PAMETNA GRADNJA PAMETNIH ZGRADA

Sveučilište u Zagrebu
Građevinski fakultet

Doc.dr.sc. Bojan Milovanović

ŠTO NAS ČEKA

Winter is here!

WINTER PACKAGE

- **30 November 2016**, the European Commission published "**Clean Energy For All Europeans**" package, more commonly referred to as the "Winter Package"

ENERGY EFFICIENCY

ACHIEVING THE BINDING 30% ENERGY EFFICIENCY TARGET BY 2030

Energy Efficiency Directive

- Binding 30% energy efficiency target for 2030;
- Create 400,000 new jobs;
- Reduce gas imports by 12%;
- Save € 70 billion in fossil fuel imports;
- Empower consumers by granting access to information on their energy consumption.

Energy Performance of Buildings

- Clear vision for a decarbonised building stock by 2050;
- Smart & Efficient buildings through use of Information and Communication Technologies and Smart Technologies;
- Smart Finance for Smart Buildings initiative:
  - More effective use of public funding
  - Aggregation of funds
  - De-risking
- Protect vulnerable groups & address energy poverty.

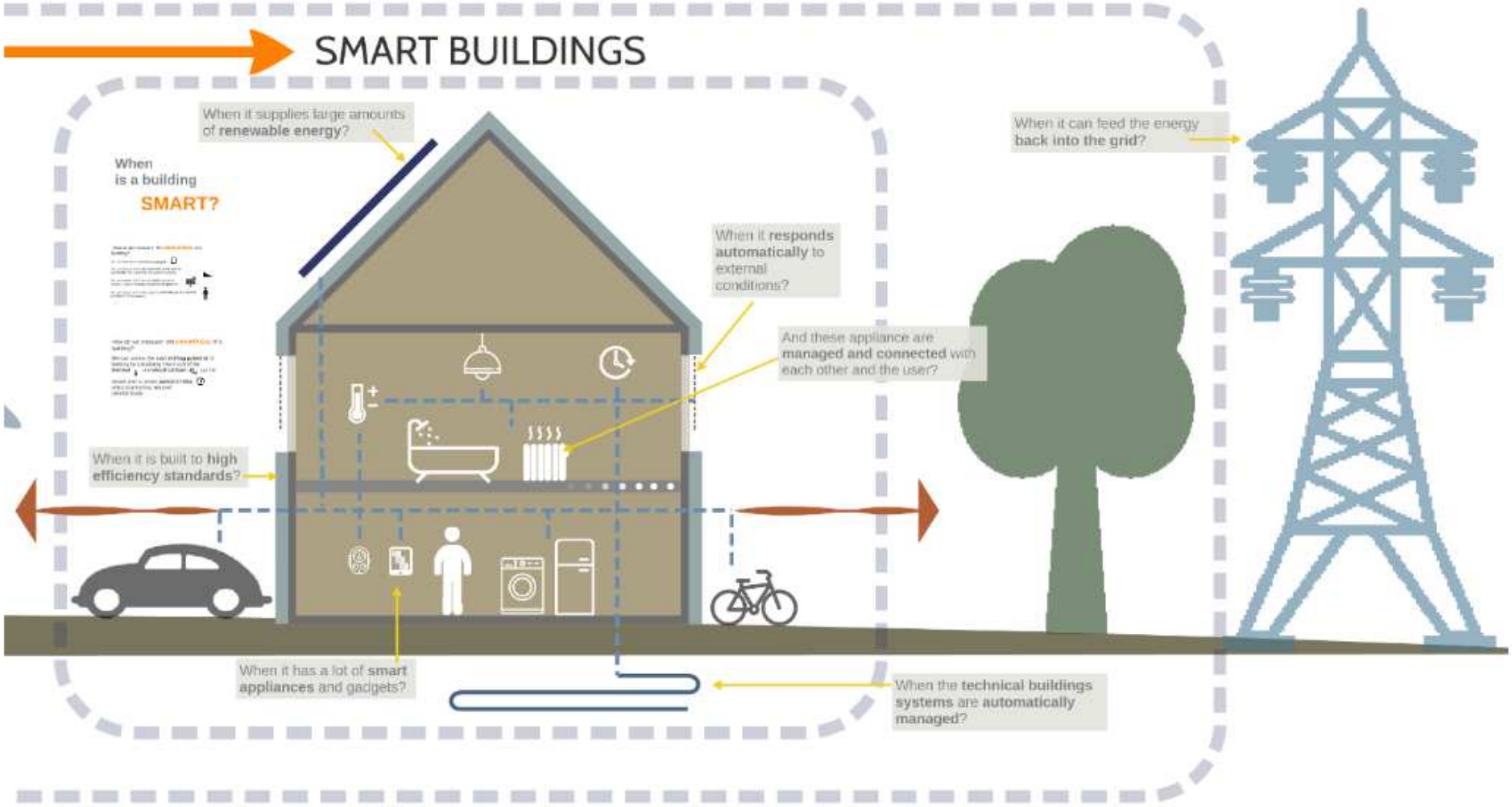
Ecodesign Working Plan 2016-2019

- List of new product groups;
- Outline on how ecodesign will contribute to circular economy objectives;
- Specific measures on air conditioning;
- Guidelines on voluntary agreements.

Arch. DI Dr. Doris Österreicher, MSc

University of Natural Resources and Life Sciences, Vienna, Austria
Institute for Structural Engineering, Sustainable Constructions

Kada je zgrada pametna?



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but let's not forget what this is all about...

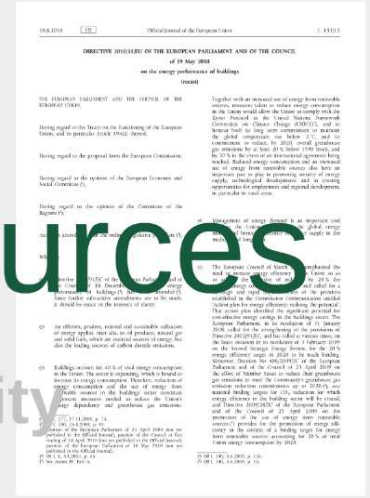
energy

and

resources

and

sustainability



From the perspective of the user:

healthy *easy to maintain*

good for the environment and for my pocket

affordable *easy to use*

useful for me!

