie-Restauration	54,0	17	36,7	3,0	6,1	6,4	Absence info
Santé	19,0	12,3	20,0	8,2	Absence info	1	2,4

Montant unitaire des gisements d'économie d'énergie en kWh cumac / m² pour une GTB de classe A

Branche		Bureau	Commerces	Enseignements	Hotels	Santé
Chauffage	Gaz	485	693	224	625	219
	Electricité	278	391	134	196	142
	Autres vecteurs énergétiques	413	567	231	425	231
Climatisation		257	165	Absence de données	71	Absence de données
ECS		16	32	89	34	95
Eclairage		193	23	49	74	12
Auxiliaires		19	8	Absence de données	Absence de données	28

41,9 kWh/m2 x 11,563 (lifepan with aging)

= 485 kWhcumac

Branche	**Bureau**	**Commerces**	**Enseignements**	**Hotels**	**Santé**
Chauffage	396	556	198	423	199
Climatisation	257	165	Absence de données	71	Absence de données
ECS	16	32	89	34	95
Eclairage	193	23	49	74	12
Auxiliaires	19	8	Absence de données	Absence de données	28

GTB de classe A avec fusion des énergies de chauffages (31% électricité et 69% combustible, issu de la FC BAR-EN-101)

Unit amount of energy savings in kWh cumac / m² for a class B building management system

Chauffage	Gaz	370	378	140	345	156
	Electricité	212	213	84	108	101
	autres vecteurs énergétiques	315	310	144	234	165
Climatisation		130	66	Absence de données	35	Absence de données
ECS		8	3	45	17	48
Eclairage		101	23	24	40	12
Auxiliaires		10	5	Absence de données	Absence de données	18

32,0 kWh/m2 x 11,563 (lifepan with aging)
= 370 kWhcumac

B CLASS

Branche	Bureau	Commerces	Enseignements	Hotels	Santé
Chauffage	302	303	124	234	142
Climatisation	130	66	Absence de données	35	Absence de données
ECS	8	3	45	17	48
Eclairage	101	23	24	40	12
Auxiliaires	10	5	Absence de données	Absence de données	18

GTB de classe B avec fusion des énergies de chauffages (31% électricité et 69% combustible, issu de la FC BAR-EN-101)

FINALLY WE CHOSE FOR A an average

Pour une GTB de classe A :

Montant en kWh cumac par m² de surface chauffée gérée par le système					
Branche / Secteur d'activité	Chauffage	Climatisation	ECS	Eclairage	Auxiliaire
Bureaux	**400**	**260**	**16**	**190**	**19**
Enseignement	**200**	**71**	**89**	**49**	**8**
Commerces	**560**	**160**	**32**	**23**	**8**
Hotellerie, restauration	**420**	**71**	**34**	**74**	**8**
Santé	**200**	**71**	**95**	**12**	**28**
Autres Secteurs	**200**	**71**	**16**	**12**	**8**

X

Zone Climatique	
H1	1,1
H2	0,9
H3	0,6

X

Surface chauffée (m²)
S

FOR B an average

Pour une GTB de classe B :

Montant en kWh cumac par m² de surface chauffée gérée par le système					
Branche / Secteur d'activité	Chauffage	Climatisation	ECS	Eclairage	Auxiliaire
Bureaux	**300**	**130**	**8**	**100**	**10**
Enseignement	**120**	**35**	**45**	**24**	**5**
Commerces	**300**	**66**	**3**	**23**	**5**
Hotellerie, restauration	**230**	**35**	**17**	**40**	**5**
Santé	**140**	**35**	**48**	**12**	**18**
Autres Secteurs	**120**	**35**	**3**	**12**	**5**

X

Zone Climatique	
H1	1,1
H2	0,9
H3	0,6

X

Surface chauffée (m²)
S

FORMULA gather A and B => for simplification and generalisation almost 4/5 in B and 1/5 in A (less and more used)

Montant en kWh cumac par m² de surface chauffée gérée par le système				
Secteur d'activité	Usage chauffage seul		Usages chauffage et eau chaude sanitaire	
	Combustible	Électricité	Combustible	Électricité
Bureaux	**320**	**190**	**330**	**190**
Enseignement	**120**	**73**	**140**	**89**
Commerces	**340**	**190**	**360**	**210**
Hôtellerie-Restauration	**310**	**99**	**360**	**150**
Santé	**130**	**81**	**170**	**130**
Autres	**120**	**73**	**140**	**89**

X

Zone climatique	
H1	**1,1**
H2	**0,9**
H3	**0,6**

X

Surface chauffée (m²)
S

S est la surface chauffée gérée par le système de gestion technique du bâtiment.

EXAMPLES – coverage => this form help A class et B class at this coverage

- Le coût dépend grandement de la configuration du bâtiment et du nombre de points à gérer
- Coût de l’équipement :
  - Pour la mise à niveau des fonctions de régulation de GTB au niveau : 15-20 €/m²

L’équipement d’une GTB sans installation précédente : 30€/m²

Secteurs	Cas d’usage	Chauffage	Classe de GTB	Surfaces	Zone climatique	Coût de l’installation	Taux de couverture
Bureaux	Migration d’installation	Gaz	A	500 m²	H 1	15 €/m²	**38.6 %**
Enseignement	Installation neuve	Electrique	B	300 m²	H 3	30€/m²	**1.6 %**
Santé	Installation neuve	Gaz	B	8 000 m²	H 2	30€/m²	**3.8 %**

WHY WE USE ONLY COMBUSTIBLE AND NOT NATURAL GAZ AND ALL ENERGY ?

