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DIGITAL ROUNDTABLE

Energy Efficiency in Serbia

Buildings

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Bundesministerium Digitalisierung und Wirtschaftsstandort

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SLAVKO LUKIC

Director

Regional Development Agency Zlatibor

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RDA Zlatibor
basic information

Year of establishment- 2002 as Regional center for SME support

Year of transformation into development Agency – 2008

Founders: city of Užice and municipalities Arilje, Bajina Bašta, Kosjerić, Nova Varoš, Požega, Priboj, Prijepolje, Čajetina, and Associations of Enterpreneuers

Accreditations: Ministry of Economy and National Development Agency (accreditation for the implementation of development projects and activities that contribute to the improvement of regional development), Ministry of State Administration and Local Self-Government (accreditation of a legal entity for the implementer of professional development programs for local government employees

ZRDA Activities – Economic Development Department

Description: Implementation of programs and projects to support potential and existing MSMEs. Activities in the field of education, consulting, financing, mentoring, informing entrepreneurs in the region. Providing support to MSMEs in connection with running a business, attracting financial resources, finding business partners. Development of a new service for MSMEs in the region, systematic and detailed monitoring and analysis of the position and development of MSMEs in the region. Participation in the initiation, preparation and implementation of projects of importance for the development of MSMEs.
Team: 4 full-time employees
Service since: 2002

ZRDA Activities – Agriculture and Rural Development Department

Description: Providing support to key actors in providing funds for the implementation of development priorities and projects from local, national and international sources; Development of long-term strategic documents for agricultural development; Improving communication and cooperation between various institutions and organizations throughout the District; Support in the implementation of the Program of measures to support the development of agriculture at the local level; Regional Committee for Rural Development of Zlatibor District; Support in empowerment through association and business networking of actors in this sector.

Team: 3-5 full-time employees

Service since: 2009.

ZRDA Activities – Environment Protection Department

Description: Implementation of projects on various aspects of the environment, including energy and climate change. Membership in the Green Council of the City of Uzice, initiating and leading the Board for ZZS ZO, initiating and coordinating the Working Group for Biomass ZO.

Team: 2 employees

Service: from 2012

ZRDA Activities -Tourism Development Department

Description:

Key tourism products of the area Ecotourism, Ethnotourism, Health, Spa & Wellness, Special interests, Events,Rural tourism, Cultural thematic routes and Mountain tourism. Existence of Master plans for the development of Tara Mountain, Zlatibor-Zlatar

destination and Golija Mountain. RDA Zlatibor employees are members of the Management and Supervisory Board of the TO region of Western Serbia. Operational participation of RBA Zlatibor in: RTO Strategic Planning and Investment Department and Department for the development of tourist products and competitiveness of the RTO destination Representative of the National Research and Development Council

Team: 3-5 people

Service: since 2009

Thank you!

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РЕГИОНАЛНА РАЗВОЈНА АГЕНЦИЈА ЗЛАТИБОР УЖИЦЕ

APPA
Акредитована Регионална Развојна Агенција

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ENERGY EFFICIENCY REGION ZLATIBOR

Evaluation and development of energy efficiency measures related to existing public building infrastructure through the application of Austrian technologies in the city of Užice, Zlatibor region

