



EU4Energy



# Energy Performance Certificate SW for Buildings

Session II: From "good intentions" to realization (panel discussion)



# Energy Performance of Buildings Directive



18.6	2010	18	Official journal of the	European Union L. 153/13
		DIRECTIVE 20	0/31/EU OF THE EUROPEAN	PARLIAMENT AND OF THE COUNCIL
			of 19 May	2010
			on the energy perform	ance of buildings
			(recat	1
Havi	KURORIA SPLAN UNI	n patriament and on o che Trezey ot che F	THE COUNCE OF THE	Together wish an increased use of energy from renewable tourcer, messure salari to teduce energy consumption in the Union would allow the Union Anicora (Transverd Governion on Cinnas Ciange (UNEGC), and a horseer hash to lines any commissions at mitted
Unio	e, and in	panicular Article 194	(2) sharaôf,	the plobal semperature rise below 2 °C, and in constraintees to reduce by 2020, overall pre-choup on emission by at least 20 S below 1990 levels, and
Ileri	ng regard :	a she proposal from	she European Commission,	by 30 % in the event of an international agreement being mathed. Reduced energy contumption and an increased use of energy from mnewable sources also have an
larri Secia	ng regard i Commie	io che opinion of ch imi (°).	e lumpean l'conomic and	important pairs to play in promising security of energy supply, solihoological developments and in creating opportunities for exployment and regional development in particular in rural areas.
Havi Repi	og mgard	to the opinion of	f she Constitues of the	
Acti	ų in accor	dance with the artist	ary legislative procedure (*).	(4) Managements of energy demand in an important tool endology the Union on influence the global energy market and hence the security of energy supply in the medium and longe errm.
Whe	THAT			
				(F) The European Council of March 2007 emphasized she
(1)	Directive ebe Cox performs Since for is these	2002/91/EC of the 1 ancil of 16 Decent ance of buildings (* other subtaansive area 1 be recass in the inte	Suropean Parliamene and of per 2002 on the energy 1 has been amended (% endremn are to be made, even of clarity.	meet of increase energy enclosery in our chains to an achieve the objective of inducing by 20% whe Ubior's energy concumption by 2020 and called for a shortoogh and rapid implementation of the proteins established in the Commission Communication enrich Access plan for energy efficiency making the potential That accion plan identified the significant potential for com-efficiency energy arrange in the buildings next. The
(2)	An effici of energy and solid also also	ers, proders, rasional y applies, inter alia, o I foels, which are emi- leading sources of co	and summable unlimation o oil produces, mawral gat nelal tources of energy, bue abon dioxide emissions.	Lampeon Parlamine, in 'te meniaten of '11 (anuar 2008, called for the nemogheting of the provident of Directive 200(39)/EC and bas called a variate sime, on the latent excasion in its reconsistent of 3 february 2009 on the latent Scatagic Interge Barleys, for the 201 sentry efficiency cargin in 2020 to be made briding.
(7)	Building in she U increase energy renewab imponan energy	a account for 40 % or nion. The sector is an fat energy consumption consumption and a le sources in whe l is massures needed dependency and g	Fread energy comumption patching, which it bound as on. Therefore, reduction of the use of energy from sublings sector contrikues so induce the Union's reschours gat unicitient.	Industries, Decide No. 401,000 (C. or this narrowani Industries and of the Science) of 21 April 2009 on the effort of Metoder Science to mileto: their generitosis gas entrations or one-site Community's generitosis entration inducion commissioner of the 2000 (F), many efficiency in the budding secont will be crucial and Directive 2009 (2010) of the Taropane Prillineari entration 2009 (2010) of the Taropane Prillineari
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29	L I, 41.2	001, p. 65. , Fat A.		() 0[1 140, 56 3009, p 156

"... to make it possible for owners or tenants of the building or building unit to compare and assess its energy performance."

• Article 12 Issue of energy performance certificates

1. **Contracting Parties** shall ensure that an energy performance certificate is **issued** for:

(a) buildings or building units which are constructed, sold or rented out to a new tenant; and

(b) buildings where a total useful floor area over 500  $m^2$  is occupied by a public authority and frequently visited by the public.

• Article 3 **Energy performance indicators** are based on a methodology for calculating the energy performance of buildings adopted in national or regional level.