It was easier for the formula to gather Natural Gaz and All energy because Natural Gaz is mostly present in all energy

RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

ADEME
AGENCE DE LA TRANSITION ÉCOLOGIQUE

THANK YOU !

Your contact :

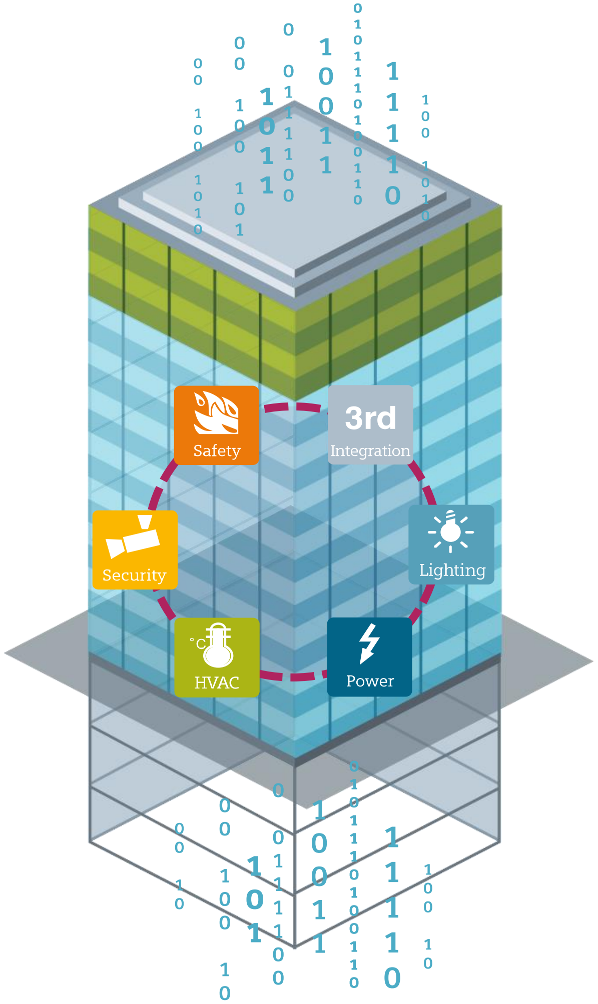
Hadrien Serougne
Coordinateur CEE– ADEME
+33 (0)1 47 65 22 74
Hadrien.SEROUGNE@ademe.fr

PART 2: Experience sharing about energy savings from BACS

Presentation by Bonnie Brook (eu.bac) on the BAC classes

Intelligent integrated control of TBSs with multiple benefits

eu.bac european building automation controls association



30%
of energy in buildings
is estimated to be used
inefficiently or unnecessarily

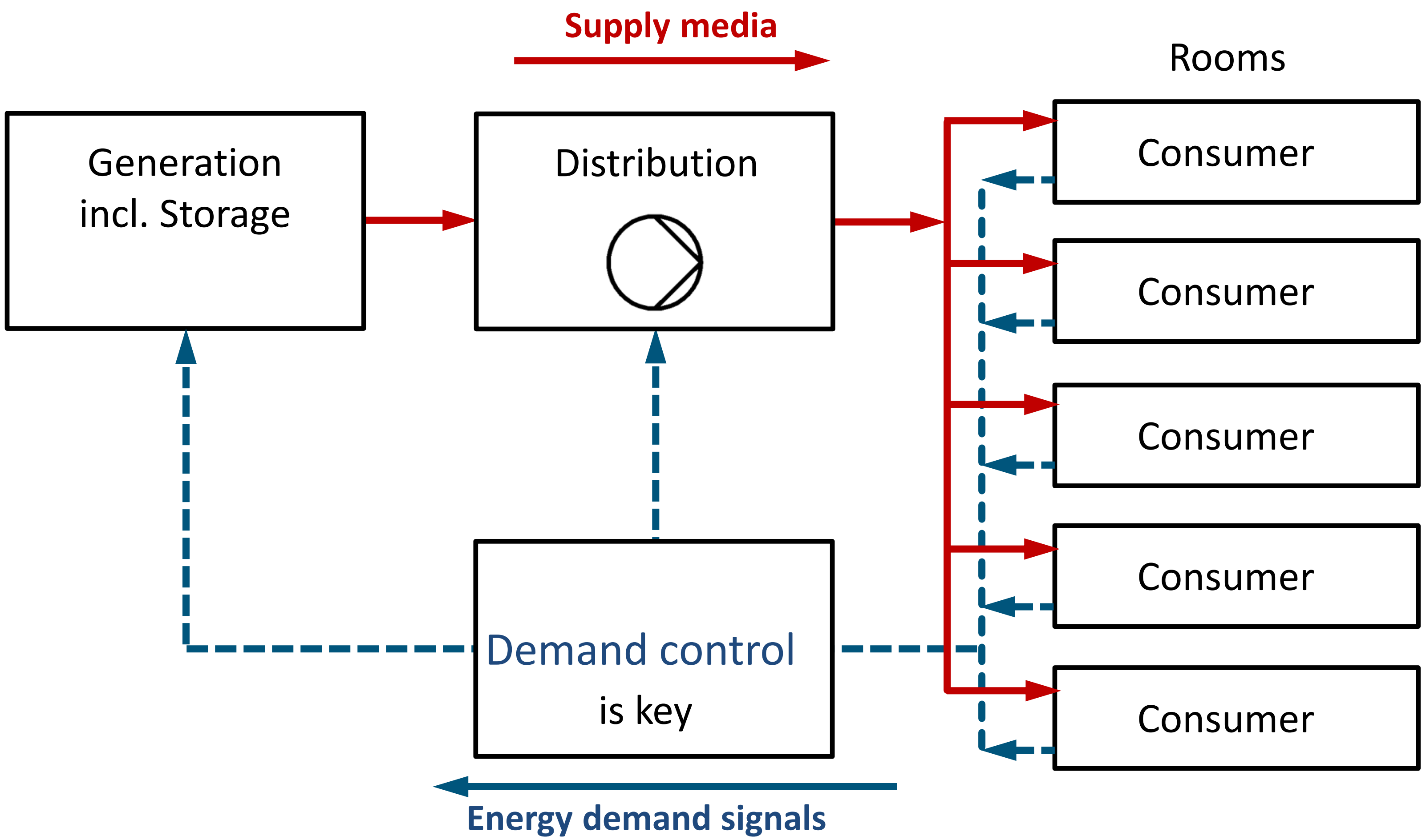
BACS can reduce thermal and electrical energy consumption* up to :

