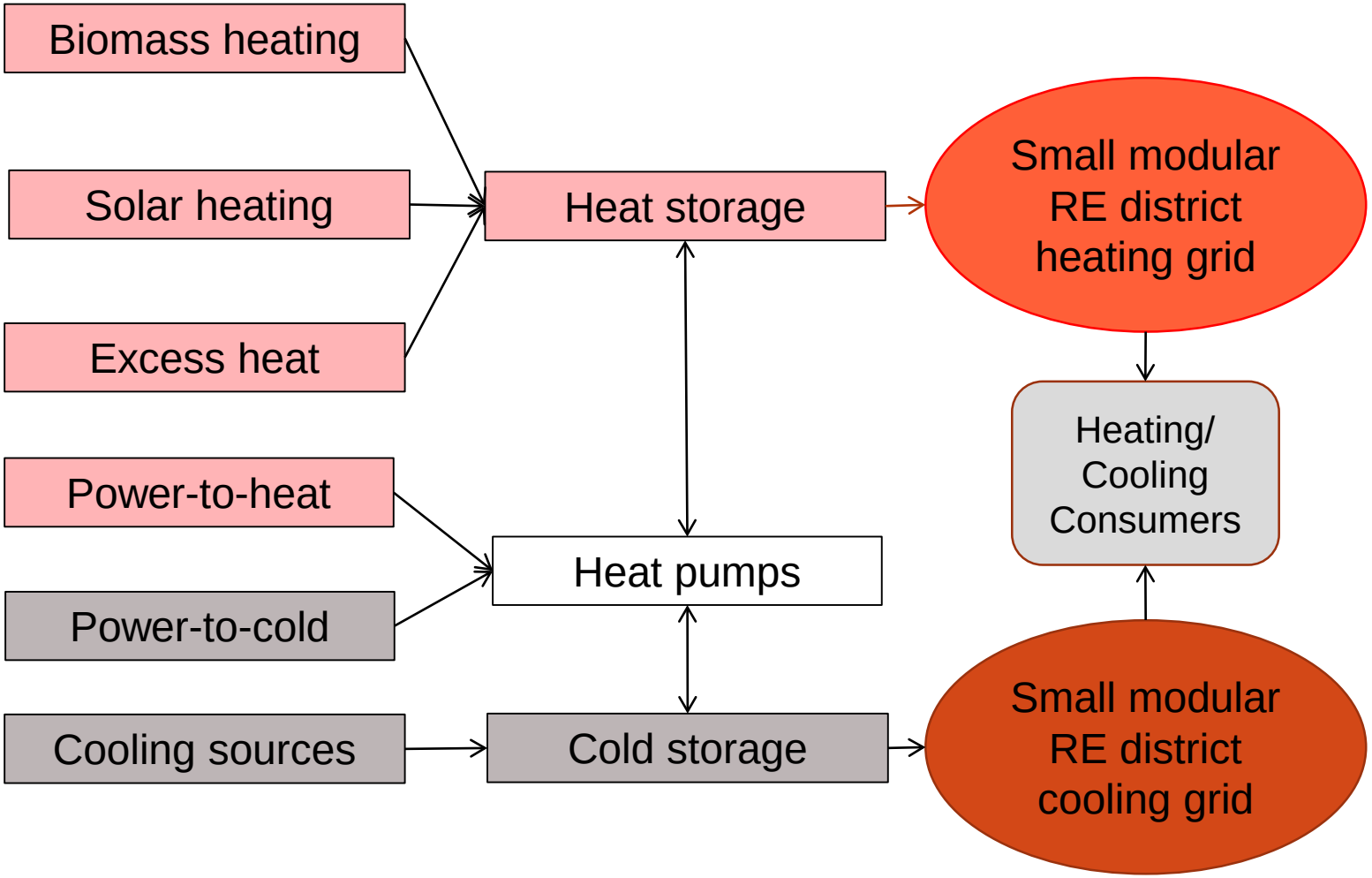
Initiating new small district heating and cooling grids in Šabac

Prof. Dr Nikola Rajakovic – rajakovic@etf.rs
Dr. Ilija Batas Bjelic - batas@etf.rs

17th ENERGY EFFICIENCY COORDINATION GROUP MEETING
Wednesday, 06 June 2018, Belgrade

CooHeating.eu

What are small, modular, renewable heating and cooling systems?