Energy demand for heating, hot water, ventilation, cooling and lighting





# Essentials of Energy Performance Certificates



- Ensures Legal Security for Building Owners, Buyers, Tenants and Authorities granting EE incentives
- Correct EP Calculation is paramount, there should be no doubt on the EPC energy indicators based on a validated EPBD compliant Calculation Kernel
- A well-functioning and reliable EPC system depends to a large extent on the certifiers' skills. Therefore, the quality of the accreditation process, education for Building Energy Experts are major quality characteristics
- **Quality Assurance** system for EPCs is increasing value and trust for the EPC stakeholders
  - Specific scoring system to assess plausibility of calculation/input
- EPCs are crucial for a functioning *Minimum Performance Requirements* introduction and for EP related incentive programmes





# EPC Concept Implementation Introduction (history of events)

**EPC** SOFTWARE Calculator/Evaluator registration Energy Performance Calculation EPBD compliant Enerav Performance Certificate Independent verification EPC in database

Public view of EPC in database

- In the course of an EBRD Policy Dialogue Project in UA an EPC concept was designed and comprehensive EPC Software for Calculation and Certification/Verification was developed
- **E7** and **Quarto** (Vienna based EE Consulter and SW house) developed jointly with 2 Ukrainian Institutions the EPC Application
  - NDIBK (National Research Institute), lead partner for Calculation Methodology
  - SAEE (State Agency for EE), lead partner for Certification, verification, databases
- SW architecture and design was based on
  - best practice research in Europe
  - 'straight-through-processing' approach (Calculation  $\rightarrow$  final EPC)
  - Web based service technology, only browser at front end is required
- Focus on integrated Quality Assurance functionality for Certificates in implementing recommendations considered to be 'state-of-the-art' on European Level





## EPC Concept Implementation Integrated software for the whole EPC process







## EPC Software Functional Benefits of EPC Software



- Managed **straight through EPC processing**: Calculation, Plausibility Check, Verification, Certification, Publication
- **Convenient, structured and guided input** of building data, elements, materials and building services
- Integrated database for Auditors and Calculators
- Common EPC database with key data as source for reports (Efficiency Class by city, building type etc.)
- Integration of Inspection Reports for heating and air-conditioning system possible
- Optional: charging (Credit Points) for Calculation and/or Certification
- Easily customisable templates for Certification documents (Excel template), no programming skills needed
- Multi language support: built-in design





## EPC – Based on European Best Practice

#### **EPC Quality Assurance elements**

**Energy Community** 



EU4Energy

- Minimum requirements for qualification of Auditors
- **Database of Auditors** publicly available
- Penalties for non-compliance
- National standard for calculation procedure
- Nationwide unique calculation kernel
- AEE in charge of EPC Quality Control
- Automatic validation of input values
- Automatic plausibility check of results
- **Random** verification of certificates second
- Database for Certificates and data of calculation

Michael Toth, March 29<sup>th</sup>, 2018, High Level Political Talks

Public access to Certificates



Source: BPIE, Energy Performance Certificate Across The EU. A Mapping of National Approaches, 2014

## EPC Software Technical features of EPC Software

**EPC** SOFTWARE

Calculator/Evaluator registration

> Energy Performance **Calculation** EPBD compliant

Energy Performance Certificate V Independent verification

EPC in database

Public view of EPC in database



- End users just need a **web browser** to use software
- One universal Calculation Engine for all Calculators
- Calculation Kernel
  - Adaptation to national calculation method, based on European standards
  - Just one calculation kernel implemented for the whole country validation of correct calculation just for one calculation kernel required
  - Interface for third party software tools via web service possible
- All EPC input data and results stored in database as well as calculators/auditors work in progress, projects





## **EPC-SW** Application Architecture







# EPC Software How to use Unique Calculation Kernel

Calculation Kernel

Based on European standards and norms (implemented and maintained by standard setting body)

Unique, country-wide Calculation Kernel\*, leaves no room for interpretation of formulas

No need for SW validation process

#### Option 1 manual entry:

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#### **Option 2 automised input:**



- Controlled access (via web browser)
- Manual entry of building data Calculation of Energy Performance Certificate by means of Unique Calculation Kernel
- **Registration** of energy evaluators, inspectors at AEE is required based on professional qualifications
- Open to any software vendor, provider (architectural design software, energy performance calculation tools), fast calculation during design
- Transparent definition and publication of XML interface for transmitting of building geometry data and rsults
- Option to integrate XML interface in design software applications (e.g. AutoCad, ArchiCad, ...)
- Thus, convenient automated EP Calculation is possible for new buildings