From the perspective of the environment:

local

renewable sustainable

with no harmful emissions

adaptive to the local climate

Pametna zgrada pruža maksimalnu kvalitetu života uz minimalno korištenje resursa.

SMARTNESS MATTERS!

RATIONALE

Acknowledging and leveraging building smartness in the Energy Performance of Buildings Directive

- Modern nearly zero-energy buildings are in essence smart, flexible buildings.

- **Building smartness is beneficial:**
  - Leads in itself to significant energy savings in a cost-effective way.
  - Improves comfort.

- **Smart buildings are key enablers of our future energy system**
  - Larger share of renewables,
  - Distributed supply,
  - Adaptive demand-side.

10 principles for smart buildings in a decarbonised energy system

PRINCIPLE 1
Maximise the buildings' energy efficiency first

PRINCIPLE 2
Increase on-site or nearby RES production and self-consumption

PRINCIPLE 3
Stimulate energy-storage capacities in buildings

PRINCIPLE 4
Incorporate demand response capacity in the building stock

PRINCIPLE 5
Decarbonise the heating and cooling energy for buildings

PRINCIPLE 6
Empower end-users via smart meters and controls

PRINCIPLE 7
Make dynamic price signals available for all consumers

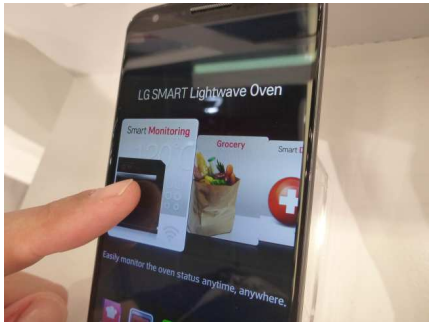
PRINCIPLE 8
Foster business models aggregating micro energy-hubs

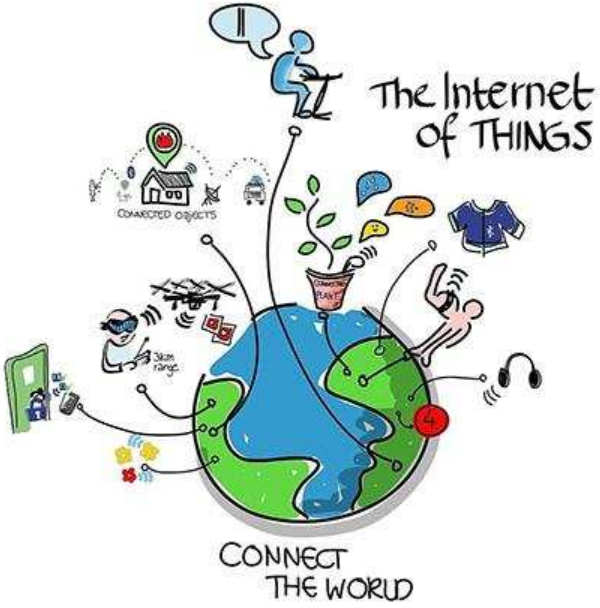
PRINCIPLE 9
Build smart and interconnected districts

PRINCIPLE 10
Building infrastructure to drive further market uptake of electric vehicles

- All principles important separately, but most effectively considered together
- Apart from principle 1, the sequence is not in order of importance

UREĐAJI, SENZORI I "STVARI" POSTAJU DIO INTERNETA





IZAZOVI

"The construction sector faces three major challenges: energy transition, process digitization and the introduction of ***energy performance contracting*** *" (*)*

Garancija da će projektirana potrošnja biti ostvarena

CSTB - Centre Scientifique et Technique du Bâtiment

Eng. Scientific and Technical Centre for Building

Etienne Crépon
President CSTB le futur en construction
Paris, 17/05/2017

(*) Translated quote. Original quote: *Le secteur de la construction fait face à 3 défis majeurs : la transition énergétique, la digitalisation des processus et* ***l'introduction des garanties de performance énergétique***

'As an expert in the field of energy efficiency in new building I find it astonishing that countries, states and cities do not pay more attention to the actual energy consumption of new buildings.

How can we be sure of the value of the codes if we don't know how well the new buildings are performing under them? So, I guess large savings could be achieved if more attention was paid to the actual energy performance'

Jens Laustsen, IEA

PRIJEDLOG TEKSTA DODATKA EPBD-A

4. 'energy performance of a building' means the calculated or measured amount of energy needed to meet the energy demand associated with a typical use of the building, which includes, inter alia, energy used for heating, cooling, ventilation, hot water and lighting;

EPBD Recast, article 2

STANJE U HRVATSKOJ...

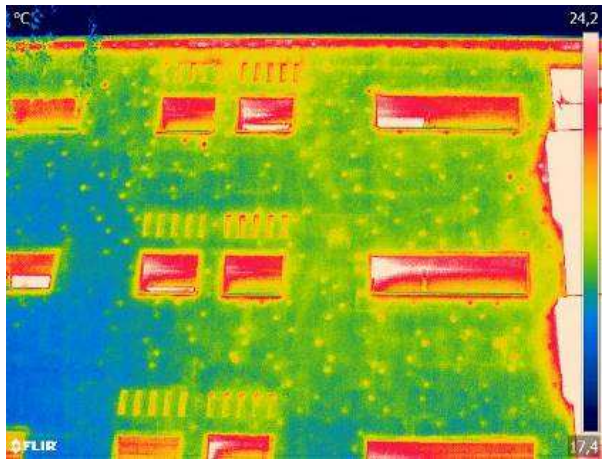
- Gradimo li pametno?
  - iz određenih razloga kvaliteta projekata arhitektonske ili građevinske struke u dijelu koji se odnosi na racionalnu uporabu energije i toplinsku zaštitu opada,
  - a ovo je dodatno popraćeno neodgovarajućim izvođenjem samih radova.