Gundula Weber

Oleksandr Melnyk

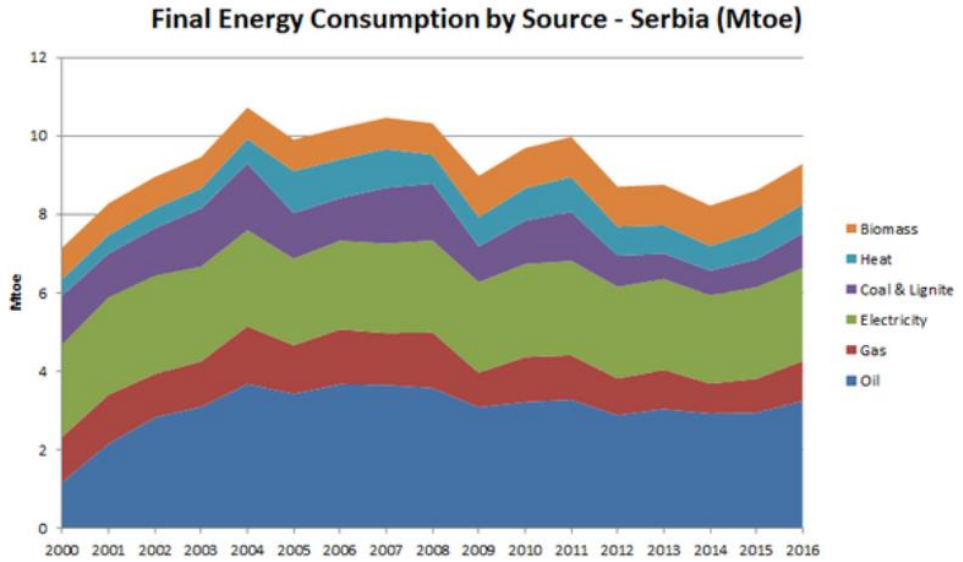
Aurelien Bres

Energy Usage / Energy effiency

Renewable energies are still underpresented

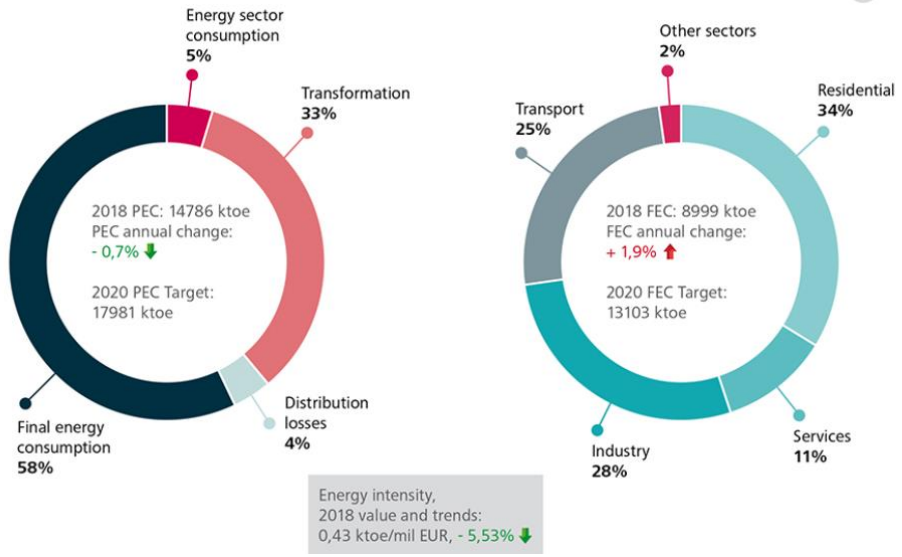
Around 1/3 of energy usage in residential and industry sector

- high potential for optimisation



2 options to implement energy efficiency:

construction	energy saving = reduction of needs (thermal / electrical) + efficient engineering	energy requirements
operation	energy saving = adaptability (use / need) + communication of components	energy consumption



Energy efficiency in Public buildings in Užice

Project 05/20-04/21

- Aim to show possibilities to overcome market barriers & implement energy –efficiency measures in public buildings and
- promote cooperation and business amongst Austrian companies and institutions

National Theater

Primary School

Swimming Pool

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BASELINE & DETAILS
PUBLIC BUILDINGS IN UŽICE

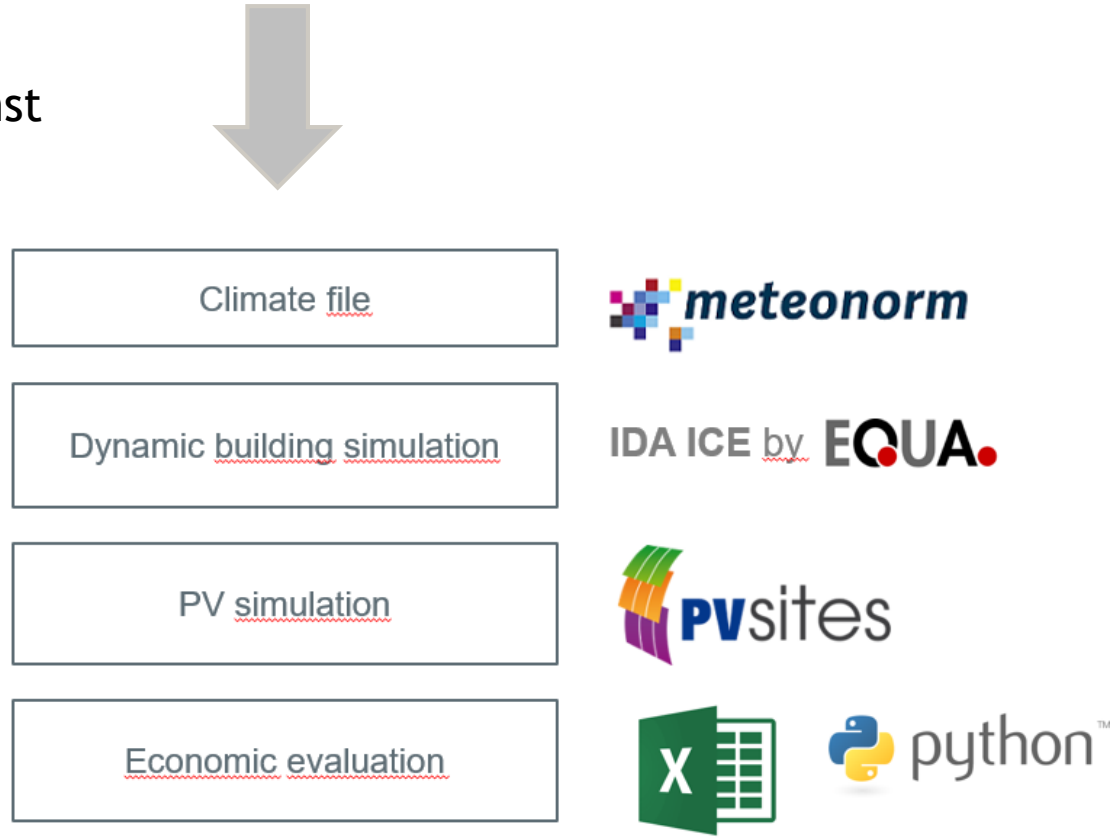
Methodology, Methods and tools

Simulation-based evaluation of energy efficiency measures

- Development of baseline simulation model
- Calibration of baseline simulation model monitoring data
- Definition of energy efficiency measures
- Simulation of energy efficiency measures
- Comparison of energetic and ecological conversion factors
- Economic evaluation with the annuity method