\* Can be used for both EP Certificates and design documentation





# Gap Analysis project of the Energy Performance of Buildings Law for Moldova (EU4Energy)



- "Gap analysis with Directive 2010/31/EU, in the area of EE of buildings, focus on EPCs for buildings, Roadmap for the subsequent EPC SW implementation", focus on secondary laws
  - Legal assessment of duties and responsibilities of national authorities defined in the LEPB, assessment of existence of secondary legislation
  - **Technical assessment** of existing secondary legislation and drafts of the calculation method of the EP of buildings, the method for **MEPs**, the **content and layout** of the Energy Performance **Certificate, inspection** of heating and A/C systems
  - Organisational assessment: appropriate institution identification
- A **Roadmap** to define implementation path of the EPC software in Moldova together with an estimate of timelines and required resources
  - This will align the creation of missing secondary laws and the SW development process and will visualise interdependencies between secondary laws and SW development





# Gap Analysis – key findings (EU4Energy)



- Primary law is **clearly structured** and covers all elements of EPBD; a few elements are not EPBD compliant (see EnCS analysis)
- **Existing secondary legislations** and drafts are comprehensive and precise, calculation methodology, certificates and MinReqs **not fully compliant** with EPBD
- Many required definitions in secondary legislation according to primary law are still not in place (eg. Independent Control System for certificates, inspection reports; content and layout of inspection reports, procedure and method for registry of companies, energy evaluators and inspectors)
- **Quick start** for EPC-SW development needs activities in certification, inspection and registration of companies and experts
- The new structure and proper staffing of Public Authority (NISE) is needed to host the development and management National Information System for EPCs the planned merger of AEE and FEE





## Who are we?

#### e7 Energie Markt Analyse GmbH

- Private research and consulting company
- Located in Vienna, Austria
- Expertise in
  - Research and consulting regarding energy efficiency and renewable energy systems
- Special expertise in implementation of EPBD
  - minimum energy performance requirements
  - calculation method for energy performance of buildings
  - Cost-optimum calculation

#### **Quarto GmbH**

- Private software company
- Located in Vienna, Austria
- Expertise in
  - Software Architecture
  - Software Design & Development
  - System Integration
  - Transposition of Business Requirements into Software
  - Project Management





Michael Toth, March 29th, 2018, High Level Political Talks

## Contact

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# Gap Analysis – missing sec. laws list (1)





- 2. Art. 13 (5): Technical specification for feasibility studies of using alternative system
- 3. Art. 14 (1): Methodology to calculate the minimum amount of energy from renewable sources
- 4. Art. 14 (1): Minimum requirements for the amount of energy from renewable sources
- 5. Art. 15 (3): National plan to increase the number of nearly zero-energy buildings,
- 6. Art. 15 (3): Definition of nearly zero-energy building.
- 7. Art. 16 (3): Specialised software to calculate and issue energy performance certificates.
- 8. Art. 16 (4): Electronic register for energy performance certificates
- 9. Art. 24 (3): Specialised software to issue reports on regular inspection of the heating system
  10. Art. 24 (6): Template for the standard report on the regular inspection of heating systems.
  11. Art. 25 (3) + (4): Approval of draft GD on air-conditioning system.





## Gap Analysis – missing sec. laws list (2)



- 12. Art. 26 (6): Template for the standard report on the regular inspection of air-conditioning systems.
- **13.** Art. 27 (3) + (4): National information system on energy efficiency of buildings: establishment of information system and preparation for the management of operation
- 14. Art. 28 (1): Definition of the independent control system
- 15. Art. 29 (2): Method of registration of companies
- 16. Art. 30 (1): Authorization procedures for energy evaluators, inspectors of heating systems and inspectors of air conditioning systems
- **17.** Art. 30 (4): Training procedures and training of energy evaluators, inspectors of heating systems an inspectors of air conditioning systems
- **18.** Art. 30 (5): Procedures for examination and examination commission of the professional competence already established
- **19.** Art. 30 (8): Authorizations procedures of evaluators, inspectors of heating systems and inspectors of air conditioning systems

Bullets in green fonts are needed for NIS development, at the latest after stage 1 (Project Definition Phase)