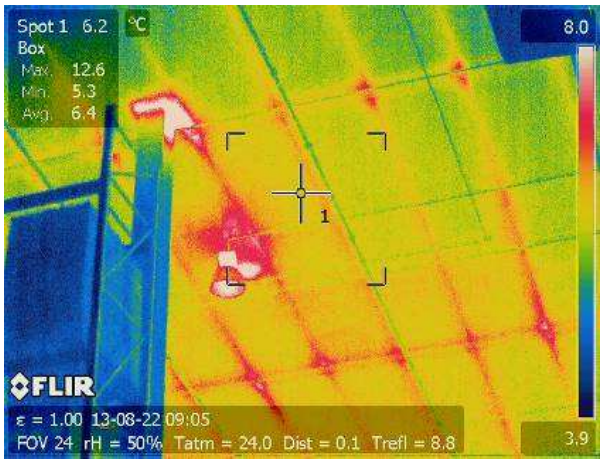
JESMO LI ZAISTA SPREMNI ZA IZVEDBU KVALITETNE VANJSKE OVOJNICE ZGRADE?

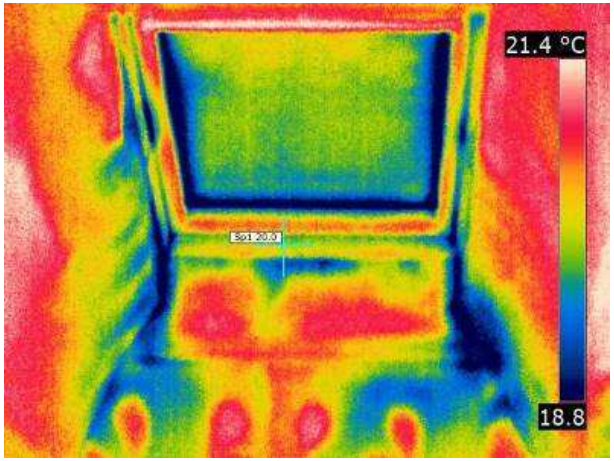


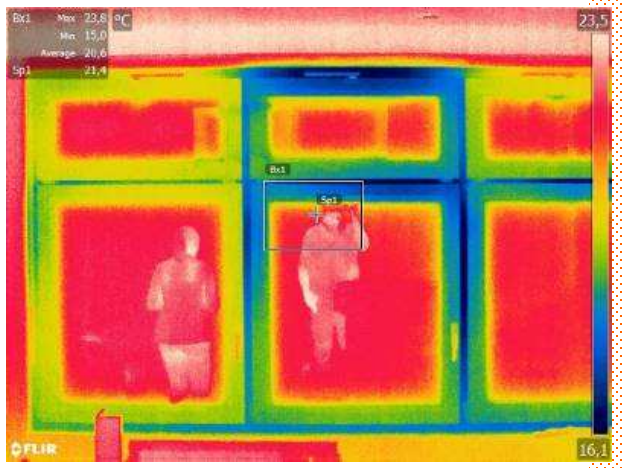



JESMO LI ZAISTA SPREMNI ZA IZVEDBU KVALITETNE VANJSKE OVOJNICE ZGRADE?





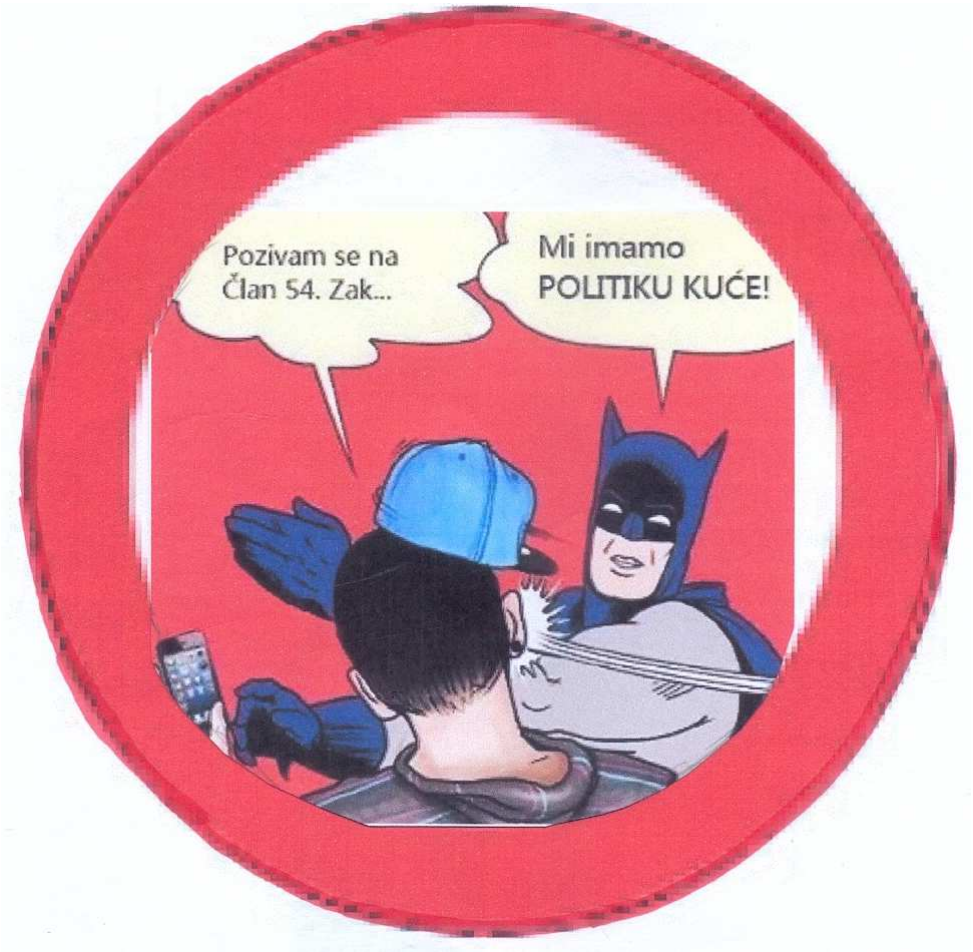




JOHN F. KENNEDY

" Potrošači, po definiciji, uključuju sve nas.
I mene kao predsjednika SAD- a.
Potrošači su najveća gospodarska
skupina na koju utječe svaka javna
ili privatna gospodarska odluka.
Oni su najvažnija skupina čiji
se stavovi vrlo često ne čuju.
Glas potrošača mora se čuti. "

(J. F. Kennedy, ožujka 1962. godine
u prigodi predstavljanja američkom Kongresu
" Deklaracije o zaštiti potrošača. ")


Pozivam se na
Član 54. Zak...
Mi imamo
POLITIKU KUĆE!