- **26%** in educational institutions and hospitals
- **27%** in residential buildings
- **41%** in hotels and restaurants
- **49%** in wholesale and retail buildings
- **52%** in offices and lecture halls

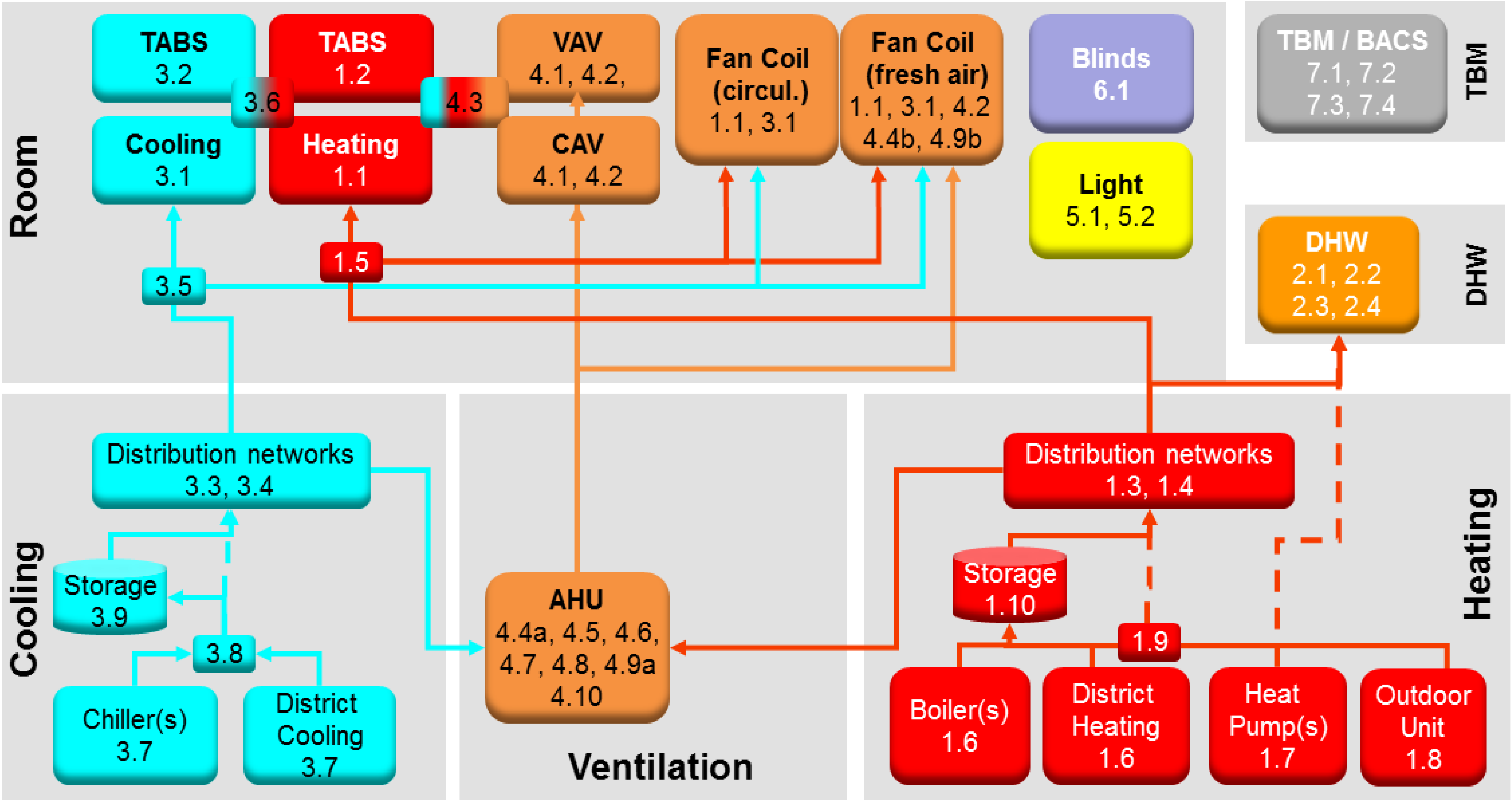
Source: eu.bac

Category	Saving potential [%]	Payback times [years]
Building automation	5-30	0-5
Technical installations	10-60	2-10
Building envelope	>50	10-60