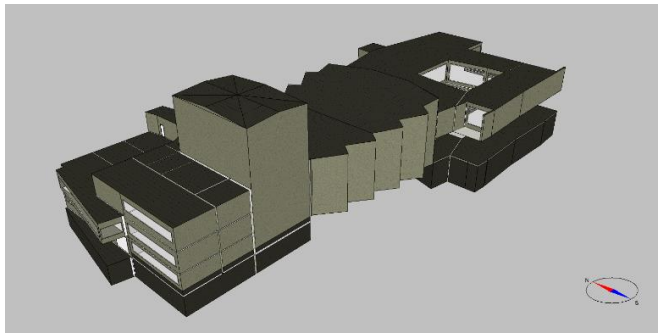
against

impact

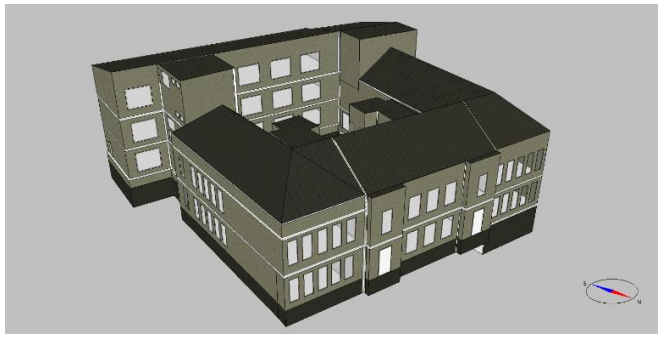


Details of the Buildings

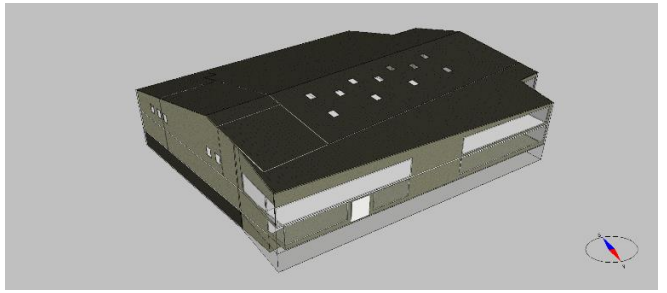
Theatre	Theatre - Narodno pozorište, Užice
Owner	Grad Užice \ Narodno pozorište Užice
Adress	Trg partizana 12, Užice
Heated Floor area	4,614 m^2
Average U-Value	1.20 W/(m^2K)
Heat delivery	Radiators



School	Primary school OS "Dušan Jerković", Užice
Owner	Grad Užice \ OŠ "Dušan Jerković", Užice
Adress	Trg Svetog Save 22, Užice
Heated Floor area	3,463 m^2
Average U-Value	1.42 W/(m^2K)
Heat delivery	Radiators



Swimming pool	Indoor pool - Gradski Bazen
Owner	Grad Užice \ JP "Veliki park", Užice
Adress	Nemanjina 150, Užice
Heated Floor area	5,063 m^2
Average U-Value	0.59 W/(m^2K)
Heat delivery	Floor heating



Assumptions for the simulations

Typical weather data for Užice generated with the software tool Meteonorm

Construction properties from available documentation

Internal loads and schedules from SIA 2024, adapted for energy demand to fit measured data

Conversion factors

Energy carrier	gCO_2/kWh	Primary energy factor	Source
Electrical energy	1100	3.015	Client
District heating (Uzice)	290	1.563	Client
Natural gas	236	1.10	Serbian norm

Definition of BASELINE & energy efficiency measures

Theatre

- Improved insulation of the thermal envelope
- Ventilation with heat recovery
- Local Combined Heating and Power plant
- PV System
  - Optimized area 56 kWp
  - Maximal area 82 kWp

Theatre	Final energy in MWh	CO2 emissions in tCO_2	Primary energy in MWh
Measured in 2019			
Electricity	67.6	74	204.0
District heating	90.4	26	141.2
Simulation results			
Electricity	74.4	82	224.3
District heating	126.3	37	197.4

Definition of BASELINE & energy efficiency measures

Elementary School

- Insulated exterior walls
- Insulated exterior walls + improved windows
- LED lighting
- Ventilation with heat recovery
- PV System
  - Optimized area 23 kWp
  - Maximal area 60 kWp

School	Final energy in MWh	CO2 emissions in tCO_2	Primary energy in MWh
Measured in 2019			
Electricity	67.6	74	203.7
District heating	335.8	97	524.8
Simulation results			
Electricity	65.8	72	198.5
District heating	375.8	109	587.4

Definition of BASELINE & energy efficiency measures

Swimming pool

- Air-to-water heat pump
  - Monovalent
  - Bivalent
- Solar thermal system
- PV system 90 kWp

Swimming Pool	Final energy in MWh	CO2 emissions in tCO_2	Primary energy in MWh
Measured in 2019			
Electricity	604.8	665	1823.5
District heating	877.2	254	1371.1
Simulation results			
Electricity	599.1	659	1806.3
District heating	912.2	265	1425.8

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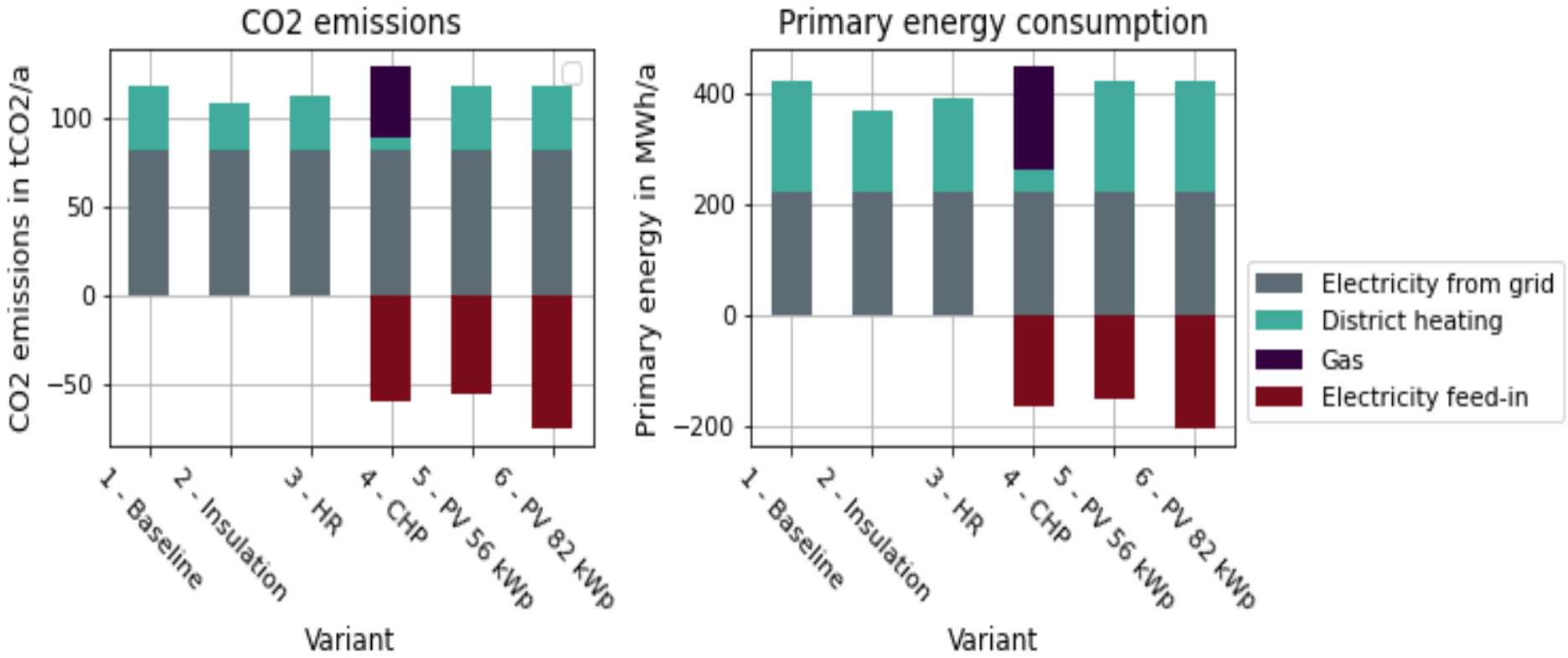
SIMULATION RESULTS

