Annex D

Investment sector (according to the sectors selected in the summary)	Investment component (by sector)	Brief description of investment component	Type of energy saving measure	Final energy consumption (GWh/year)			Substitution of energy source (GWh/year) To be filled only in case of substitution of the energy source				Energy savings (GWh/year)	RE generation (GWh/year)	CO_2 emissions (t CO_2eq/year)			Emission factor	Source of emission factor
				Energy source	before	after	New energy source	Emission factor (new source)	Energy consumption before (substituted source)	Energy consumption after (new source)			before	after	savings		
Public buildings	Thermomodernization	Wall insulation, doors and windows replacement, modernization of heating pipe distribition and local heat node within each building/modernization & exhchange of the local enenergy heating systems (phase I project till 2030). This include both buildings connected/not connected to the DH (district heating). These public buildings will be manging and monitoring through central IT platform for energy management including also part of Smart City/IoT (including also smart grids approach). Phase I, till 2030. (around 62 300 m2), Phase II till 2040 (around 89 000 m2)	Optimization	Heat/cold	28,6	14,7					13,9		9752,6	5012,7	4739,9	341	IPCC 2006
											0		0	0	0		
											0		0	0	0		
											0		0	0	0		
	Thermomodernization	Phase I, till 2030 include wall insulation, doors and windows replacement for residential buildings (usable/heating area around 180 000 m2 within multifamily buildings and with some small part one family buildings). These buildings actually conected to the DH. For phase II (between 2030-2040) - wall insulation, doors and windows replacement for residential buildings connected to the DH (multifamily buildings with estimated usable/heating area of 230 000 m2). This part of project include modernization of heat nodes (for both phases, phase I + phase II) + modernization of the heat distribution system and domestic hot water infrastructure+ automation and IT interfaces (for managing and monitoring).	Optimization	Heat/cold	170	58,3					111,7		57970	19880,3	38089,7	341	IPCC 2006
	Thermomodernization	Phase I (till 2030) include wall insulation, doors and windows replacement for residential buildings not connected to the DH (usable/heating area of 150 000 m2 together for multifamily/one family buildings). Phase II (between 2030-2040) wall insulation, doors and windows replacement for residential buildings not connected to the DH (usable/heating area of 190 000 m2 together for one family/multifamily buildings).	Optimization	Natural gas	44,4	22,3					22,1		8968,8	4504,6	4464,2	202	IPCC 2006
	Thermomodernization	Phase I (till 2030) include wall insulation, doors and windows replacement for residential buildings not connected to the DH (usable/heating area of 100 000 m2 togerher for one family/multifamily buildings). Phase II (between 2030-2040) wall insulation, doors and windows replacement for residential buildings not connected to the DH (usable/heating area of 130 000m2 within multifamily buildings).	Optimization	Coal	29,6	14,9					14,7		10093,6	5080,9	5012,7	341	IPCC 2006
											0		0	0	0		
Building integrated renewables	PV installation on the Public buildings	Rooftop installation (for all public buildings and on the buildings of municipal companies) with power installation 2,12 MWp (till 2030) and 0,79 MWp (between 2030-2040). These PV installation will be managing and monitoring through central IT platform for energy management including also part of Smart City/IoT (including also smart grids approach). This PV installation will be also included within VPP (Virtual Power Plant) approch/solutions.	New installation	Electricity							0	2,9	0	0	2085,1	719	The National Centre for Emissions Management (KOBiZE)
	PV installation on residential buildings	PV installation for the whole residential family and multifamily buildings 4 MWp (till 2030) and 6 MWp (between 2030 - 2040) . These PV installation will be manging and monitoring through central IT platform for energy management including also part of Smart City/IoT (including also smart grids approach). This PV installation will be also included within VPP (Virtual Power Plant) approch/solutions.	New installation	Electricity							0	10	0	0	7190	719	The National Centre for Emissions Management (KOBiZE)
	Hybrid Heating installation for one family buildings	Heating pumps+PV+heat storage (hybrid) installation for the one family buildings (phase I, till 2030) and (phase II, till 2040)	Replacement	Coal							0	7,8	0	0	1575,6	202	IPCC 2006
											0		0	0	0		
											0		0	0	0		
											0		0	0	0		
											0		0	0	0		
District heating	Development & Construction new heating network for cogenerattion Hydrogen Plant.		New installation	Heat/cold							0		0	0	0		
	Development and construction new micro heating network for for decentralized heating source "islands". Phase I, till 2030.		New installation	Heat/cold							0		0	0	0		
	Development and construction new micro heating network for for decentralized heating source "islands". Phase II, between 2030-2040		New installation	Heat/cold							0		0	0	0		
											0		0	0	0		
Smart grids	Central IT platfrom for managing energy for all infrastructure in the city including: big data analysis, machine learning, microgrids management, managing demand energy vs supply, IoT etc.,										0		0	0	0		