CoolHeating.eu

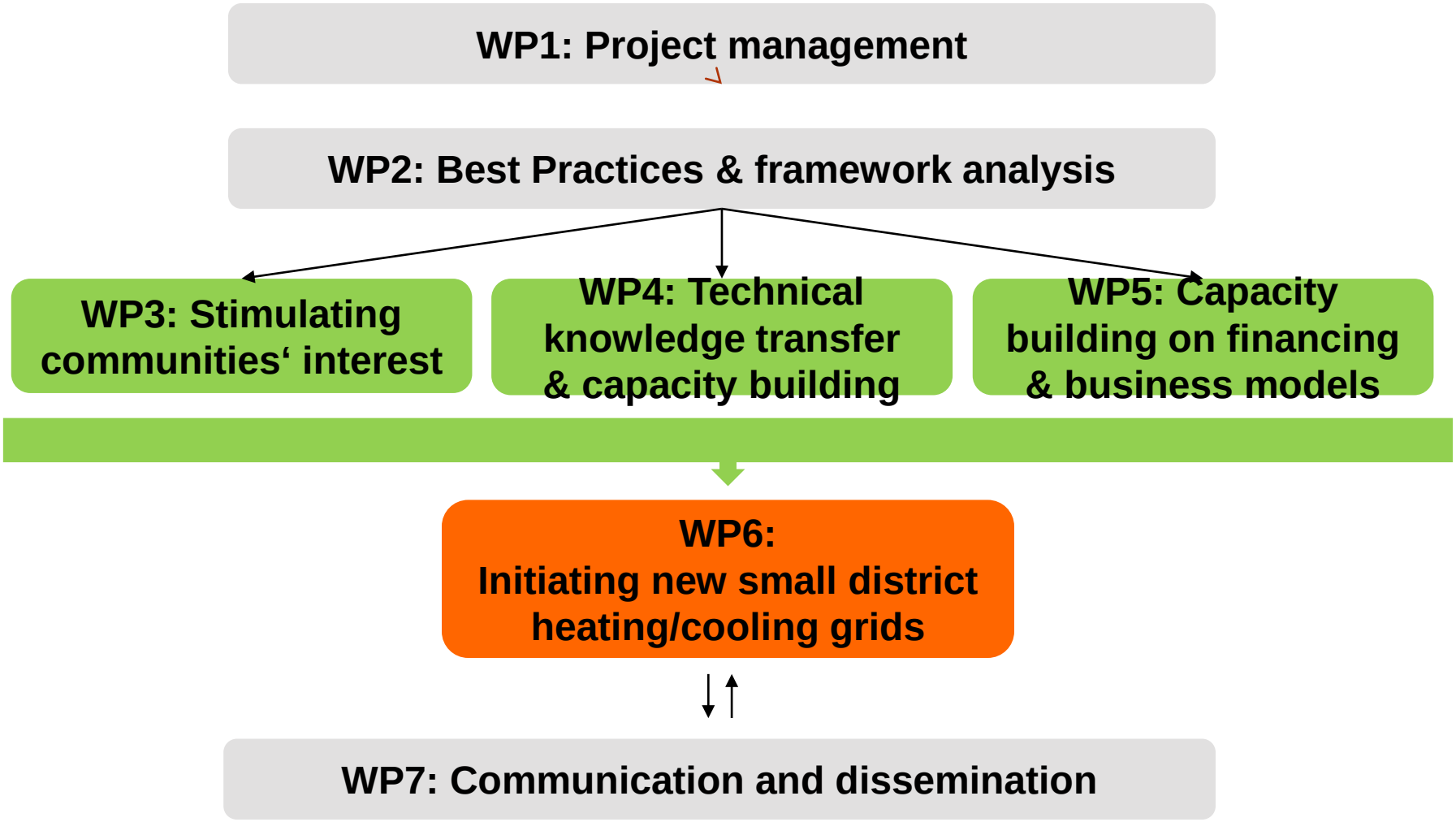
Geographical Focus

Austria | Denmark | Germany

Croatia | Slovenia | Bosnia-Herzegovina | Macedonia | Serbia

Target countries with best practice examples (in green) and target countries (orange) with less developed renewable district heating sector

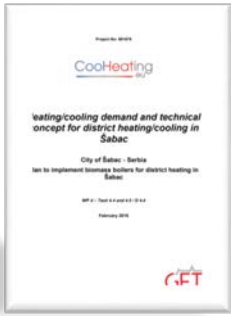
Work Packages



The place of the business plans and feasibility checks in “CoolHeating”

