1.2 Action Plan for Technology combined heat and power plants based on internal combustion engines of up to 500kW (ICE CHP)

1.2.1 About ICE CHP technology

Cogeneration – also known as Combined Heat and Power Plant (CHP) – is the simultaneous generation of heat and power. CHP involves using residual energy in power production to generate heat for industrial processes and district heating, providing significantly higher system efficiencies. The electricity generated by the cogeneration plant is normally used locally, which results in negligible transmission and distribution losses. While it can comprise a range of technologies, it will always include an electricity generator and a heat recovery system. The total energy efficiency of CHP technologies is estimated at 80-85% compared to 35-42% on average from conventional power generation (where 65-58% of the energy potential is released as waste heat), or 55% from the more recent combined cycle power generation (IEA 2012).

The specific CHP technology that has been selected as part of the TNA is based on internal combustion engines of at most 500kW (ICE CHP). The market potential in Moldova up to 2020 is estimated at the level of at least 15 MW, with an economic and technical life-time of 20-25 years. In Moldova it is expected that CHPs will be owned by either private suppliers of non-regulated CHP energy, or private or municipal suppliers of regulated CHP energy. The consumer base is also rather diverse and can include residential households (heat consumers mainly), domestic and non-domestic users of electricity, and industrial and service providers (who can be non-regulated CHP owners at the same time). The total amount of investments needed to implement ICE CHP project constitutes around 17.25 million US$.

Combined heat and power plants based on internal combustion engines (ICE CHP) technology is widely spread in the world. For example, in UK there are 1,438 CHP schemes in operation. Of these, 328 are in the industrial sectors and 1,110 are in commercial, public administration, residential, transport and agriculture sectors.

ICE CHP capacity is in range of 70kWe-1,500kWe with an electricity efficiency of 25-40%. The heat produced is usually hot water, rather than steam, and they generally produce 1-2 units of heat for each unit of electricity, with the ratio of heat to power generally decreasing with size(Carbontrast 2010). 4500 h of high and constant heat demand is needed to make CHP economical.

The main reasons ICE CHP technology was identified as one priority measure for Moldova energy sector are as following:

- In order to increase energy security, 650MW CHP should be built in the country up to 2020 (MES 2030). The main requirement such target be achieved is the presence of heat demand. For the conditions of the Republic of Moldova, distinguished by relatively mild winters and long warm summers, feasible heat demand can be met mainly at decentralized heat consumers. The estimation maid by the experts of working group showed that the CHP capacity at these sites rare will exceed 1 MW, the most applicable being 500kW;

- There are 14 centralized heating systems in Moldova (ANRE 2011) that need to be restructured because of their high energy inefficiency. The construction of ICE CHP could serve as one optimal solution in the process of these systems rehabilitation;
- Distributed heat and electricity production lead to energy losses decreasing;
- Internal Rate of Return is quite attractive and it is in range of 18-20%, calculated for the first 10 years;
- Relatively short construction time is required as ICE CHP is produced in an aggregated module.

1.2.2 Targets for technology transfer and diffusion

There is no enough country experience on promoting ICE CHPs. Their successful dissemination requires following preliminary step, started in 2013-2014 and ending in 2020. During this period around 15 MW of ICE CHP should be built.

By 2020 the final objectives that will be achieved by implementing ICE CHP, including GHG emission reduction, correspond to those from the Table 1.1.-2. If 15MW of such power plant is built by this year, the contribution of ICE CHP projects to GHG emission reduction target, established by SNC for Energy sector High Alternative Scenario (HAS), will constitute 1,6% or 7,7% if it is refers to Intermediate Alternative Scenario target.

Table1.2.2-1CO2 emissions reduction from ICE CHP implementation

Items	units	ICE CHP for residential householders	ICE CHP for industrial and service providers	TOTAL	The contribution to GHG emission reduction established by SNC HAS, %
CO2 reduction of 500kW ICE CHP	tCO2	278.20	852	1130	
Potential for ICE CHP implementation, including:	MW	1	13	14	
by 2015	MW		1	1	
by 2020	MW	1	13	14	
CO2 reduction, including	tCO2	556	23,859	**24,415**	
by 2015	tCO2		1,704	**1,704**	0.1
by 2020	tCO2	556	22,155	**22,711**	1.0

Based on the experience gained, new targets for ICE CHP dissemination will be established for the years after 2020.