WHAT ARE OUR GOALS?

CREATING JOBS & GROWTH, BRINGING DOWN GREENHOUSE GAS EMISSIONS, SECURING ENERGY SUPPLY

Putting energy efficiency first

Demonstrating global leadership in renewables

Delivering a fair deal for consumers

Clean Energy for All Europeans: a focus on building smartness

Sylvain Robert
Unit C3 Energy Efficiency
European Commission – DG ENERGY

European Commission

A CONSUMER-CENTRIC STRATEGY

A FAIR DEAL FOR CONSUMERS

BETTER INFORMED

- Access to fit-for-purpose smart meters
- Certified price comparison tool
- Clearer energy bills

EMPOWERED

- Rew[illegible] demand-response

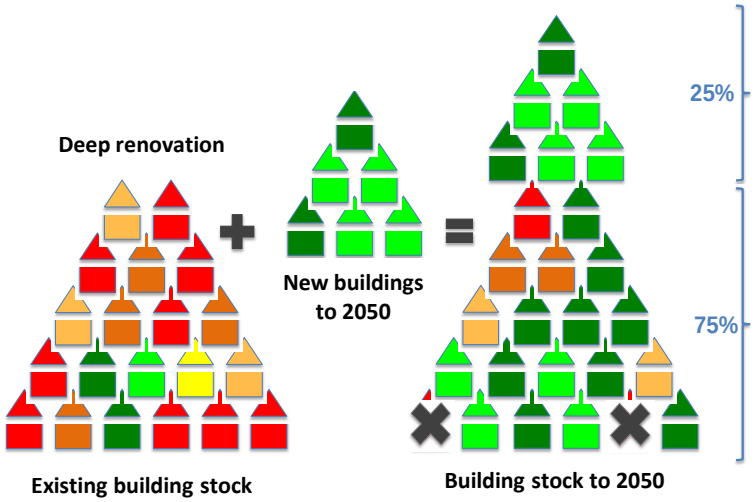
Net-UBIEP

PROTECTED

- Monitoring of energy poverty (governance)
- Information on alternatives to disconnection
- Secured electricity supplies
- Sound data management

Sylvain Robert
Unit C3 Energy Efficiency
European Commission – DG ENERGY

THE AMENDMENT OF THE EPBD II



- "Energy efficiency first" is a key element of the Energy Union
- About 75% of buildings are energy inefficient
- Only 0.4-1.2% of the stock is renovated each year
- The main objective is to accelerate the cost-effective renovation of existing building, which is a 'win-win' option for the EU
- Renovation work and energy retrofits add almost twice as much value as the construction of new buildings

THE AMENDMENT OF THE EPBD II

- Long-term strategies for renovation of the building stock (Art. 4/EED becomes Art. 2a/EPBD)
- Mobilizing funding for carbon-free buildings: targets for 2030/2050: market signals to investors
- **ICT and smart technologies, automation and BIM, e-mobility**
- Link between public funding and EPCs; focus on microclimate and health (heating and ventilation)

Net-UBIEP

NET UBIEP

Network for Using BIM
to Increase Energy Performance

www.net-ubiep.eu

KOORDINATOR:

ENEA
Agenzia nazionale per le nuove tecnologie,
l'energia e lo sviluppo economico sostenibile