D5.3 Guideline on drafting heat/cold supply contracts for small DHC systems

D4.4 Heating/cooling demand and technical concept for district heating/cooling in Šabac,



D5.2 Economic calculation tool for small modular district heating and cooling projects

D5.1 Guidelines on improved business models and financing schemes of small renewable heating and cooling grids

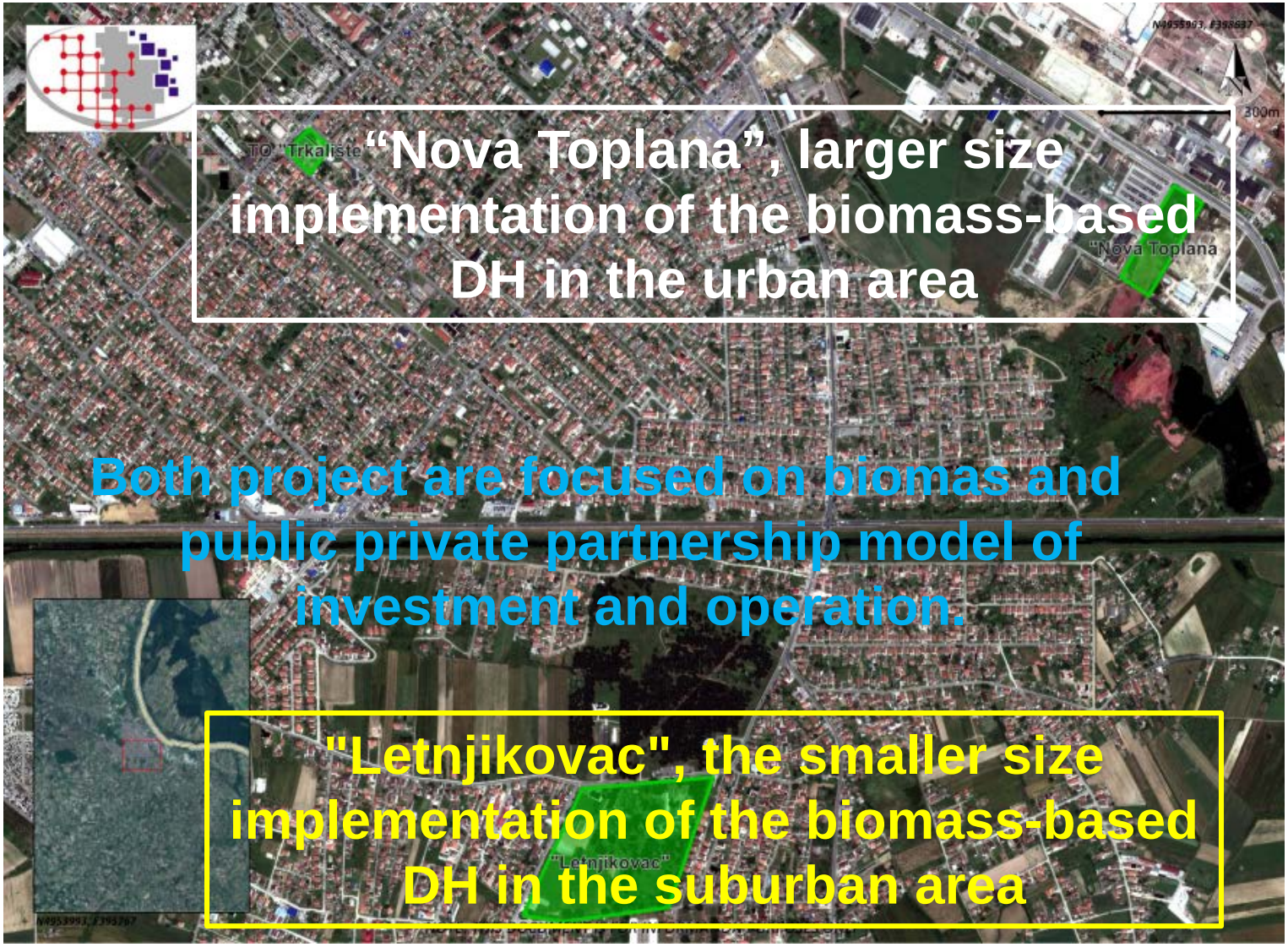
D5.4 ***Target community business models***