Theatre building

Insulation/heat recovery: moderate decrease in CO2 emissions

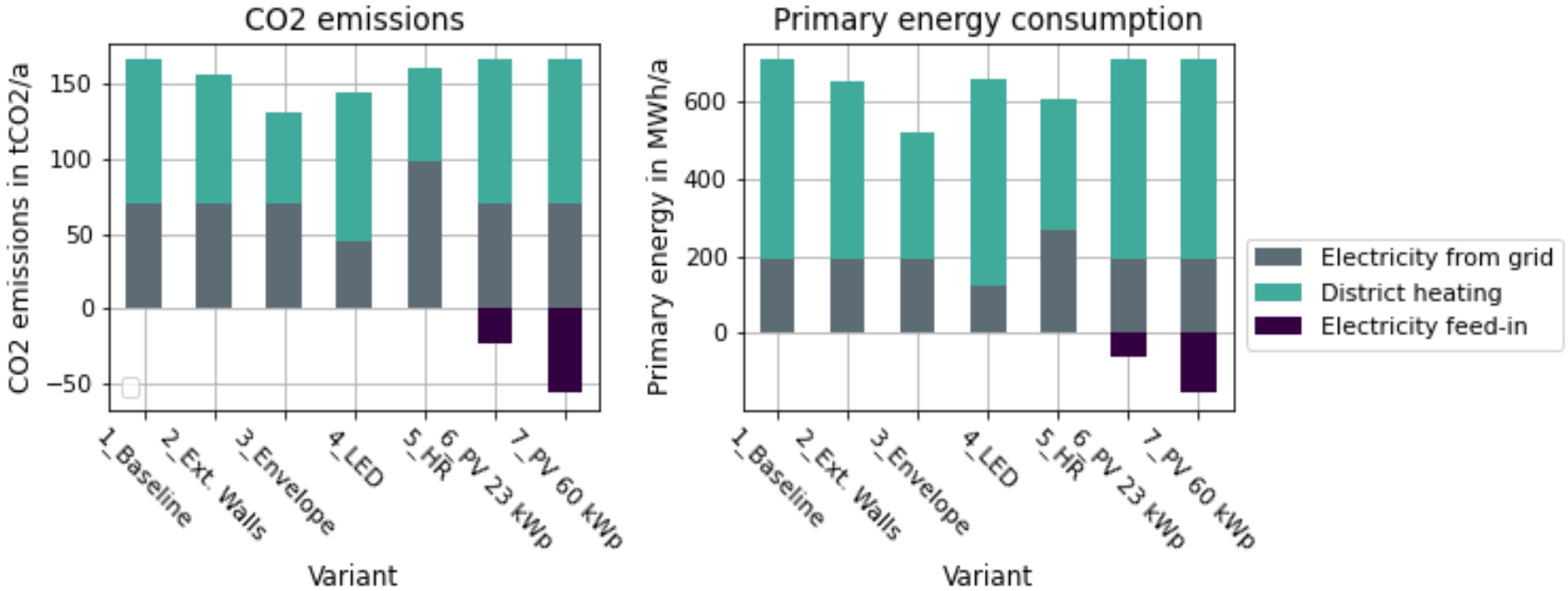
- Heat demand in baseline already rather low