Energy demand and supply model in EN 15232

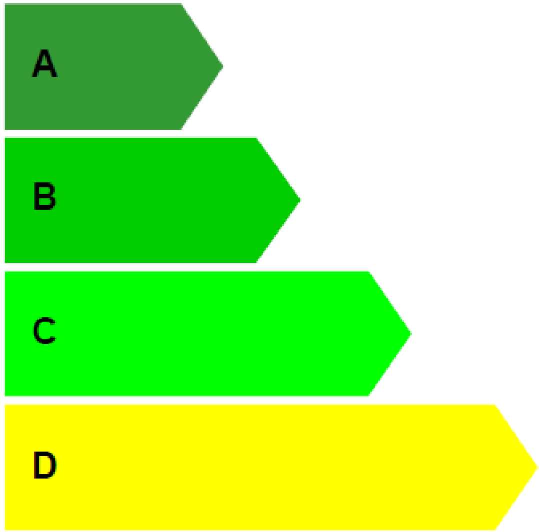


EN 15232: Relationships of BAC functions



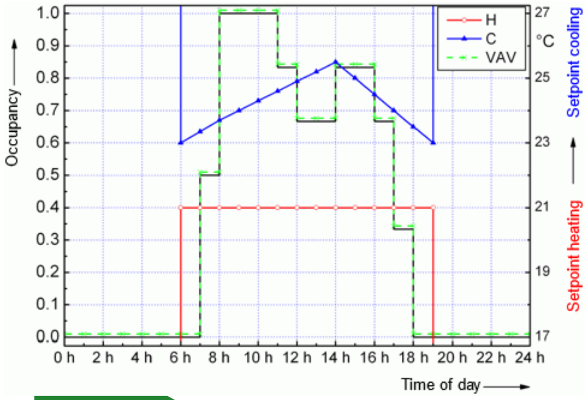
Source: eu.bac

EN 15232: BAC efficiency classes

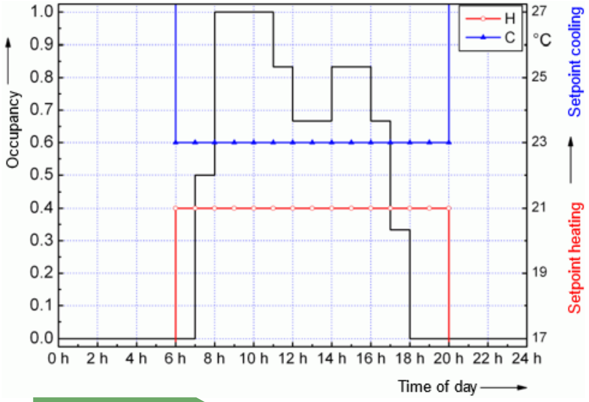


Class	Energy Efficiency
A	Corresponds to high energy performance BACS and TBM · Networked room automation with demand-based control · Variable-speed control · Variable demand-based temperature control · Diagnostics, analysis, performance evaluation, benchmarking
B	Corresponds to advanced BACS and some specific TBM functions · Networked room automation · Multi-stage control · Variable setpoint temperature control · Energy monitoring, trending and reporting
C	Corresponds to standard BACS and BAC minimum functions · Networked automation of primary HVAC plants · On/off control or fixed time control · Outside temperature compensated control · Non-communicating room control, thermostatic valves for radiators
D	Corresponds to non-energy efficient BACS. Systems shall be retrofitted. · Without networked automation functions · Mostly manual control or simple on/off control · Constant temperature control · No electronic room automation

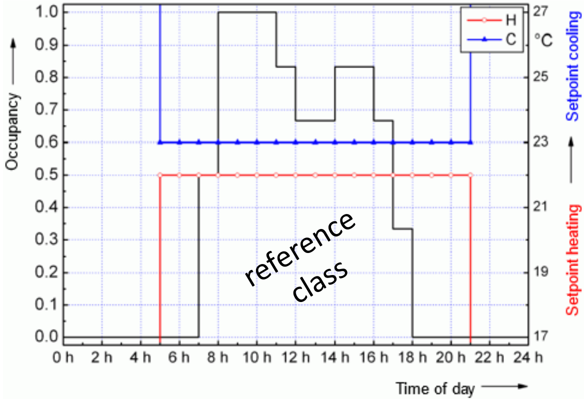
Office user profile and control quality for BAC energy efficiency classes D … A