-City of SABAC-

D6.1 Feasibility Checks of small modular renewable heating and cooling grids: Letnjikovac & Nova Toplana

CoolHeating.eu

City of Šabac



CooHeating.eu

Technical concepts

"Nova Toplana“:

- 3 biomass boilers 3 x 4.5 MW,
- existing natural gas boilers,
- buffer storage tank 200 m³,
- connecting pipeline 2.2 km

"Letnjikovac“:

- Biomass load boiler 1.5 MW,
- fuel oil peak boiler 3.5 MW,
- buffer storage tank 60 m³,
- grid length of 7.7 km,
- 250 individual substations.

Investment costs and financing

	"Letnjikovac"	"Nova Toplana"
TOTAL [€]	**2,095,000.00**	**7,200,000.00**
Equipment/Machinery	1,845,000.00 €	6,250,000.00 €
Buildings and construction works	200,000.00 €	900,000.00 €
Plot	0.00 €	0.00 €
Project and investment documentation	50,000.00 €	50,000.00 €
Intangible assets (patents, licenses, software)	0.00 €	0.00 €
Initial working capital	0.00 €	0.00 €

	"Letnjikovac"	"Nova Toplana"
TOTAL [€]	**2,095,000.00**	**7,200,000.00**
Private equity	370,000.00 €	2,200,000.00 €
i=1%, repayment period 15 years, grace period 4 years	1,450,000.00 €	5,000,000.00 €
Connection fees	150,000.00 €	0.00 €
Investment subsidies	125,000.00 €	0.00 €
Bridge loan (6 months delay, i=5%)	-	-

[1] Based on the best available non-commercial credit lines for the switching to biomass in Serbian utilities from the international cooperation agreements

Key costs

Fuel				Heat value
Type	MWh/a	t/a	l/a	GJ/t
Biomass	4,740	1,422	/	12
Heating oil	484	44	46,106	40
Total	**5,224**			

Fuel				Heat value
Type	MWh/a	t/a	m3	GJ/t
Biomass	44,315	13,295	/	12
Natural gas	26,397	/	2,566,278	37
Total	**70,712**			

- Biomass: 18 €/MWh (yty 1.00%)
- Natural gas: 35.71 €/MWh (yty 2.80%)
- Electricity: 50 €/MWh (yty1.00%)
- Heating oil: 100 €/MWh (yty 2.80%)

	"Letnjikovac"	"Nova Toplana"
Total yearly salary cost of all employees [€/a]	1,500	85,000
Year to year cost change index [%]	2.00	2.00

- O&M: 1.5% of the investment costs, (yty 2.50%)
- Cost of management, insurance and lease: 1% of the investment costs (yty 2%)

Socio-environmental impacts

"Letnjikovac":

- Lower **energy costs**,
- high level of energy supply **comfort**.
- **1** direct **new employee** and several other indirect employments due to the effects on local economy.
- Improved **air quality** and lower expenses for health services.
- New opportunities for owners of forests and agricultural areas in providing biomass for the DH plant.
- Improved energy efficiency in biomass use.
- Introduction of energy cooperatives.