PARTNERI U KONZORCIJU

NET UBIEP

ENEA
Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile

FUNDACIÓN LABORAL DE LA CONSTRUCCIÓN

GRUPPO CS
consulenza&formazione

CSIC
Consejo Superior de Investigaciones Científicas

ISSO
KENNISINSTITUUT VOOR INSTALLATIETECHNIEK

ÚVS
Ústav vzdelávania a služieb
Institute of Education and Services

Skaitmeninė Statyba

VIAEUROPA®

SAPERE AUDE
VILNIUS GEDIMINAS TECHNICAL UNIVERSITY

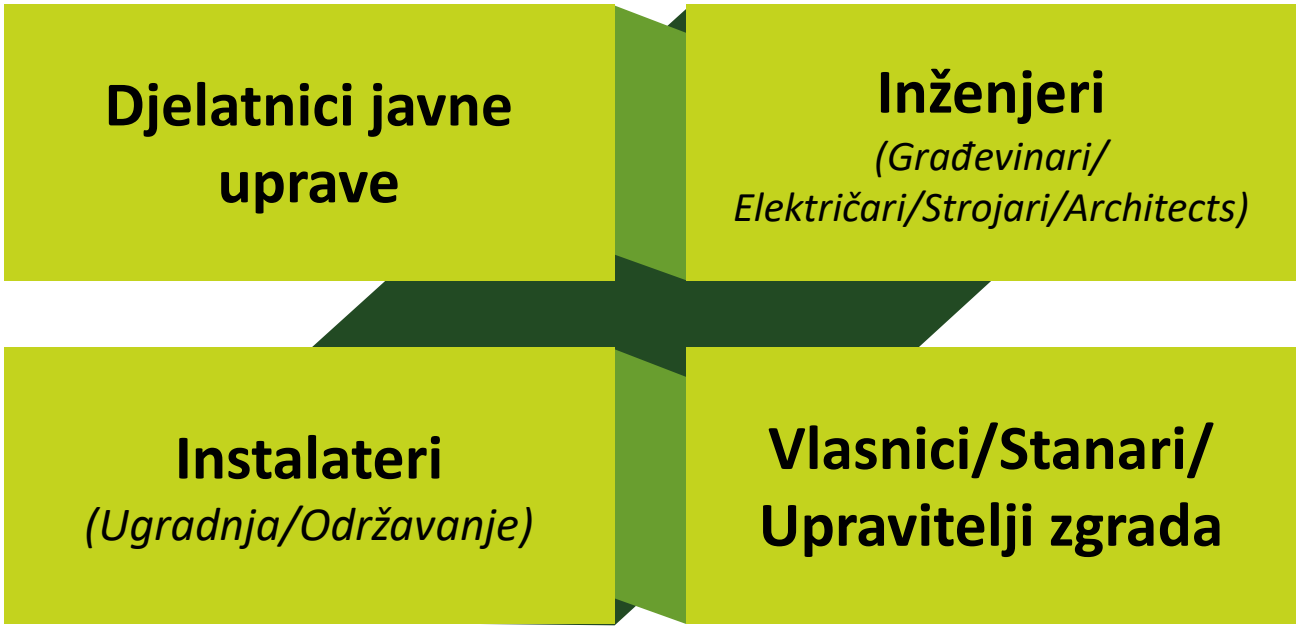
CILJEVI PROJEKTA NET-UBIEP

- Net-UBIEP nastoji doprinijeti povećanju energetske učinkovitosti u zgradama promoviranjem korištenja BIM-a tijekom cjelokupnog životnog ciklusa zgrade.
  - BIM – building information management

Better management of the information during the whole life cycle of the building is absolutely necessary in order to avoid mistakes and have trustful information at any time / when an intervention is necessary.

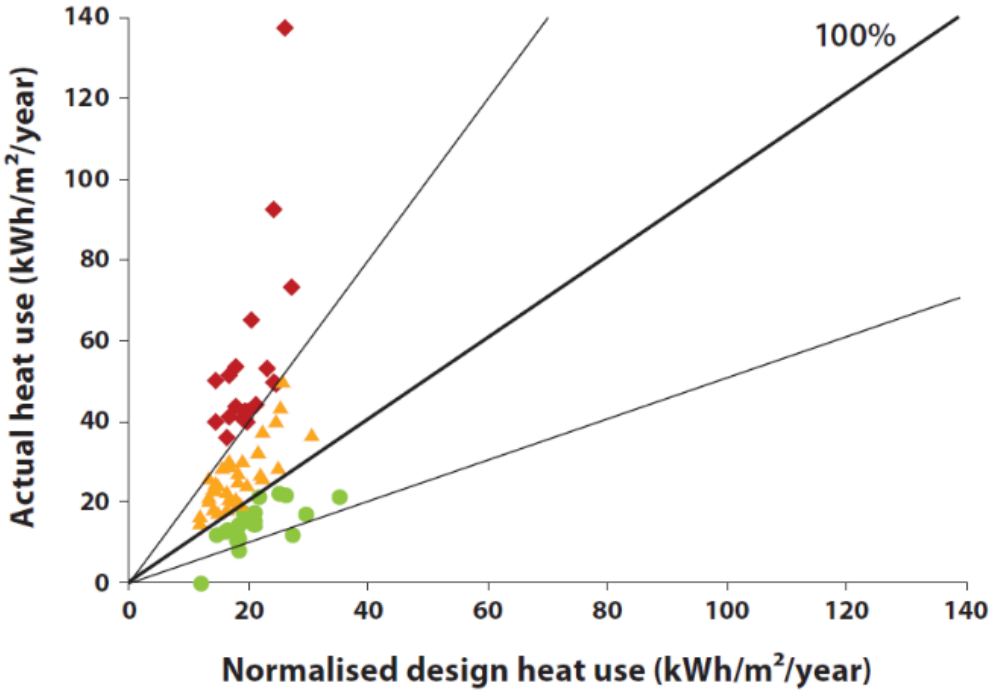
CILJANE SKUPINE

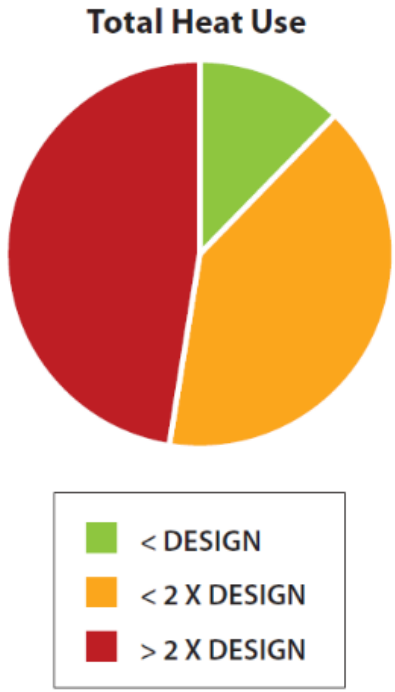
- **Tehnologija, ali i ljudi!**
- Svi sudionici u gradnji i korištenju zgrada moraju biti svjesni svoje uloge u prikupljanju, upravljanju i čuvanju potrebnih informacija vezanih uz energetsku učinkovitost



STVARNA & PROJEKTIRANA POTROŠNJA

- Usporedba projektirane potrošnje i stvarne potrošnje
- Uzroci:
  - korištenje
  - Izvođenje???





Source: Ghent University

EUROPEAN STANDARDISATION

Ulazni podaci

Izlazni podaci

Building physical framework

Quasi-stationary heat balance

$$\Phi_h^h = \omega_{Ri} T_{Ri} + \omega_i^i T_i + \omega_e T_e + \omega_e^{B_e} \frac{1-\phi_e}{1-\phi_e B} T_e$$
$$+\omega_{sol} I_{sol} + \omega_{sol}^{B_i} \frac{1-\phi_i}{1-\phi_i B} I_{sol} + \omega_{sol}^{B_e} \frac{1-\phi_e}{1-\phi_e B} I_{sol}$$
$$+\omega_{sky}(T_{sky} - T_{se}) + \omega_{sky}^{B_e} \frac{1-\phi_e}{1-\phi_e B}(T_{sky} - T_{se})$$
$$+\omega_{Rn} T_{Rn} + \omega_{Rn}^{B_n} \frac{1-\phi_n}{1-\phi_n B} T_{Rn} + \omega_n T_n + \omega_g^{B_g} \frac{1-\phi_g}{1-\phi_g B}$$
$$+\omega_G G_{si} + \omega_G^n G_{si}^n + \omega_G^g G_{si}^g$$
$$+\omega_G^{e_{B_e}} \frac{1-\phi_e}{1-\phi_e B} G_{se} + \omega_G^{n_{B_n}} \frac{1-\phi_n}{1-\phi_n B} G$$