CHP/PV: significant electricity production



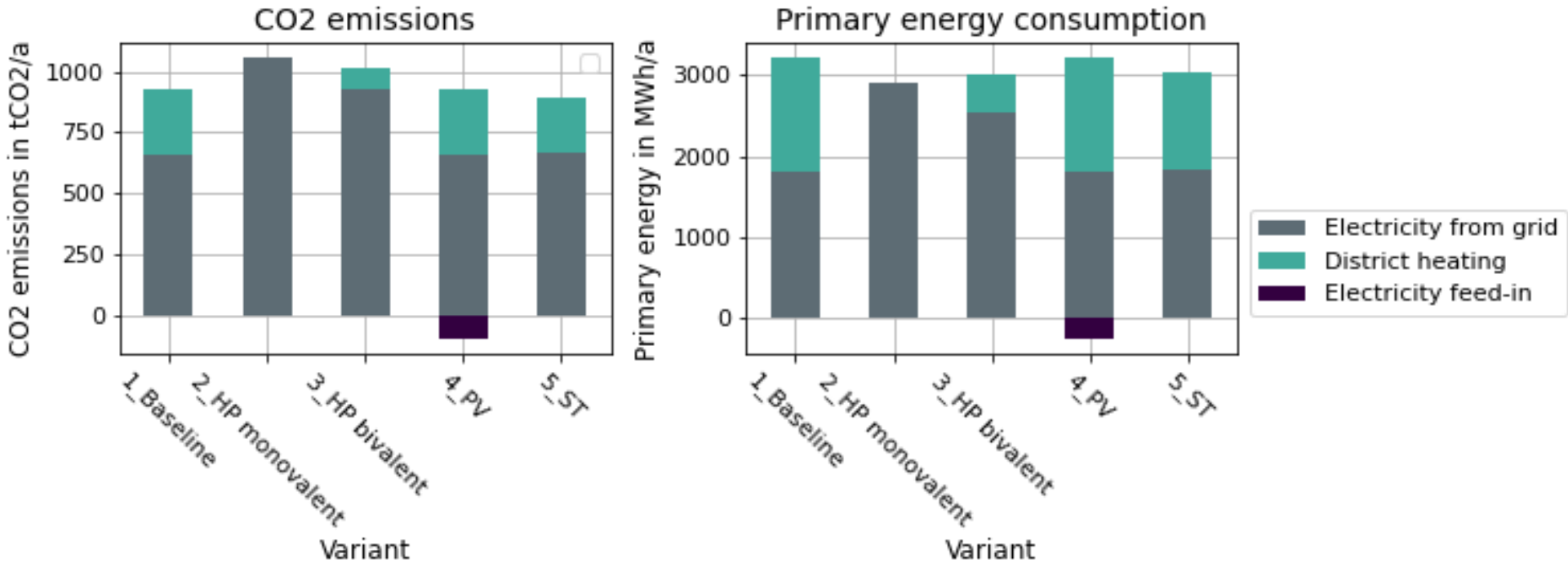
School building

- Insulated exterior walls: 11% reduction of heat demand
- Insulated exterior walls + improved windows: 36% reduction of heat demand
- LED lighting: 36% reduction in electricity demand but 4% increase in heat demand
- Ventilation with heat recovery: reduction of heat demand but increase of electricity demand (but presumably better air quality)



Swimming Pool

- Air-to-water heat pump: decrease in primary energy consumption but increase in CO2 emissions
- Solar thermal system: -6% primary energy, -3.5% CO2 emissions
- PV system 90 kWp: -8% primary energy, -11% CO2 emissions



Conclusion

variety of different energy efficiency measures simulated in three public buildings depending on the actual situation

results show:

- reduction of primary energy use and reduction of CO2 emissions due to the set efficiency measures
- results are highly dependent on the building layout, consumption and loads
- relatively high investment costs for the measures due to cheap energy and electricity prices
  - wide range of payback times for the various energy efficiency measures

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GERHARD SABATHIEL

CEO

SA Consulting GmbH

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Serbien – Energieeffizienz im Bau

Economic considerations related to EE Measures in Public Buildings in Serbia

Energy Efficiency in Serbia
General Remarks

Energy Efficiency in Serbia

- → Implementation of EU EE scheme
- → adoption of secondary legislation on energy management done
- → Priority in full transposition of EU Directive on EE
  - Legal Framework for energy performance contracting in place
  - ESCO projects at an early stage

- → Large number of buildings with high energy consumption leads to good opportunities for reduction of energy consumption
- → Low energy prices affect financial feasibility of investments in EE projects

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Energy Efficiency Financing in Serbia

→ For 2020 EUR 4,25 Mio dedicated to EE projects by gvt. Budget mainly to support EE measures of local governments

Budget Fund for EE in Serbia:

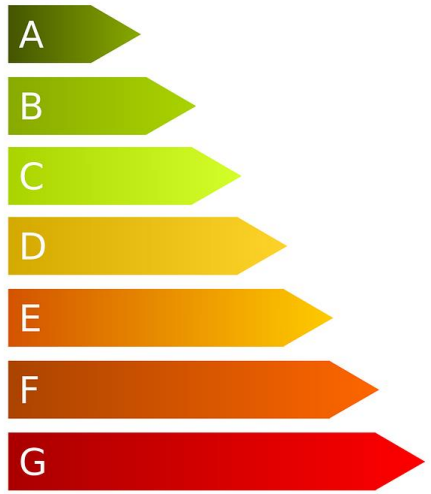
- EUR 1,4 Mio approved annually by government
- One project-one municipality principle

→ Public Investment Management Office supports local governments related to reconstruction and improvement of public facilities

→ Plans to launch a private household EE Fund in 2021 for co-financing of EE projects

- Planned size of the Fund is EUR 21,6 Mio
- financed by EE fees paid by citizens

Energy Efficiency in Uzice



- City of Uzice has allocated funds for EE projects in private households mainly focused on purchase of eco friendly boilers and thermal insulation
- In 2020 200 projects with EUR 334.000,- subsidized
- EE Budget for 2021 is EUR 375.000,-

Published by Serbia-business.eu on Dec. 3rd, 2020

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European EE Financing Mechanisms

Interreg IPA Funds:

- → Allignment with EU EE aquis
- → Supports pilot & demo projects on innovative technologies and EE
- → Serbia received > EUR 300 Mio between 2014-2020
- → New Tool for the period 2021-2027 IPA III

WeBSEFF-Western Balkans Sustainable Energy Financing Facility:

- → EBRD Financing Facility providing credit lines to Partner banks in order to finance investments in EE
- → Available for Municipalities, ESCOs, Municipal Service Providers up to EUR 2,5 Mio
- → Technology cutting CO^2 emmisisons by >20%
- → Retrofitting buildings making them >30% energy efficient

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Economic Evaluation of 3 Public Buildings in Uzice

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Business Considerations

General Remarks:

- Project Period: 20 years
- Estimated Price Increase for Energy: 2% p.a.
- Calculation Interest Rate: 1,5% p.a.