#### Table 17: Consolidated secondary legislation and SW development network plan

No	activities insecondary laws creation		has	el	•				
	Quarter of a year	1	2	3	4	5	6	7	8
4	Energy performance certification (EPC)								
4.1	Review existing definition of form and content of the energy			1	]				
	Development of a report template as annex which is integral part		ł	<b>.</b>	ŧ	}			
4.2	of the certificate				}				
5	Inspection of heating systems								
5.1	Development form and content for the inspection report (report				1				
6	Inspection of air conditioning systems				2	1	2 .		-
	Approval of draft governmental decision on inspection of air				<u>}</u>				
0.1	conditioning systems		ļ		Į				
6.2	Development form and content for the inspection report (report template)			E					
8	Independent Control System (ICS)		-	-	<i>.</i>				
0 1	Definition of the Independent Control System for certificates and								
0.1	inspection reports of heating and air conditioning systems				<u> </u>	:			
9	Registry of independent experts and companies				<u>.</u>				
8.1	Development of method of registration of companies Development of authorisation procedures for energy evaluators.				<u> </u>				
9.2	inspectors of heating systems and inspectors of air conditioning				1				
	systems				}				
11	National Institution for Sustainable Buildings				3				
11.1	Merge of FAEE and AEE to the new NISE				1			1	
		_							
4.0	NIC Designed Definition and Dispusing Changed								
12	NIS Project Definiton and Planning Stage 1		Stage (of Phase	1					
12	NIS Project Definiton and Planning Stage 1 Quarter of a year	1	Stage (of Phase 2	3	4	5	6	7	8
12 12.1	NIS Project Definiton and Planning Stage 1 Quarter of a year SRS Definition (SW requirement specification)	1	Stage (of Phase 2	3	4	5	6	7	8
12 12.1 12.1.1	NIS Project Definiton and Planning Stage 1 Quarter of a year SRS Definition (SW requirement specification) Calculation Kemel Definition, itemised formula descriptions	1	Stage (of Phase 2	3	4	5	6	7	8
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## Energy Performance of Buildings **Example Screenshots of Software (1)**

#### **Detailed input of layers for building elements**

Element Templates											
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Comparisons	Eleme	nt No:			7						11 15
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Project Data	Descri	ption:									
🞲 Building	Eleme	nt Are	a:		Walls	3			-		
Element	Eleme	nt Typ	e:		EWi -	wall conditioned by the external			-		
Envelope	Outer	Surfac	e Mate	erial:	Brick	ceramic			*		
1 Heating	Is Ventilated Coating: Input Mode: U-Value [0,001 - 100 W/m²K]:				No		•				
the adding					Detai	iled	-				
Hot Water	U-Valu	ie [0,0	01 - 1	00 W/I	m²K]: 0,19	4921933398571					
Cooling	R-Valu	ie (m²	K/W]:		5,13	02589840171					
😢 Ventilation											
💡 Lighting	Layer	<u>'S</u>									
Result	Total 1	Thickne	ess (m	]:	0,54						
🔯 History	6 A	dd 💙	K Rem	iove La	ayer 🖸 Cop	y Layer │ △ Move Up │ ▽ Move	e Down 📔 Exp	oort to 🔻			
🄏 (Debug)					Out-2- In ▲ ♥	Name 🔺 💡	Thickness 🕈	Thermal Conductivity 🕈	Thermal Conductivity 9	Thermal Conductivity	Description 9
Credits & Purchases 🔻		G	<u>~</u>	~	1	Plates of plaster (1200 kg/m <sup>3</sup> )	0,015	0,41	0,47	0,47	
Background Info 🗸 🗸		മ		~	2	Concrete cellular (1200 kg/m³)	0,20	0,49	0,55	0,55	
🧭 Admin 🗸 🗸	Element Templates       Semecal Lufo         Comparisons       Element No:         Current Project       Name:         Voject Data       Bescription:         Sement       Outer Surface Material:         Divelope       Element Type:         Outer Surface Material:       Brick ceramic         Double       Value [0.001 - 100 W/m*k]:         Outer Surface Material:       Brick ceramic         Double       Value [0.001 - 100 W/m*k]:         Value [0.001 - 100 W/m*k]:       0.194921933398571         Scoling       Name:         Pertilation       Ighting         Securit       States [m]:         Outer Surface Info       States [m]:         Credits & Purchases       Total Thickness [m]:         Outer Surface Reground Info       Image: Project Info         Background Info       Image: Plates of plaster (1200       0.015       0.44       0.47       0.47         Image: Plates of plaster (1200       0.015       0.44       0.47       0.47       Image: Plates of plaster (1200       0.015       0.44       0.47       0.47         Image: Plates of plaster (1200       0.015       0.44       0.47       0.47       Image: Plates of plaster (1200       0.015       0.41 <td< td=""></td<>										
		ሪ	۵	▼	4	Plates of plaster (1200 kg/m³)	0,015	0,41	0,47	0,47	
		ሪ	▲	▼	5	Perlitobeton (1000 kg/m³)	0,11	0,33	0,38	0,38	
	Page	1 of 1	(5 ite	ms) (	3 1 3					Pag	e size: 20 🔻