Estimating H_{tr} using CTSM-R

$$d\mathbf{T}(t) = \left(\mathbf{A_c}\mathbf{T}(t) + \mathbf{B_c}\mathbf{U}(t)\right)dt + d\mathbf{W}(t)$$
$$[T_i] = [1 \quad 0]\,\mathbf{T}(t) + \mathbf{0}\mathbf{U}(t) + e_t$$
$$\mathbf{A_c} = \begin{bmatrix} \frac{\partial \frac{dT_i}{dt}}{\partial T_i} & \frac{\partial \frac{dT_i}{dt}}{\partial T_e} \\ \frac{\partial \frac{dT_e}{dt}}{\partial T_i} & \frac{\partial \frac{dT_e}{dt}}{\partial T_e} \end{bmatrix} \quad \mathbf{B_c} = \begin{bmatrix} \frac{\partial \frac{dT_i}{dt}}{\partial \Phi_h^h} & \frac{\partial \frac{dT_i}{dt}}{\partial I_{sol}} & \frac{\partial \frac{dT_i}{dt}}{\partial T_e} \\ \frac{\partial \frac{dT_e}{dt}}{\partial \Phi_h^h} & \frac{\partial \frac{dT_e}{dt}}{\partial I_{sol}} & \frac{\partial \frac{dT_e}{dt}}{\partial T_e} \end{bmatrix}$$
$$\mathbf{U}(t)^T = [T_e \quad \Phi_h^h \quad I_{sol}]$$

$$H_{tr} = \frac{1}{r_{i,e}} + \frac{1}{r_{i,c}}$$

$$\omega_i^i = -\left(\frac{1}{r_{i,i}} + \frac{1}{r_{i,e}}\right) \quad \omega_h^i = 1$$
$$\omega_1^i = \frac{1}{r_{i,i}} \quad \omega_e^i = 0$$
$$\omega_i^1 = \frac{1}{r_{i,i}}$$
$$\omega_i^1 = -\left(\frac{1}{r_{i,i}} + \frac{1}{r_{i,e}}\right)$$

e building heat balance

$$C_i \frac{dT_i}{dt} = \Phi_h + \Phi_{sol} + \Phi_l + \Phi_{tr} + \Phi_v + \Phi_m + \Phi$$

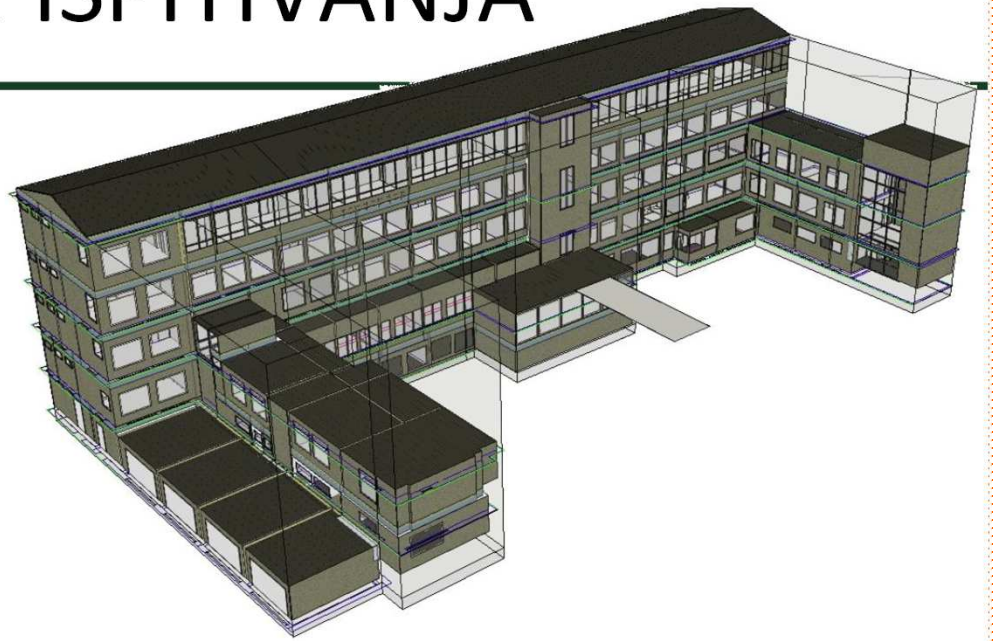
Any calculation is only as good as the actual planning and construction.

The influence of quality is often neglected!!!


CAR
VS
HOUSE

PRIMJER ISPITIVANJA

- Projektirano:
  - n_{50}=0,5 h^{-1}
- Rezultat simulacije:
  - 94 MWh



- Izmjereno:
  - n_{50}=3,7 h^{-1}
- Rezultat simulacije:
  - 290,72 MWh

Razlika 310% !!!

Izvor: Mario Vašak, Anita Martinčević, Antonio Starčić, Bojan Milovanović, Ninoslav Kurtalj, Nedjeljko Perić

TKO ĆE IZVESTI OBNOVU SVIH OVIH ZGRADA?

Europski strukturni i investicijski fondovi

ZA ENERGETSKU OBNOVU ZGRADA JAVNIH USTANOVA KOJE OBAVLJAJU DJELATNOST ODGOJA I OBRAZOVANJA ZAPRIMLJEN JE 231 PROJEKT

22. veljače 2017. - Poziv za dostavu projektnih prijedloga 'Energetska obnova zgrada u javnim ustanovama koje obavljaju djelatnost odgoja i obrazovanja' službeno je zatvoren 21. veljače 2017. godine. Fond za zaštitu okoliša i energetsku učinkovitost, u svojstvu Posredničkog tijela razine 2 (PT2), zaprimio je ukupno 231 projekt čija ukupna vrijednost investicija iznosi oko 800 milijuna kuna, a traženi iznos bespovratnih sredstava oko 402 milijuna kuna.