→ Considered CO^2 and business opportunity

Impact on Financial Feasibility:

- Very low energy, esp. electricity price
- Utilization of Buildings
- High Conversion Factor for electricity drives CO^2 savings potential

Theater Building Results

→ 5 measures defined incl. PV in 2 different sizes

Basic Data:

	Baseline	Insulation	HR	CHP	PV 56	PV 82
Investment		224.600	126.000	97.500	69.020	101.150
Energy Cost/a	16.606,59	13.836,84	14.958,71	14.235,24	12.437,08	10.913,99
CO^2 changes t/a		-9,9	-5,9	-48,9	-54,6	-74,9
CO^2 changes %		-8,35	-4,98	-41,27	-46,08	-62,95
Payback Period years		n/a	n/a	51,4	18,2	19,7

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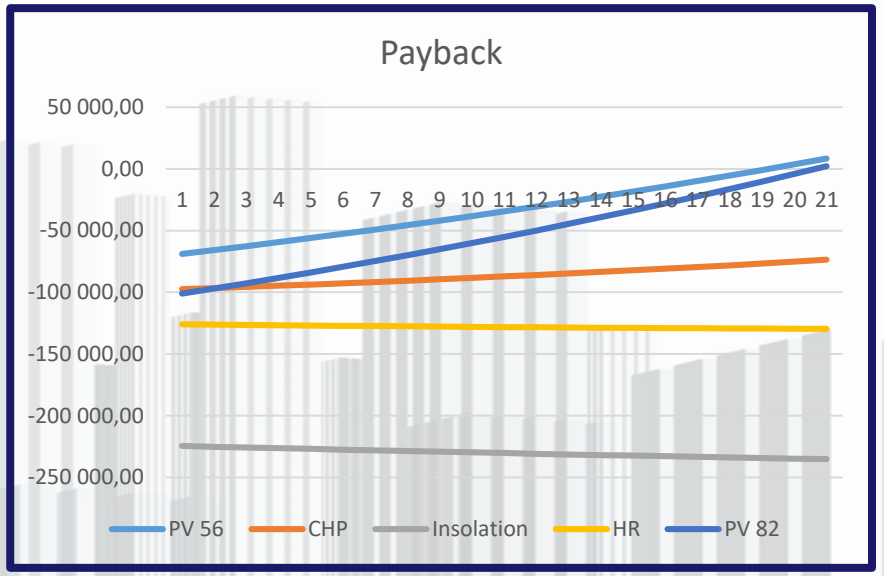
Theater Building Results

Financial Aspects

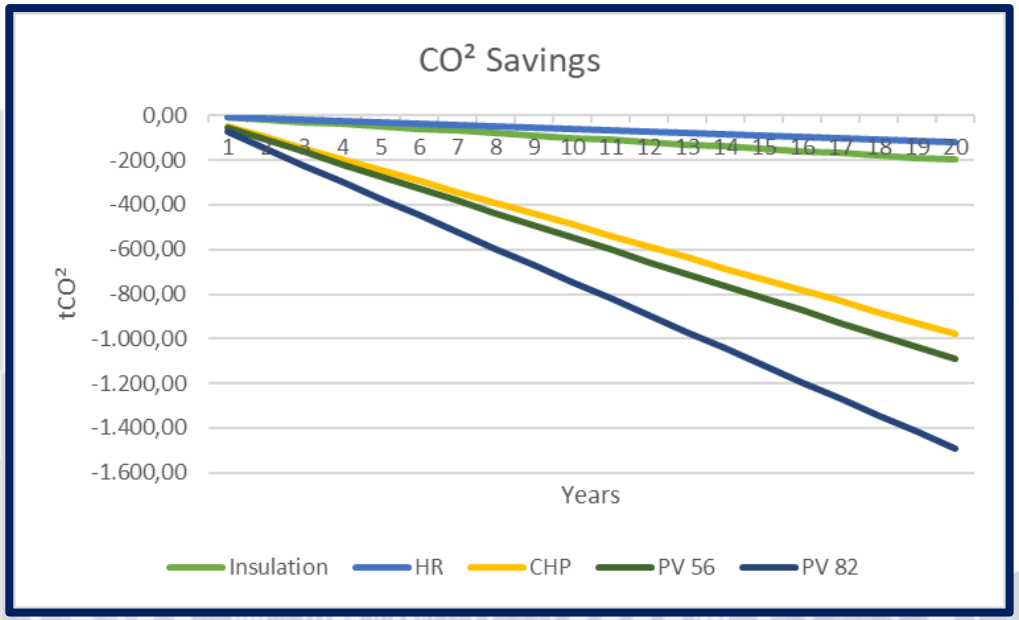
- Insolation, HR and CHP do not make economical sense
- PV as only possibility to reach positive financial results within the 20 years project period – PV electricity production during daytime does not correspond to hightest need in the evening for performances
- Insulation and HR require highest investment, but do not deliver positive financial results



Theater Building Results

CO^2 Aspects

- PV and CHP and deliver good CO^2 reduction opportunity
- Insulation and HR deliver low results only



Theater Building Results

- → Low utilization of the building has significant consequences for the sustainability of EE measures
- → Both PV measures lead to positive financial results during the project period and show the largest CO^2 reductions
- → Most of the produced electricity would be sent to the grid due to inbalance of production and electricity demand
- → Other measures are financially not feasibile within the project period
- → CO^2 reduction potential of insulation measures are relatively small although represent higher investments than PV