## Energy Performance of Buildings **Example Screenshots of Software (2)**

#### **Overview of building elements**

📐 EPCalc - Energy Pe	erfo	orma	ance	e Calcula	tor							6	» - 🔒	Demo 1   jd1	🖉 Log Off
Main 🔺	Main Add Copy Create Template X Delete C Refresh Validate this section Export to T														
Projects	Intervention of a control of a contro a control of a control of a control of a control of a														
Element Templates				No 🔺 🕈	Name 🔺 🕈	- 9	Element Area	Element Type	Area [0,0001 - • 100000 m31	U-Value [0,001 - 100 W/m²K]	R-Value [m²K/W]	U-Value Glass 🕈	U-Value Frame	g-Value [0,3 - 👎 1]	Description 🕈
Comparisons			G	3	Floor	statistical	Ground floor	GFig - Ground floor	0,00	0,270	3,704	0,000	0,000	0,000	
Project Data			C	5	Front Door		The front door	FDi - door conditioned by the	2,60	1,800	0,556	0,000	1,000	0,765	
Element			G	4	Roof		Attic coverage	Aciu - attic- cov. conditioned	0,00	0,190	5,263	0,000	0,000	0,000	
III Heating	4		G	1	Wall 1		Walls	EWi - wall conditioned by the external	0,00	0,025	40,000	0,000	0,000	0,000	
Ventilation Ventilating			G	7	Wall 2		Walls	EWi - wall conditioned by the external	0,00	0,195	5,130	0,000	0,000	0,000	
Result			C	2	Window 1		Windows	Wi - windows conditioned by external	1,80	1,300	0,769	0,000	0,000	0,675	
Credits & Purchases V			C	6	Window 2		Windows	Wi - windows conditioned by external	1,30	1,281	0,781	1,200	1,100	0,650	
💋 Background Info 🛛 👻		Pag	e 1 of	1 (7 items)	< 1 >									Pag	e size: 20 🔻





## Energy Performance of Buildings **Example Screenshots of Software (3)**

#### **Rating of Plausibility Check**

roject Nam	e:		SW Der	mo [00~(	001 [3]	]									
tatus:		🔓 Certified Assigned Auditor:						<u>AT01</u>							
ating:		Green Construction Year:							2016						
ating Points	31	Building Purpose:							Houses for one famil						
ertificate N	umber:	201803	0700000	1	Building Compactness Index:										
ttachment:			N/A			Bui	lding	Facade Gla	zing Coeffic	cient:					
Audit Dat	a Verification	Rating Details	Certif	ication	Proje	ct Data (D	ataba	ase) 🖸	History						
Rule ID	Rule Descrip	otion	Ŷ	Applica	ible 9	Rule Points	۴	Points 🕈	Value 🕈	Multi Value	Ŷ	Range From	Ŷ	Range To	Ŷ
1.01	Length of bu	uilding		Yes	1		1	10.000	No		3		150		
1.02	Width of bui	lding		Yes		1		1	8.000	No		3		150	
1.03	Gross floor	area		Yes			1 1 11		110.000	No		30		400	
1.04	Floor height	of building		Yes			1	1 2.600		No		2.2		4	
1.05	Heat transfe	er coefficient U		Yes			1	0	-	Yes		(3 Violati	ons)	-	
1.06	GValues of	windows		Yes			1	1	-	Yes		-		-	
1.07	Share of wi	ndow frame area		Yes			1	1	-	Yes		-		-	
1.14	Input of gro	und floor type		Yes		1		1	1.000	No		1		1	
2.01	Share of wi	ndow area		Yes			2	2 0.118		No		0.1		0.3	
2.02	Share of fac uncondition	Share of facade area against unconditioned space				2		2	0.000	No	0			0.3	
2.03	Factor of co	mpactness		Yes			2	2	0.905	No		0.9		1.5	
2.04	Envelope ar of floors	ea in relation to nu	umber	mber Yes			2 2 235.3			No		40		400	
2.05	Pipe length	heating		Yes		2 0 -				Yes		(1 Violati	(1 Violation) -		





## Energy Performance of Buildings Example Screenshots of Software (4)

#### **Energy Performance Certificate**