Najveći broj zaprimljenih projekata dolazi iz Primorsko-goranske županije (29), zatim Osječko-baranjske županije (25), Grada Zagreba (17) i Vukovarsko-srijemske županije (16). Više...

HRT Vijesti

HRT UŽIVO | HRT NA Z

VIJESTI | SPORT | MAGAZIN | RASPORED | HRT PRIKAZUJE | ORKESTRI / ZBOR

Odobreno 616 projekata za energetsku obnovu zgrada

07. 02. 2017. prije 2 tjedna

Tržište rada Usprkos velikoj stopi nezaposlenosti, Hrvatska gladna stručne radne snage

'Nedostaje 10 tisuća zidara i 600 vozača'

Hrvatskoj sve više nedostaje stručne radne snage, a najkritičnija situacija je u turizmu, prometu i građevinarstvu. Na kadrovske probleme u ovom potonjem sektoru upozoreno je i jučer na otvaranju međunarodnog sajma graditeljstva i pratećih industrija SASO 2017 u Splitu. I dok je resorni ministar graditeljstva i prostornog uređenja Predrag Štromar komentirao da se hrvatsko građevinarstvo oporavlja, Dragutin Ranogajec, predsjednik Hrvatske obrtničke komore (HOK), upozorava da toj gospodarskoj grani nedostaje 10.000 radnika. Dodao je kako postoji potreba i za oko 600 vozača ocijenivši nelogičnim da u Hrvatskoj, koja ima posebnu školu za vozače, zakon priječi osobama do 21 godine upravljanje vozilima nosivosti veće od 7,5 tona. "Imamo niz apsurda koje moramo mijenjati želimo li opstati i preuzimati nove poslove. Apsurdno je da zemlja s toliko nezaposlenih, nema radne snage. Naš je prijedlog da se ukidaju zdravstvena osiguranja za one koji odbiju posao. Ne pokrenemo li se, ostat ćemo bez radne snage, nećemo moći preuzimati nove poslove i doživjet ćemo krah", kazao je Ranogajec pozvavši Vladu da se angažira u strukovnom obrazovanju kako bi mladi bili osposobljeni za tržište rada. *db*

Dragutin Ranogajec, predsjednik HOK-a T. MILETIĆ/PIX

Propisi - informacija

NACRT PRAVILNIKA O SUSTAVU IZOBRAZBE I CERTIFICIRANJA GRAĐEVINSKIH RADNIKA KOJI UGRAĐUJU DIJELOVE ZGRADE KOJI UTJEČU NA ENERGETSKU UČINKOVITOST U ZGRADARSTVU NA JAVNOM SAVJETOVANJU

20. veljače 2017. - Ministarstvo graditeljstva i prostornoga uređenja izradilo je 'Nacrt Pravilnika o sustavu izobrazbe i certificiranja građevinskih radnika koji ugrađuju dijelove zgrade koji utječu na energetsku učinkovitost u zgradarstvu' koji se nalazi na javnom savjetovanju. Pravilnikom se propisuje sustav izobrazbe i certificiranja građevinskih radnika koji ugrađuju dijelove zgrade koji utječu na energetsku učinkovitost u zgradarstvu.

Zainteresirana i stručna javnost svoje prijedloge, primjedbe i mišljenja na Nacrt Pravilnika može uz prethodnu registraciju dostaviti putem portala **e-savjetovanje** najkasnije **do 22. ožujka 2017.** godine. Ovim putem skrećemo pozornost da je 'Prilog 2 - Izgled i sadržaj Certifikata' moguće vidjeti u rubrici Ostali dokumenti.

Fit-to-NZEB

Innovative training schemes for retrofitting to nZEB-levels

www.fit-to-nzeb.com

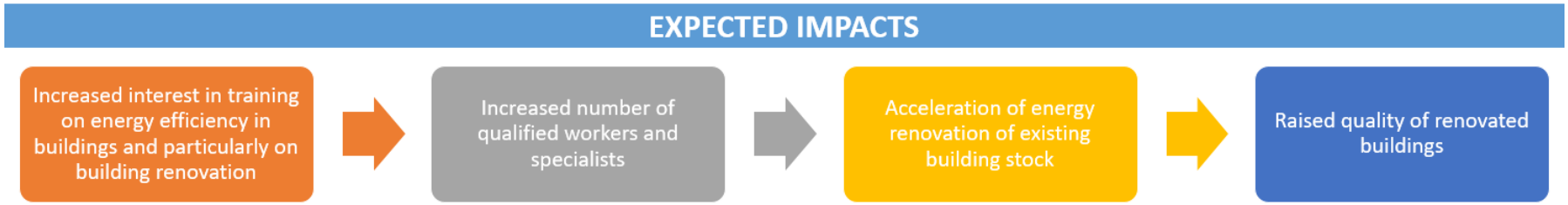
KOORDINATOR: EnEffect

Center for Energy Efficiency EnEffect – Bulgaria

FIT-TO-NZEB

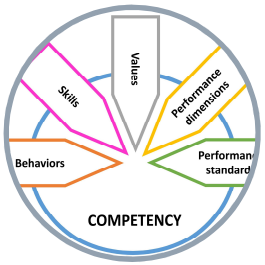
Fit-to-NZEB
Innovative training schemes for retrofitting to nZEB-levels

- Cilj projekta
  - je povećanje kompetencija i vještina građevinskih djelatnika u području obnove postojećih zgrada na razinu G0EZ
- Kako?
  - kroz jedinstvene programe edukacije razvijene od strane konzorcija
- Zašto?
  - Potrebno je povećati broj obnova i
  - Potrebno je povećati kvalitetu dubinske obnove postojećih zgrada.



FIT-TO-NZEB GOALS

Fit-to-NZEB
Innovative training schemes for retrofitting to nZEB-levels



Elaborate a set of required technological competences related to the EE and RE solutions in building renovation

Develop new training programmes at all levels of the vocational education.

Develop training system employing the newly elaborated technical competences

Review the national educational plans for the relevant professions.