	Smart meters for buildings, lamps, PV and heating source etc.										0		0	0	0		
											0		0	0	0		
											0		0	0	0		
											0		0	0	0		
											0		0	0	0		
Sustainable urban mobility											0		0	0	0		
											0		0	0	0		
											0		0	0	0		
											0		0	0	0		
											0	10,9	0	0	2201,8	202	IPCC 2006

Innovative energy infrastructure	Decentralized and distributed energy production on Hybrid installation: integrated PV + Heating pumps (HP)	Decentralized heating source for city communities (multifamily buildings, phase I - till 2030). This will also include necessary micro heating network for connecting with block buildings. The planned heat power will be around 1 MWt (2 x 0,5 MWt; Hybrid installation -> HP+PV). These technology measures/solutions are aimed at moving away from central heating networks currently based on a coal source and replacing them with low-temperature heating microgrids based on hybrid installations (PV + HP/Heating pumps). The decentralized sources ("energy islands") will be manging and monitoring through central IT platform for energy management including also part of Smart City/IoT.	New installation	Heat/cold							0	6,3	0	0	2148,3	341	IPCC 2006
	Decentralized and distributed energy production on Hybrid installation: integrated PV + Heating pumps	Construction decentralized heating source ("energy islands") for city communities (multifamily buildings, phase II - between 2030-2040). This will also include necessary micro heating network for connecting with block buildings. The planned heat power will be around 1,5 MWt (3 x 0,5 MWt, Hybrid installation -> HP+PV). These measures/solutions are aimed at moving away from central heating networks currently based on a coal source and replacing them with low-temperature heating microgrids based on hybrid installations (PV + HP/Heating pumps). The "energy islands" will be manging and monitoring through central IT platform for energy management including also part of Smart City/IoT (including also smart grids approach).	New installation	Heat/cold							0	9,5	0	0	3239,5	341	IPCC 2006
	Development of the installation with electrolyser for Green Hydrogen production plus necessary infrastructure including storage (for store hydrogen as compressed)	It is assumed that around 7 GWh of electricity will be produced from some of the energy, produced from all PV installations in the city. This energy will be used for the production and storage of Green Hydrogen. The Green Hydrogen will be used to produce energy in the hydrogen fuell cell/CHP system as an element of the energy balancing system (as part of the VPP) for the city's needs (Green Hydrogen will be used as an "energy carrier" and as an "energy store"). Construction/development is planned during phase I, till 2030.	New installation	Hydrogen production and storage of hydrogen													
	Development of the new PV farms	Construction/Development of the new PV farms with total 21 MWp (phase I, till 2030 + phase II, till 2040).	New installation	Electricity								21				719	The National Centre for Emissions Management (KOBiZE)
	Heat storage (big installation)	Construction of the heat storage for the new planned CHP energy sources (storage capacity around 78 000 m3)	New installation	Heat/cold								4,5				341	IPCC 2006
	Power Plant/CHP based on Green Hydrogen	Commercial pilot plant. Usage of the hydrogen fuel cell/CHP (production of the heat and electric energy). Green Hydrogen produced using electricity from the different PV installation in Krosno (phase I, till 2030). The installation will test the possibility of scaling this type of installation in Krosno and build models where the share in energy production for hydrogen production will be generated by residents, e.g. as energy cooperatives based on RES. This kind installation will consider as a part for VPP (virtual power plant) for (intelligent/smart grids) producing and supply of energy for different dynamic needs within the city. This energy component will be intrgrated with central IT energy management system as well with Smart City/IoT (including also smart grids approach).	New installation	production of heat and electricity from hydrogen							0	3,2	0	0	646,4	202	IPCC 2006
Public lighting	Public lighting (lamps) changing	Changing high pressure sodium public (street light) lamps into the LEDs. The project require repalcement around 3500 lamps becaause of the actually there are inefective old lamps within the city lighting system. Lighting management system for managing and monitoring of public lamps including energy management. Lighting management system as a subset of central IT energy management system (central IT platform for managing all buildings and infrastructures in the city). The lighting management system will be integrated also with Smart City/IoT platform (including also smart grids approach).	Replacement	Electricity	2,9	0,79					2,11		2085,1	568,01	1517,09	719	The National Centre for Emissions Management (KOBiZE)
											0		0	0	0		
											0		0	0	0		
											0		0	0	0		
Add other sector											0		0	0	0		
											0		0	0	0		
											0		0	0	0		
											0		0	0	0		
	TOTAL				**275,5**	**110,99**			**0**	**0**	**164,51**	**76,1**	**88 870,10**	**35 046,51**	**72 910,29**		