"Nova Toplana"

- Decrease in the heating costs;
- Reduction of CO_2 equivalent emissions by **7,540 tons** per year;
- Creation of the regional and national **biomass market**;
- Increased **security of biomass supply** and lower dependency on gas imports.

	Energy	Volume		Economic value	Emission CO_2eq/a
	MWh/a	m3/a	tons/a	€/a	tons
Natural gas	40,943	3,980,459	-	1,592,184	7,540
Biomass (η=20%)	19,435	-	5,831	349,830	-
Total	**60,378**	**3,980,459**	**5,831**	**1,942,014**	7,540

Key revenue parameters: Letnjikovac

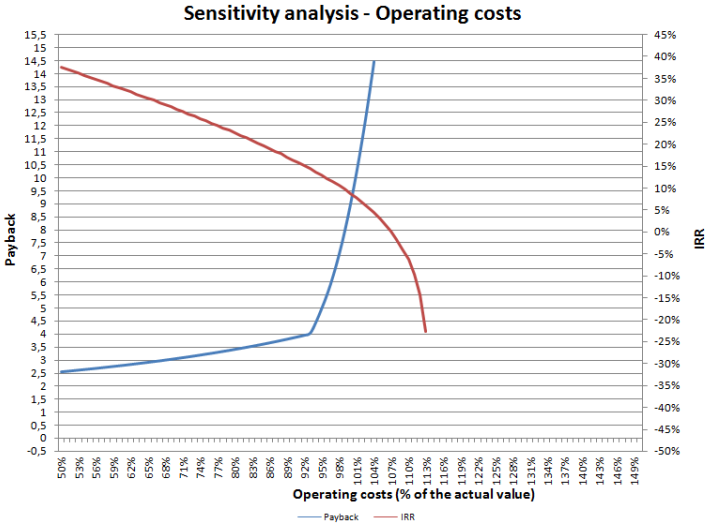
CASH FLOW in €		Discount rate: 4,00%
Year	Cash flow	Discounted Cash flow
C0	-370.000	-370.000
CF1	60.934	58.590
CF2	100.358	92.786
CF3	102.535	91.153
CF4	104.759	89.549
CF5	5.197	4.271
CF6	7.853	6.206
CF7	10.042	7.631
CF8	12.281	8.973
CF9	14.569	10.236
CF10	16.910	11.423
CF11	19.302	12.538
CF12	21.748	13.584
CF13	24.248	14.563
CF14	26.804	15.479
CF15	29.417	16.334
TOTAL	**186.956**	**Payback: 9.05 years**

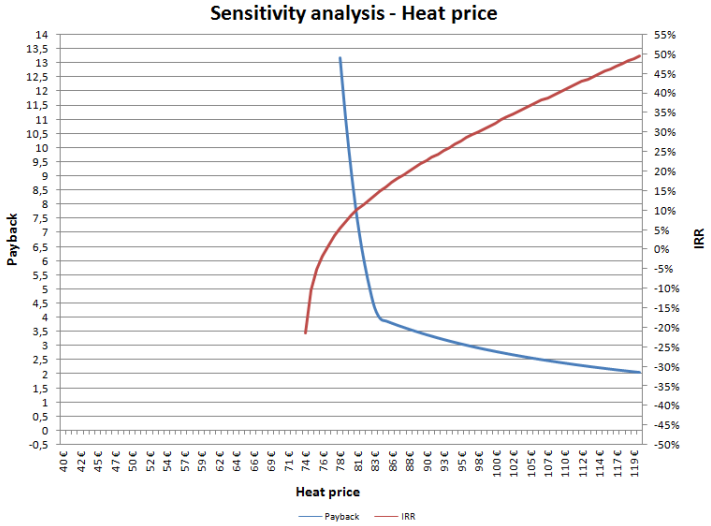
4% discount rate is employed in the simulations of the economic performance of the projects. The following show economic calculations are contained simulation results from Economic calculation tool for small modular district heating and cooling project

