







## **Energy Audits and Energy Efficiency Design**

**Case study - Croatia** 

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## **General information**

- Buildings account for 40% of total energy consumption on national level
- > Most buildings built before 1987 no thermal insulation
- > 83% of the buildings do not meet even 1987 technical requirements
- Average specific energy consumption is 150-200 kWh/m<sup>2</sup> (energy grade E)
- Environmental Protection and Energy Efficiency Fund (EPEEF) founded in 2004
- > National Energy Efficiency Action Plan created for every 5-year period
- > Strategies in line with the EU2020, 2030 & 2050 plans





## **Main Policies & Stakeholders**

- > Croatian Energy Policy
  - > Energy Development Strategy of the Republic of Croatia
    - > Third National Energy Efficiency Action Plan
- > Ministry of Environmental Protection and Energy
- > Ministry of Construction and Physical Planning
- > Environmental Protection and Energy Efficiency Fund





## **Current energy consumption trends**

> Final energy consumption in households by fuel







## **Current energy consumption trends**

- > Final energy consumption in households by end-use
- > Variations in energy consumption by years are not due to increased energy efficiency, but changes in the economy and climate conditions







## **Current energy consumption trends**

> Final energy consumption per dwelling







## **Financing energy efficiency**

- > EPEEF through different programmes/schemes:
  - > Family houses refurbishment programme
  - > Multi-apartment buildings refurbishment programme
  - > Non-residential buildings energy refurbishment programme
  - > Public buildings energy refurbishment programme
  - > Co-financing construction of new buildings
  - > Co-financing purchasing A+++ appliances
  - > Co-financing energy efficient public lighting





### > Family houses refurbishment programme from 2014

- > 12.000 applications
- Co-financing envelope renovation, heating system replacement, RES
- > Allocated around 40 mil. EUR
- > 6.000 family houses (1.2 mil. m<sup>2</sup>, 22.500 inhabitants)
- > Around 7.000 EUR/dwelling







- > Family houses refurbishment programme from 2014: An example from the programme
  - > Investment: 11.240 EUR
  - Grant: 8.247 EUR (73%) >
  - > Annual energy savings: 21.989 kWh
  - > Annual cash savings: 468 EUR
  - Annual CO<sub>2</sub> emissions savings: 0,64 t )
  - Payback period: 6,4 years )



after





#### > Multi-apartment building refurbishment programme

- > Buildings larger than 400 m<sup>2</sup>
- > 866 projects so far
- Co-financing envelope renovation, heating system replacement, RES, energy audits and project development
- > Allocated around 20 mil. EUR so far





- Multi apartment refurbishment programme: An example from the programme
  - > Investment: 103.038 EUR
  - > Grant: 29.675 EUR (29%)
  - Annual energy savings: 178.897 kWh
  - > Annual cash savings: 23.654 EUR
  - Annual CO<sub>2</sub> emissions savings: 42 t
  - > Payback period: 3,1 years



before

after





### > Public buildings refurbishment programme (2014-2015)

- > 200 buildings
- **>** Total area of 420.000 m<sup>2</sup>
- > Estimated total investment around 53 mil. EUR
- Estimated energy consumption decrease of 30-60% (from average of 250 kWh/m<sup>2</sup> to 150 kWh/m<sup>2</sup>)
- > Estimated CO<sub>2</sub> emissions savings of 20.500 t
- > Up to 100% grant for energy audits and project documentation
- > Up to 40% grant for construction works





## An example of Energy certificate



Klimatski podatci		
Klimatski podaci (kontinentalna ili primorska Hrvatska)	Kontinentaina	
Broj stupanj dana grijanja SD [Kd/a]	2939,5	
Broj dana sezone grijanja Z [d]	178,9	
Srednja vanjska temperatura u sezoni grijanja 6, [C]	3,6	
Unutarnja projektna temperatura u sezoni grijanja 6, [C]	20,0	

#### Podaci o termotehničkim sustavima zgrade

Način grijanja zgrade (lokalno, etažno, centralno, dalijinski izvor)	daliinski izvor
Izvori energije koji se koriste za grijanje i pripremu potrošne tople vode	Tehnološka Para;El. Energija
Način hlađenja (lokalno, etažno, centralno, daljinski izvor)	Centralno, lokalno
Izvori energije koji se koriste za hlađenje	električna energija
Vrsta ventilacije (prirodna, prisilna bez ili s povratom topline)	Prisilna bez povrata topline
Vrsta i način korištenja sustava s obnovljivim izvorima energije	
Udio obnovljivih izvora energije u potrebnoj toplinskoj energiji za grijanje [%]	0,00

#### Energetske potrebe

	Za referentne ki	referentne klimatske podatke Za stvarne klimatske podati		matske podatke	Zahtjev	
	Ukupno proh/st	Specifično [k//htm/ai]	Ukupno	Specifično (kwh.tm*ai)	Dopusteno (kWh6m/a))	Ispunjeno DA/NE
Qitted	92.928.00	97,15	86.358,71	90,28	76,09	NE
Qw			provide setting of	g and see a		
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Q <sub>WA</sub>	1	1		2 S		
<b>9</b> н.		1				
QCM	30.587.00	31,98	32.181,00	33,64		
Qca						1
Qc						
Q <sub>re</sub>	0					
E,	1	1		1		5
Edul						
Egrim	i—			3		1
CO2 [kg/a]		2	1	1		
Q'HAR [kWh/(m <sup>*</sup> ei]	92.928,00	27,90	86.358,71	25,92	21,85	NE
Objašnjenje:	2	obvezr	na ispuna	ispunj	ava se opcijski	<u> </u>

Građevni dio zgrade	U [W/(m <sup>2</sup> K)],	$U_{max}[W(m^2K)]$	Ispunjeno DA/NE
Vanjski zidovi, zidovi prema garaži, tavanu	1,19	0,45	NE
Ravni i kosi krovovi iznad grijanog prostora, stropovi prema tavanu	0,25	0,30	NE
Zidovi prema tlu, podovi prema tlu	3,11	0,50	NE
Stropovi iznad vanjskog zraka, stropovi iznad garaže	2,50		
Zidovi i stropovi prema negrijanim prostorijama i negrijanom stubištu temperature više od 0 °C			
Prozon, balkonska vrata, krovni prozori, prozirni elementi pročelja	2,50	1,80	NE
Vanjska vrata s neprozirnim vratnim knilom	2,10	2,90	DA
Objašnjenije: 🗌 obvezna ispun	ð 🛄	ispunjava se opci	iski





## Conclusions

- > Great increase in "know how" in the last 10 years
- Energy efficiency is a great opportunity for job creation (both construction works and engineering)
- > Economic situation is the main obstacle towards significant increase in energy efficiency – although co-financing schemes exist, investments still represent significant financial barrier for citizens



## Profile





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## Zlatko BAČELIĆ MEDIĆ

- > Experience in team management and project coordination in energy efficiency, renewable energy and new technologies implementation
- Team leader in preparation of investment grade energy audits in public, private and industrial sectors
- > Experience in capacity building in developing countries
- Extensive experience in technical modeling and preparation of financial analyses for energy efficiency and renewable energy projects
- > Expertise in optimization and cost-optimality in energy efficiency projects
- Expertise in analysis and assessment of energy sectors, including energy planning
- > Project experience across SEE

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