School Building Results

→ 6 measures defined incl. 2 different PV sizes

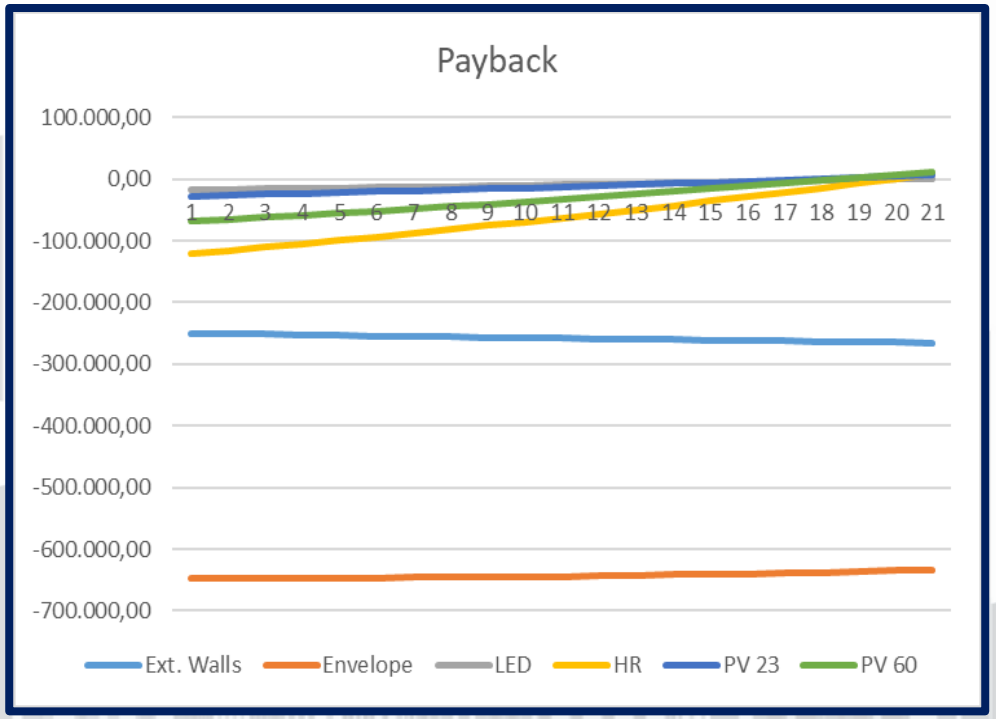
Basic Data:

	Baseline	**Ext. Walls**	**Envelope**	**LED**	**HR**	**PV 23**	**PV 60**
Investment		250.000,00	647.622,40	17.315,00	121.205,00	27.540,00	69.020,00
Energy Cost/a	32.518,40	29.601,74	22.705,30	31.534,31	25.424,81	30.728,44	28.183,58
CO^2 changes t/a		-10,4	-34,8	-22,6	-5	-23,5	-56,8
CO^2 changes %		-6,24	-20,89	-13,57	-3,00	-14,11	-34,09
Payback Period years		n/a	92,2	19,5	18,8	16,8	17,5

School Building Results

Financial Aspects

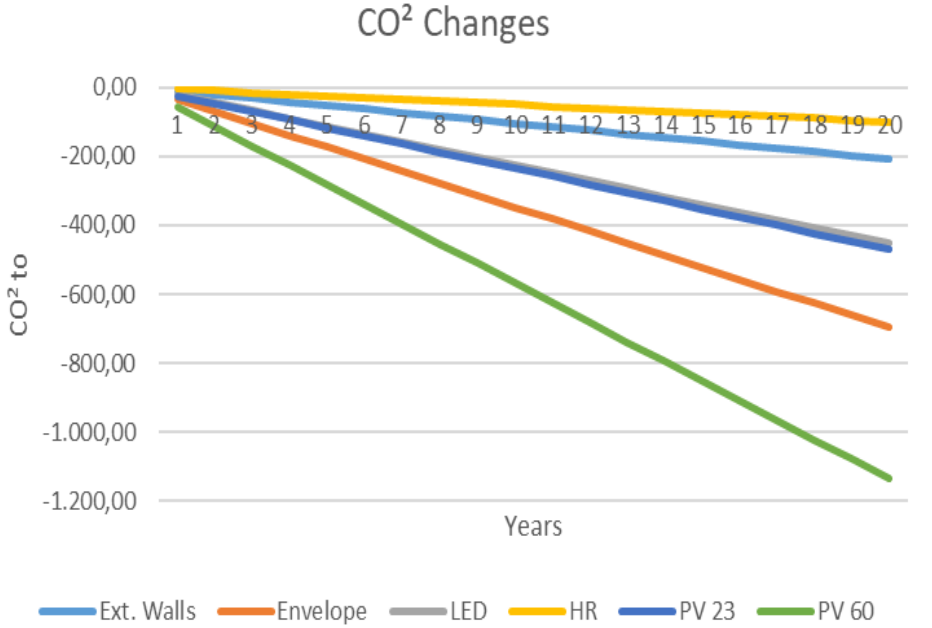
- Insulation of external Walls and the whole envolope requires significant investment and is not financially feasible
- HR and PV reach slight positive results within the 20 years period
- PV efficiency impacted by school close during summer time



School Building Results

CO^2 Aspects

- Hightest impact reached with PV or full envelope insulation
- LED reaches similar CO^2 reduction as the smaller PV installation with much smaller investment
- HR and Ext. Walls insulation lead to a minor CO^2 reduction only



School Building Results

- → much higher heating energy than electrial energy needed due to functionality
- → Summer school beak limits PV opportunity for own consumption
- → Insulation Measures require significant investment compared to other options
- → Full envelope insulation delivers best CO^2 reduction opportunity, but without financial feasibility
- → LED represents the smallest investment and would reduce CO^2 significantly with a financial feasibility within the project period
- → Further reductions in CO^2 could be reached with a comination of measures, e.g. HR, LED and PV 23 and representing financial feasibility within the project period

Swimming Pool Results

→ 4 measures defined

Basic Data:

	Baseline	HP mono	HP bivalent	PV	ST
Investment		150.000,00	48.000,00	111.690,00	60.000,00
Energy Cost/a	125.124,80	80.974,32	95.669,48	117.526,41	113.664,80
CO^2 changes t/a		136,9	91,3	-99,5	-32,5
CO^2 changes %		14,82	9,89	-10,77	-3,52
Payback Period years		3,5	1,7	16	5,4