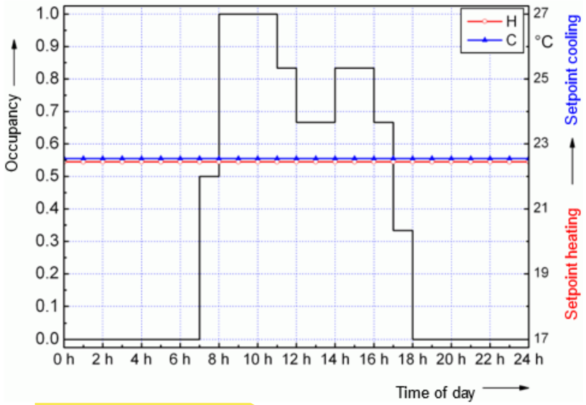
A



B



C



D

Distribution of BAC classes in buildings affected by the EPBD across EU

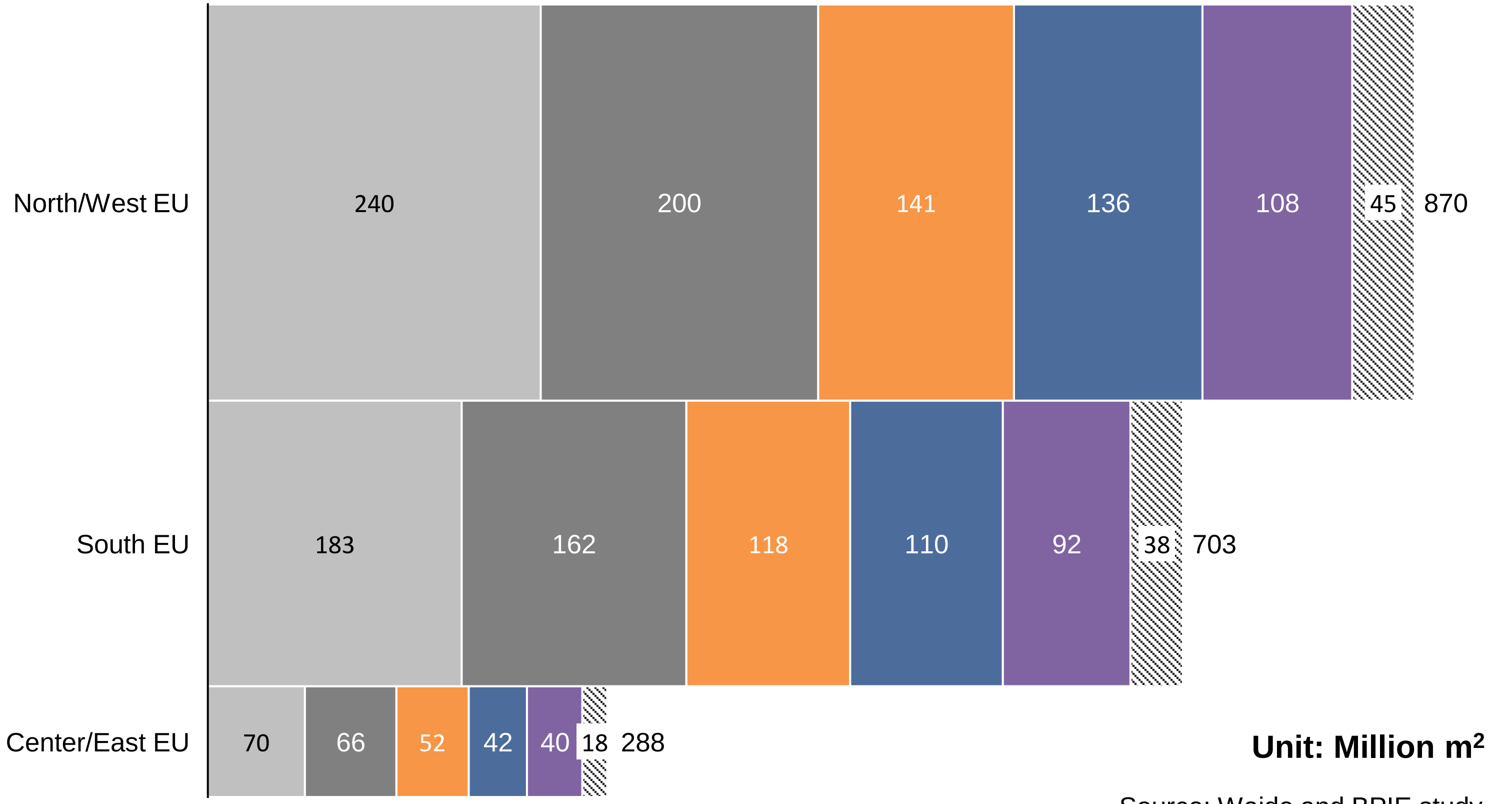
eu.bac european building automation controls association

% of buildings BACS level

	A/B	C/D
Schools	10%	90%
Offices	20%	80%
Univ.	30%	70%
Hotels	15%	85%
Hospitals	50%	50%
Misc.	50%	50%

Misc.: Retail, Corporate Campuses, Shopping centres

1.8Bm^2 area affected by EPBD across EU



Unit: Million m^2

Source: Waide and BPIE study

EPBD BACS compliance verification package from eu.bac

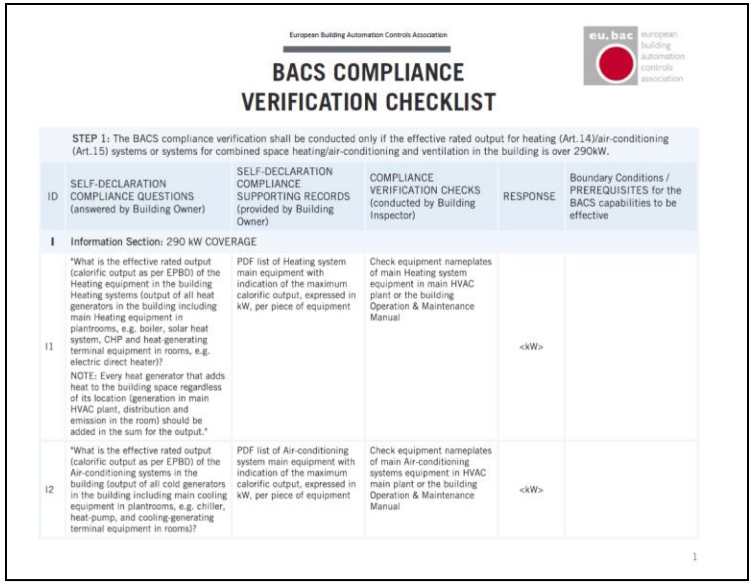
"Member States shall lay down requirements to ensure that, where technically and economically feasible, **non-residential buildings** with an effective rated output for heating (Art.14)/air-conditioning (Art.15) systems or systems for combined space heating/air-conditioning and ventilation of **over 290kW** are equipped with building automation and control systems by 2025."