Profitability	Cash flow
Initial capital investment (discounted for received subsidies)	1.820.000,00
Private equity invested	370.000,00
Equity net present value (NPV)	**83.317,86**
Equity internal rate of return (IRR)	**8,76%**

CooHeating.eu

Sensitivity analysis: Letnjikovac





- **Operating costs** :
  - increase of 5%:
    - significantly increase the payback time to **around 15 years**,
    - decrease the internal rate of return towards **unprofitability**.
  - decrease of 5%:
    - reduce the payback time to around **5 years**
    - increase the internal rate of return to around **12.5%**.
- more sensitive to the **operating cost increase** and more sensitive is its **payback time**.
- **Heat price:**
  - increase of **average heat price** to around **82 €/MWh**
    - decrease the payback time to around **5 years**
    - increase the internal rate of return to around **12%**.
  - decrease of **average heat price** to around **78 €/MWh**
    - increase the payback time to **around 15 years**
    - decrease the internal rate of return towards **4%**(marginal profitability).
- more sensitive to the **heat price decrease** and more sensitive is its **payback time**.

CoolHeating.eu

Key revenue parameters Nova Toplana

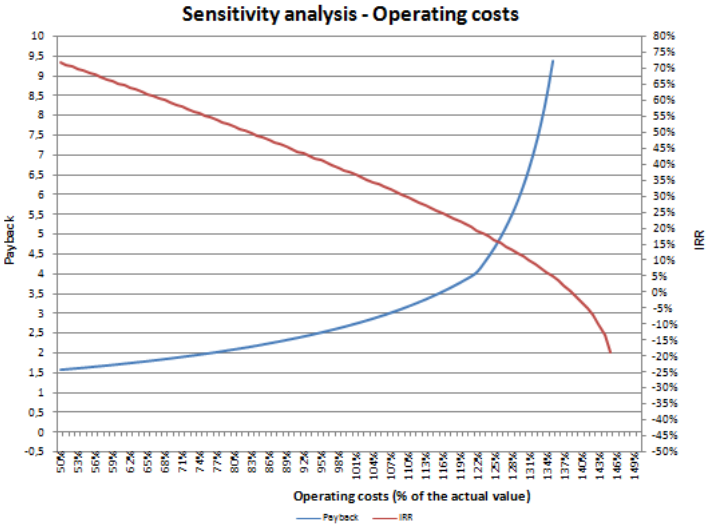
CASH FLOW in €		Discount rate: 4,00%
Year	**Cash flow**	**Discounted Cash flow**
C0	-2.200.000	-2.200.000
CF1	616.819	593.096
CF2	1.034.851	956.777
CF3	1.054.046	937.043
CF4	1.073.509	917.640
CF5	743.860	611.399
CF6	763.237	603.198
CF7	782.879	594.924
CF8	802.786	586.588
CF9	822.957	578.199
CF10	843.395	569.767
TOTAL	**6.338.339**	**Payback: 2.69 years**