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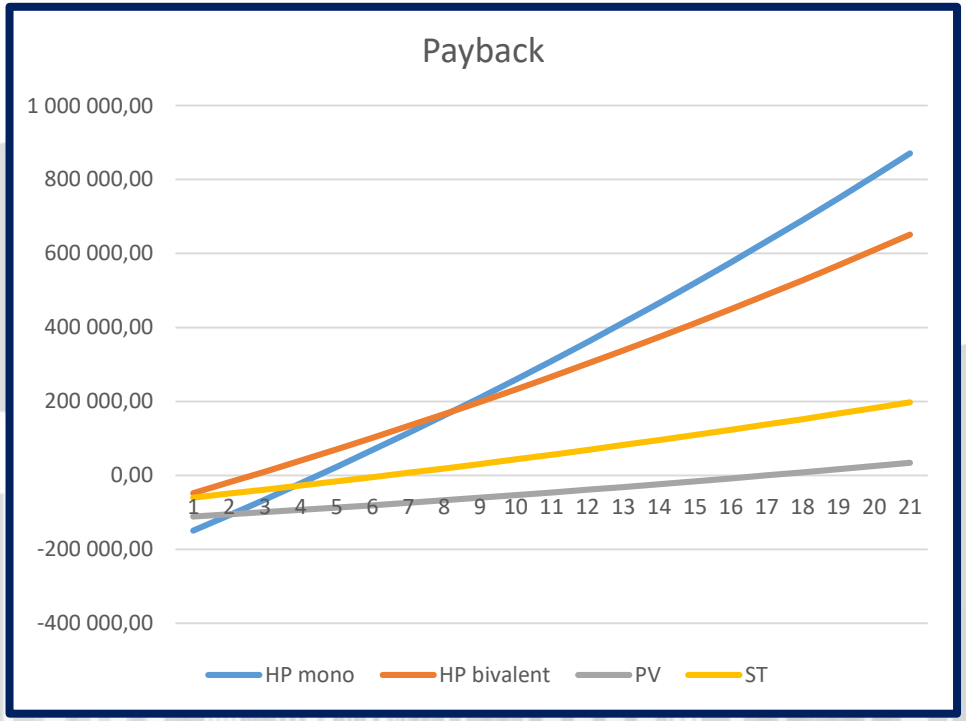
Swimming Pool Results

Financial Aspects

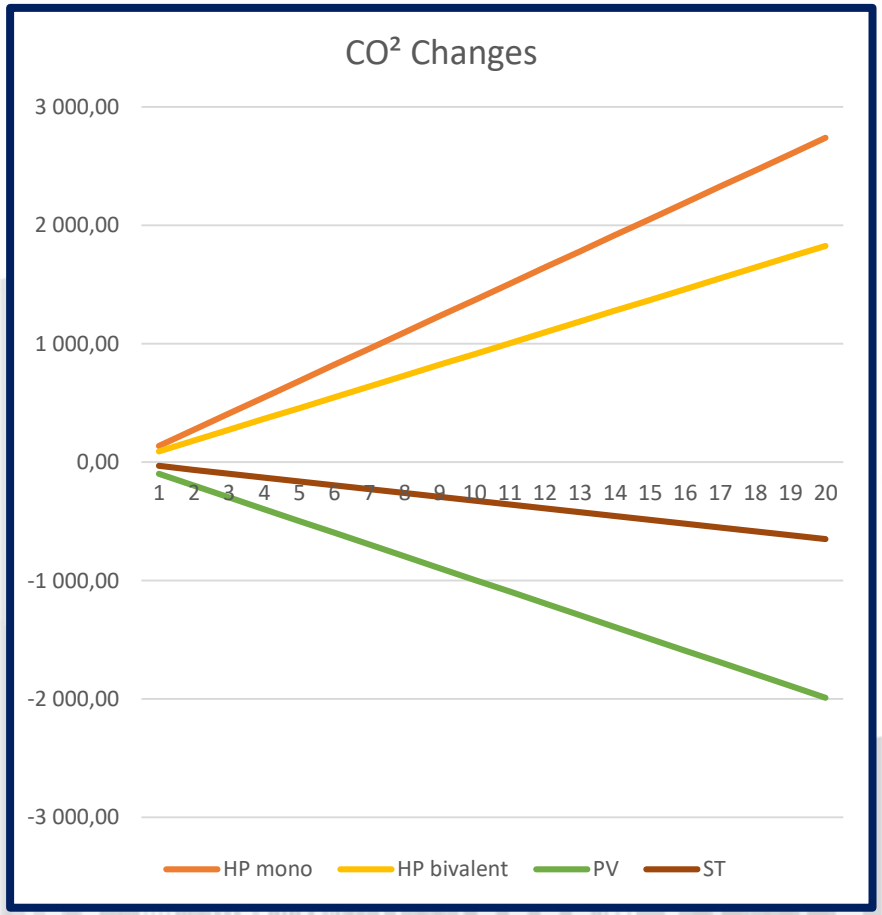
- All 4 measures reach financial feasibility within the 20 years period
- Both HPs show very good results with HP monovalent needing the largest investment and HP bivalent representing the shortest payback period of all investments



Swimming Pool Results

CO^2 Aspects

- Swimming pool requires large amount of heating
- CO^2 reduction potential relatively low due to electricity having a much higher conversion factor than heat from DH Uzice
- Both HP measures even increase CO^2 due to increased need of electricity
- PV show best results in CO^2 reduction, followed by ST



Swimming Pool Results

- → EE measures show best financial results of all 3 buildings
- → CO^2 reduction opportunity limited due to high electricity conversion factor
- → HP bivalent could be combined with PV
  - HP leads to large cost reduction
  - PV offsets CO^2 increase

Thank You!

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