"The building automation and control systems shall be capable of:

(a) continuously monitoring, logging, analysing and allowing for adjusting energy usage;

(b) benchmarking the building's energy efficiency, detecting losses in efficiency of technical building systems, and informing the person responsible for the facilities or technical building management about opportunities for energy efficiency improvement;

(c) allowing communication with connected technical building systems and other appliances inside the building and being interoperable with technical building systems across different types of proprietary technologies, devices and manufacturers."

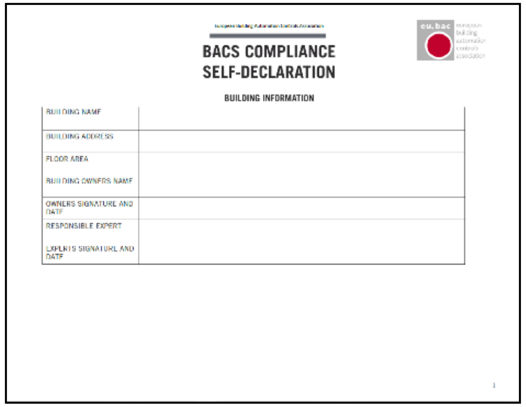

European Building Automation Controls Association

BACS COMPLIANCE VERIFICATION CHECKLIST

STEP 1: The BACS compliance verification shall be conducted only if the effective rated output for heating (Art.14)/air-conditioning (Art.15) systems or systems for combined space heating/air-conditioning and ventilation in the building is over 290kW.

ID	SELF-DECLARATION COMPLIANCE QUESTIONS (answered by Building Owner)	SELF-DECLARATION COMPLIANCE SUPPORTING RECORDS (provided by Building Owner)	COMPLIANCE VERIFICATION CHECKS (conducted by Building Inspector)	RESPONSE	Boundary Conditions / PREREQUISITES for the BACS capabilities to be effective
I	Information Section: 290 kW COVERAGE				
I1	"What is the effective rated output (calorific output as per EPBD) of the Heating equipment in the building Heating systems (output of all heat generators in the building including main Heating equipment in plantrooms, e.g. boiler, solar heat system, CHP and heat-generating terminal equipment in rooms, e.g. electric direct heater)? NOTE: Every heat generator that adds heat to the building space regardless of its location (generation in main HVAC plant, distribution and emission in the room) should be added in the sum for the output."	PDF list of Heating system main equipment with indication of the maximum calorific output, expressed in kW, per piece of equipment	Check equipment nameplates of main Heating system equipment in main HVAC plant or the building Operation & Maintenance Manual	<kW>	
I2	"What is the effective rated output (calorific output as per EPBD) of the Air-conditioning systems in the building (output of all cold generators in the building including main cooling equipment in plantrooms, e.g. chiller, heat-pump, and cooling-generating terminal equipment in rooms)?	PDF list of Air-conditioning system main equipment with indication of the maximum calorific output, expressed in kW, per piece of equipment	Check equipment nameplates of main Air-conditioning systems equipment in HVAC main plant or the building Operation & Maintenance Manual	<kW>	

1


BACS COMPLIANCE SELF-DECLARATION

BUILDING INFORMATION

BUILDING NAME	
BUILDING ADDRESS	
FLOOR AREA	
BUILDING OWNERS NAME	
OWNERS SIGNATURE AND DATE	
RESPONSIBLE EXPERT	
EXPERTS SIGNATURE AND DATE	

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our new website
eubac.org

Open discussions about energy savings calculations for BACS, and about BAC classes

Methodologies for
“BACS” and “Road Lighting Systems”

3rd Dialogue Group meeting

9 November 2021

PART 3: Experience sharing about energy savings from Road Lighting

Monitoring and verification of energy savings due to renovation of outdoor lighting systems – case study Slovenia

Presentation by Dr. Boris Sucic (Jozef Stefan Institute)

Monitoring and verification of energy savings due to renovation of outdoor lighting systems – case study Slovenia

Boris Sucic, JSI

streamSAVE Dialogue Groups, Priority Action: BACS & Road lighting, 9/11/2021

This project has received funding from the Horizon 2020 programme under grant agreement n°890147. The content of this presentation reflects only the author's view. The European Commission is not responsible for any use that may be made of the information it contains.

Introduction – Our Common Challenge

- **Energy efficiency** – the most powerful and cost-effective way for achieving goals of sustainable development
- The difficulty comes in trying to reconcile the "**development**" with the "**sustainable**"
- Development of **new knowledge** and skills is widely recognized as **the first step** in the process of **energy efficiency improvement**
- **Energy experts** are responsible **to close the gap between theory and practice**

Energy efficiency in Slovenian energy policy

Climate-neutral Slovenia and Europe by 2050

	GHG (total)	GHG (non-ETS)	RES	EE	Interconnect.	R&D
2020	SI: no specific target EU: -20 % (according to 1990)	SI: +4 % (according to 2005) EU: -10 % (according to 1990)	SI: 25 % EU: 20 %	SI: 20 % EU: 20 %	SI: no specific target EU: 10 %	SI: 3 % GDP (at least 1% of public funds)
2030	SI: -36 % EU: -40 %	SI: at least -20 % (EU Regulation: -15 %) EU: -30 %	SI: at least 27 % EU: 32 %	SI: at least 35 % EU: 32,5 %	SI: no specific target (2017: >83 %) EU: 15 %	SI: 3 % BDP (at least 1% of public funds)

Energy efficiency in Slovenian energy policy(2)

ALL COPMANIES

- **Energy costs reduction and environmental protection**
- **Competitiveness and creation of new jobs** (energy management, new and efficient technologies etc.)