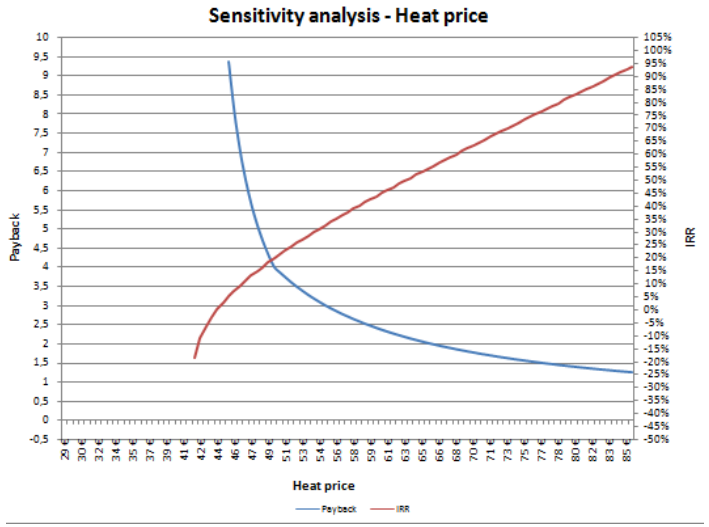
4% discount rate is employed in the simulations of the economic performance of the projects. The following show economic calculations are contained simulation results from Economic calculation tool for small modular district heating and cooling project

Profitability	Cash flow
Initial capital investment (discounted for received subsidies)	7.200.000,00
Private equity invested	2.200.000,00
Equity net present value (NPV)	**4.748.629,68**
Equity internal rate of return (IRR)	**37,40%**

CooHeating.eu

Sensitivity analysis Nova Toplana





- **Operating costs:**
  - increase of operating cost of 20%
    - increase the payback time to **4 years**
    - decrease the internal rate of return to **20**%.
  - decrease of operating cost of 20%
    - reduce the payback time to around **2 years**
    - increase the internal rate of return to around **50**%.
- more sensitive to the **operating cost increase** and more sensitive is its **internal rate of return**.
- **Heat price:**
  - increase of **average heat price** to around **67 €/MWh**
    - decrease the payback time to around **2 years**
    - increase the internal rate of return to around **55%**.
  - decrease of **average heat price** to around **47€/MWh**
    - increase the payback time to **5 years**
    - decrease the internal rate of return to **15%**.
- more sensitive to the **heat price decrease** and more sensitive is its **internal rate of return**.