Introduce the necessary changes

Establish capacity for professional training of trainers.

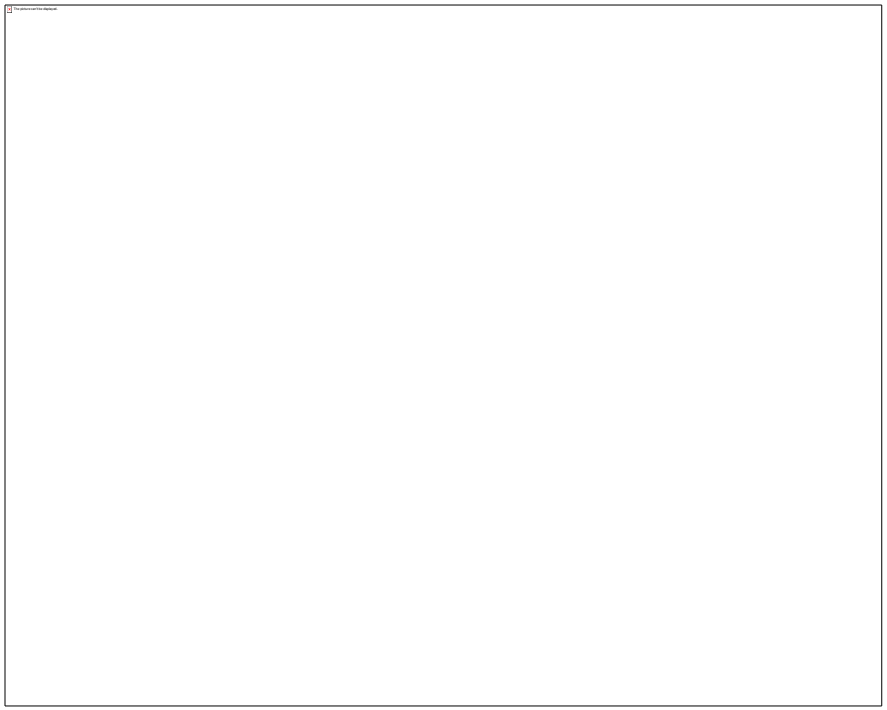
Train and certify a sufficient number of trainers

Support and monitor the first courses on the new programmes at all levels.

Fit-to-nZEB project is designed to respond to the defined needs

PARTNERI U KONZORCIJU

Fit-to-NZEB
Innovative training schemes for retrofitting to nZEB-levels



EnEffect

UNIVERSITY OF ARCHITECTURE CIVIL ENGINEERING AND GEODESY

SEVEn

CTU CZECH TECHNICAL UNIVERSITY IN PRAGUE

CLUSTER pRO nZEB

URBAN INCD INCERC

MosArt ARCHITECTURE LANDSCAPE URBAN DESIGN

iPHA Passive House Academy

COLEGIUL TEHNIC DE ARHITECTURĂ ȘI LUCRĂRI PUBLICE "I.N. SOCOLESCU"

ZEPHIR PASSIV HAUS ITALIA Affiliato iPHA

HELLENIC PASSIVE HOUSE INSTITUTE

TU WIEN TECHNISCHE UNIVERSITÄT WIEN Vienna | Austria

Sveukupno 13 partnera

WP4 - TRAINING PROGRAMMES FOR INSTITUTIONS OF HIGHER EDUCATION

- Razvoj novih programa edukacije koji su u **skladu s EQF razinama 6 i 7**
- Razvoj potrebnog **nastavnog sadržaja** (learning content):
  - Definirati programsku povezanost,
  - Nastavni materijali
    - Prezentacije,
    - Praktične vježbe
    - 3D vizualizacije
    - Video materijali
    - E-learning
    - Način provođenja ispita
- Provesti **barem 3 pilot edukacije**

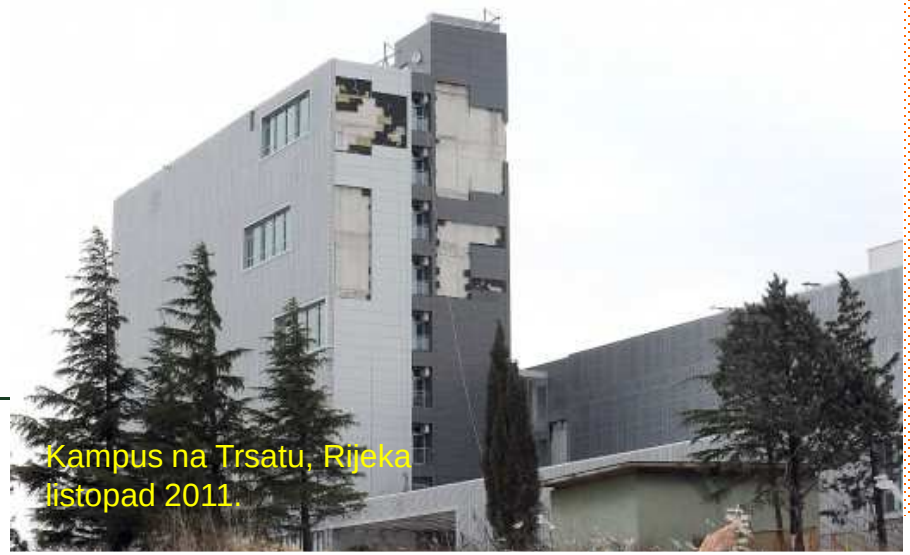
- … na kraju krajeva, želimo osigurati izgrađeni okoliš visoke kvalitete korištenjem učinkovitog projektiranja u kombinaciji s *tehnološkim napretkom* na svim razinama.

DA BI IMALI VIŠE OVOGA...

… A MANJE OVOGA

Split; veljača 2015.

Rijeka, zgrada useljena 3 mjeseca ranije; ožujak 2015.



Kampus na Trsatu, Rijeka
listopad 2011.

” We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because ***that goal will serve to organize and measure the best of our energies and skills***, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win.”

September 12, 1962;
Rice University, Houston, Texas

Hvala na pažnji!

Bojan Milovanović

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