GREEN PRODUCTS

- **Orientation toward sustainable and energy efficient products and services –** key pathway for the future development of the Slovenian industry: new materials, energy industry, e-mobility, sustainable houses, ICT products and services, etc.

Monitoring and verification of energy savings

- **Long tradition** of energy efficiency and energy auditing in **Slovenian society**
- **Educational program for energy managers** in place since 2008
- There was a need for a **tools/methods** for **monitoring and verification of energy savings** and support for systematic reduction of the energy consumption in all sectors
- The answer: **Systematisation of knowledge and preparation of methods for identification of energy savings!**

Outdoor lighting

- Two different calculation methods are possible:
  - Calculation method **based on design/operational data** (mostly used by the system operators)
  - Calculation method **based on standardized average annual energy savings per lighting source/system** (used in cases where operational data is missing or is inadequate state)

Outdoor lighting (2)

- Calculation method based on design/operational data
  (existing systems – requirement: at least 30% reduction of energy consumption)

$$ES = \sum_{i=1}^{n} P_{i,old} \times t_{i,old} \times f_{p,old} - \sum_{j=1}^{m} P_{j,new} \times t_{j,new} \times f_{p,new}$$

- *P* represents installed power of the lighting system
- *t* represents annual operational hours and
- f_p represents coefficient determining automatization (dimming) capabilities of the addressed lighting system

Outdoor lighting (3)

- Calculation method based on design/operational data
  (new systems, applicable in cases of new highway sections or new streets)

$$ES = \sum_{j=1}^{m} L_{j,new} \times \left(8 - E_{j,new} \times f_{p,new}\right)$$

- *L* represents length of the section where new lighting system is applied
- *8* is average annual electricity consumption in kWh per meter of new section (value is based on literature review and actual conditions on Slovenian roads)
- E_j represents estimated annual electricity consumption in kWh per meter of new road based on estimation that new lighting system will have 4,000 operational hours per year (dimming is not included)

Outdoor lighting (4)

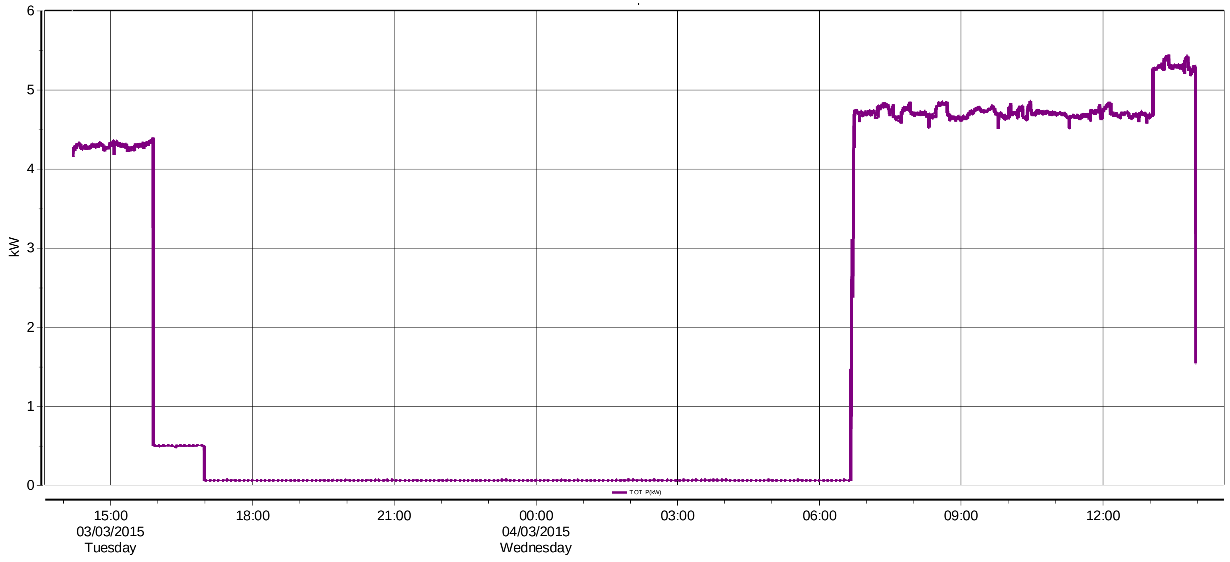
- Calculation method based on standardized average annual energy savings per lighting source/system (used in cases where operational data is missing or is inadequate)