CoolHeating.eu

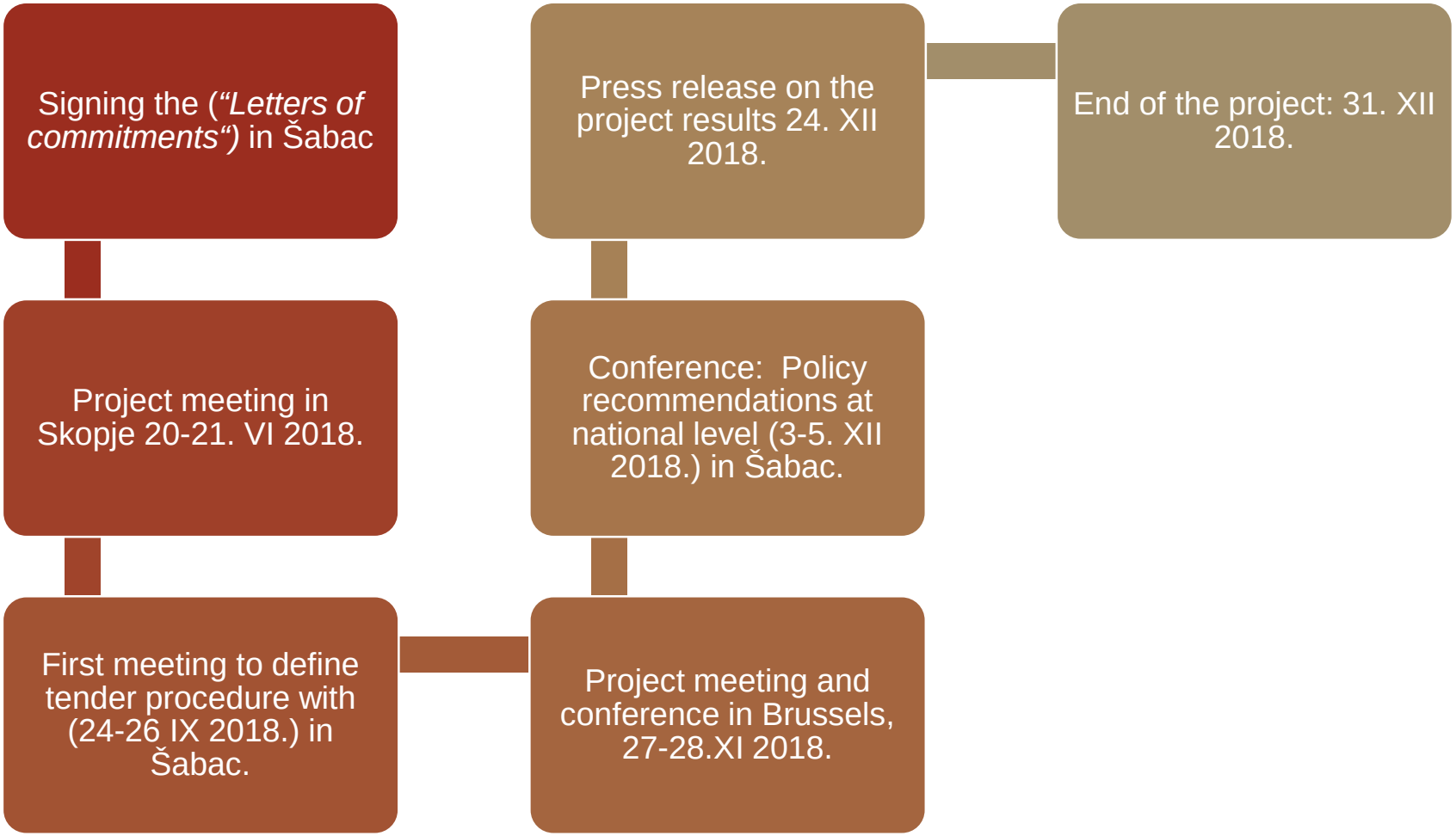
Conclusions

- **"Nova Toplana": 7,200,000€**
- **average yearly price 423 €** based on the **10 years contract (2019-2029)**, very attractive IRR **37.40%** short payback time of (2.69 years).
- reductions in the of **7,540 t** CO_2eq
- increased energy security
- storage for biomass up to 90 days of yearly
- regional biomass market
- economic activity in the biomass supply sector.

- **"Letnjikovac": 2,095,000 €.**
- IRR **8.76%** the average yearly price of **1,016 €**. The contract minimum period of **15 years (2019-2033)** payback time of the project (9.05 years).
- increased quality of life trough better comfort,
- better air quality,
- economic opportunities on the local level avoided biomass cutting and costs for inefficient use of biomass

The successful realization of one of those projects will be indicative for the overall direction of possible energy transition in the heating sector of Republic of Serbia!

Next steps


Signing the (*"Letters of commitments"*) in Šabac
Project meeting in Skopje 20-21. VI 2018.
First meeting to define tender procedure with (24-26 IX 2018.) in Šabac.
Project meeting and conference in Brussels, 27-28.XI 2018.
Conference: Policy recommendations at national level (3-5. XII 2018.) in Šabac.
Press release on the project results 24. XII 2018.
End of the project: 31. XII 2018.

Hvala!

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691679.
The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Union nor of the Innovation and Networks Executive Agency (INEA). Neither the INEA nor the European Commission are responsible for any use that may be made of the information contained therein.

Контакт:

др Илија Батас Бјелић

batas@etf.rs

www.coolheating.eu/rs

Useful links:

http://www.coolheating.eu/images/downloads/feasibility_checks/D6.1-Feasibility-Check-Sabac.pdf

https://balkangreenenergynews.com/rs/coolheating-u-sapcu-koriscenje-biomase-za-daljinsko-grejanje

CoolHeating.eu