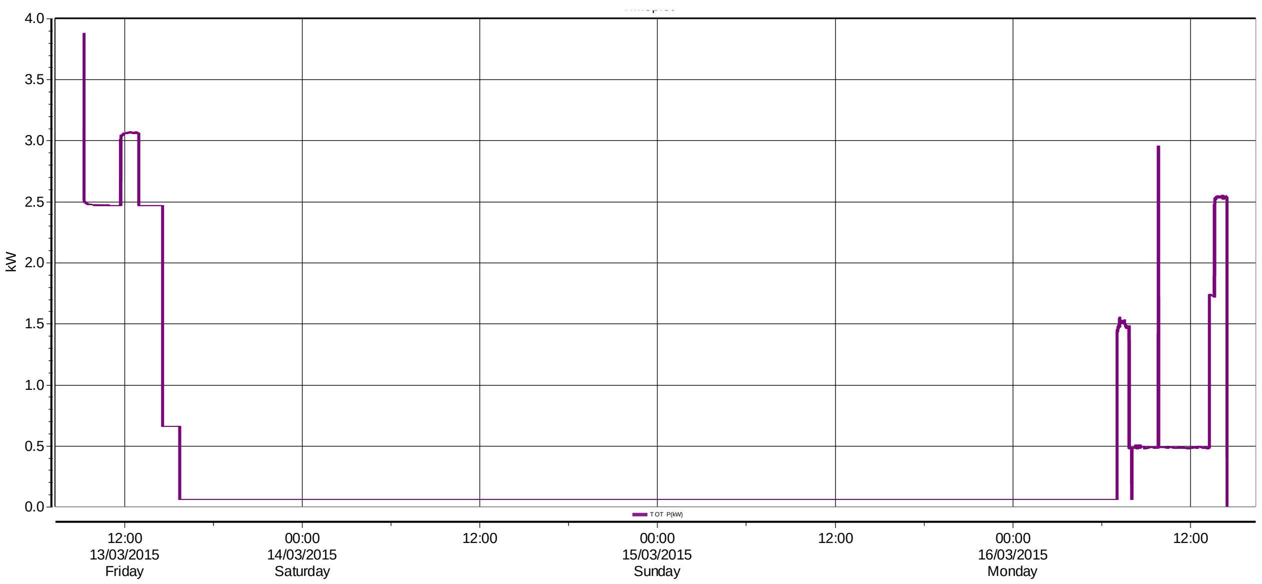
$$ES = \sum_{i=1}^{n} n_i \times SES_i$$

- n_i represents number of installed/replaced lighting sources/systems
- SES_i represents standardised average annual energy savings per lighting source/system (values are based on comprehensive evaluation of implemented projects)

Outdoor lighting (5)

- Comprehensive testing and verification of energy savings – field work and laboratory





Outdoor lighting (6)

- Example of standardised average annual energy savings per lighting source/system

Existing situation (type and power of lighting source/system)	New situation (type and power of lighting source/system)	Standardised average annual energy savings (SES) per lighting source/system
Mercury-vapor lamp (400 W)	Modular LED (225 W)	**680 kWh/year**
Mercury-vapor lamp (400 W)	Sodium-vapor lamp (250 W)	**608 kWh/year**
Mercury-vapor lamp (400 W)	Metal-halide lamp (250 W)	**608 kWh/year**

Risks and uncertainties – main external parameters influencing renovation of outdoor/public lighting systems

- Future development of **energy efficiency projects related with the outdoor/public lighting systems**, with the requirement of fulfilling the safety, environmental and energy requirements, is associated with **multiple complexities with interactive, dynamic and uncertain characteristics**
- The most influencing external parameters:
  - Environmental and safety regulations,
  - Economic growth and living standard,
  - Demographic and industrial development,
  - **Energy prices**

Risks and uncertainties –Energy Prices

- 1900 cost of barrel of oil = $ 1
- 1973 cost of barrel of oil = **$?**

Risks and uncertainties –Energy Prices

- 1900 cost of barrel of oil = $ 1
- 1973 cost of barrel of oil = **$ 2**

Risks and uncertainties –Energy Prices

- 1900 cost of barrel of oil = $ 1
- 1973 cost of barrel of oil = $ 2
- October 1973 – Yom Kipur war OPEC oil embargo & first oil shock!
- 1974 cost of barrel of oil = **$?**

Risks and uncertainties –Energy Prices

- 1900 cost of barrel of oil = $ 1
- 1973 cost of barrel of oil = $ 2
- October 1973 – Yom Kipur war OPEC oil embargo & first oil shock!
- 1974 cost of barrel of oil = **$ 12**

Risks and uncertainties –Energy Prices

- 2020 cost of electricity = 40 €/MWh
- 2021 cost of electricity = 140 €/MWh
- **2022 cost of electricity ~ 100 €/MWh**
- **2030 cost of electricity = ????**

Conclusion

- **Energy renovation of outdoor/public lighting systems** is **standardised energy service offered by Slovenian ESCOs** (based on energy performance contracting)
- Majority of outdoor/public lighting systems operators have established **comprehensive cadastre** of their systems
- In practice, **energy management systems** are used for **verification of energy savings**
- **Copy-paste planning** - the most frequent mistake!
- Renovation strategy **must be adaptive** and **must rely on the empirical data**

Open discussions about energy savings calculations for Road Lighting

Methodologies for
"BACS" and "Road Lighting Systems"

3rd Dialogue Group meeting

9 November 2021

Next steps

Methodologies

3rd Dialogue Group meeting

9 November 2021

Next steps

- Meeting minutes
  - please feel free to send us your suggestions, either in the online forum or to dialogues@streamsave.eu
- All information will be included on the platform
  - in case you are not registered yet, we will show you how
- Training Module: now available → you can provide feedback directly in the platform
- The discussions continue in the online forum

Next Dialogue Activities

- Date for the next Dialogue Group web-meeting

Tuesday 23 November 3.00 to 4.30 pm CET		**Electric Vehicles** **+ full demo of the Training Module**	Registration

- + 2 dialogue workshops in first semester 2022,

- and a new cycle of dialogue groups starting from March 2022

Feedback

- Please, fill out our quick feedback survey

- You may also leave us a longer message
  - Via forum on the streamSAVE platform
  - Via the anonymous form (link in the chat)
  - Via dialogues@streamsave.eu
    - Please accept as sender

- To receive more info → register on the streamSAVE platform: https://streamsave.flexx.camp/signup-0818ml

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LGi
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Thank you

Get in touch for more information!

Project coordinator - Nele Renders, VITO

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