1.2.3 Barriers to the ICE CHP diffusion

In the R. of Moldova a favourable Enabling Framework is created to diffuse efficient PPs like ICE CHP is. In particular:

- The existing in Moldova legal framework permits foreign investors to invest on the country territory, they having internationally recognised level of protection (LEP, 2004);

- Energy Efficiency Fund (EEF 2010) and EEF Regulation (EEFR, 2012) have been approved and published. ICE CHP projects are eligible for this Fund. The sum allocated from the state budget to the EEF is increasing from year to year;
- Moldova is a full member of Energy Community and that assures the investors the country will follow EU acquis;
- MoSEFF Project launched for Moldova by EBRD permit to get up to 2 million Euro credit with up to 20% grant for realisation of energy efficient projects. A ICE CHP of 500kW needs less than 1 million Euro and is eligible for MoSEFF fund;
- In the past the Government exempted from import duties the installation for construction of both Combined Cycle PP in Giurgiulesti and Coal PP in Ungheni. So that the same exemption could be applied for ICE CHP imported installations too;
- Moldova has taken a commitment to reduce by 25% GHG emissions reduction by 2020 as a signatory to the Copenhagen Accord (CA 2010). This target encourage the promotion of energy efficiency measures, including ICE CHP technology;
- Starting with 2013 the electricity market is liberalized for economic agents (EA, 2010). Liberalised market will favour not regulated ICE CHP to sell the excess of electricity to the power market, making PP more feasible economically;
- Additional amendments required by Energy Community has been introduced in the new draft of Electricity Act (it will be approved and published in early 2013), in order to make new PPs access to the grid more favourable;
- Energy Strategy target of 650 MW CHP be built by 2020 favours the implementation of ICE CHP.

However, there are multiple barriers of meeting the specified targets and milestones for transfer and diffusion of ICE CHP technology. Among the most important are:

- There is not identified the concrete location where ICE CHP technology is feasible, i.e. where heat demand exceed as higher as 4500 h/year of installed heat capacity use;
- There are no Feed-in tariffs approved for the energy produced at new CHPs, if the energy is delivered for public needs. Lack of such tariffs introduces an uncertainty for investors to return their investments;
- Inadequate sharing of project experience. Knowledge on the implementation of small capacity ICE CHP projects in Moldova is very limited. Sharing of experience around planning and pricing, risk identification and mitigation, implementation and operation is generally limited;
- Cost allocation for heat and power is not transparent. For existing regulated CHPs the costs for electricity price calculation are increased in favour to heat price. As a consequence, the price for heat at ICE CHP cannot compete with one generated at existing CHPs, leading to energy market distortion and having an negative impact on ICE CHP diffusion;
- Unclear framework for negotiating the price for surplus of non-regulated electricity. There is no clear framework governing the process and principles for the sale of excess non-regulated electricity on the electricity market. Although this is an issue affecting all producers of non-regulated electricity, it is a particular challenge for ICE CHP projects, which rely on the sale of all electricity produced to be able to recover the considerable costs involved;
- Inadequate information on the implementation of ICE CHP projects. The knowledge on this project has remained concentrated within a small group of local experts, which has slowed the uptake of energy efficiency projects by other potential beneficiaries in the country. Additionally, this has also implied that search for foreign consultancy services has been

mainly left with the interested parties on their own, who, without necessarily having enough knowledge about the economics of similar projects implemented elsewhere, cannot make an accurate assessment of the provided results;

- Environmental management is not seen as a shared social responsibility. Due to other more urgent economic priorities, environmental management has only recently started to be acknowledged as a real problem with potential impact on the quality of life in Moldova. Reliance on external technical assistance, which created the image of the environment being mostly a concern of development partners or rich countries, has contributed to the general attitude of indifference regarding sustainability matters. Industry-wise, energy efficiency is still not a matter of great concern although a change in attitude is slowly occurring.

1.2.4 Proposed action plans for ICE CHP Technology

In order to overcome the barriers to the ICE CHP diffusion the following planned actions should be undertaken:

- The Ministry of Economy will:

  a) by 2013-2014, apply to donor countries to get a technical assistance on ICE CHP project identification for municipalities' centralized heating. There is not identified the concrete location where ICE CHP technology is feasible, i.e. where heat demand exceed as higher as 4500 h/year of installed heat capacity use. In the frame of The Eastern Europe Energy Efficiency and Environment Partnership (the "E5P"), EBRD is actively looking to identify one or a number of bankable district heating projects in Moldova, either as one or a number of stand-alone projects, or as a programme comprising demonstration projects in 2-3 cities;

  b) continue to develop a legal framework to attract foreign investments in efficient power plant development, including in ICE CHP. The country is poor. There is small chance for local investments.;

  c) by 2014, promote a Government Decree exempting from import duties the ICE CHP installations bought from abroad, in order to assure the project feasibility.

- Energy Efficiency Agency (EEA) will:

  a) introduce, during 2013-2015, a system of energy audit framework in order to identify the private and public enterprise where ICE CHP is feasible, as there is not identified the concrete location where ICE CHP technology is feasible, i.e. where heat demand exceed as higher as 4500 h/year of installed heat capacity use;

  b) during 2013-2016, encourage the appropriate private and public enterprises to build ICE CHP, having a support from Energy Efficiency Fund (EEF 2012), EBRD support through MoSEFF II Project (MoSEFFII 2012) and banks;

  c) disseminate the advantages of ICE CHP project. Knowledge on ICE CHP projects in Moldova is very limited.

- National Energy Regulatory Agency will:

  a) by 2015, create a regulatory framework to facilitate ICE CHP development through assuring regulated tariffs for such PPs, if the energy is destined for public purposes. Lack of Feed-in tariffs introduces an uncertainty for investors to return their investments;

b) by 2014, create a framework for negotiating the price for surplus of non-regulated electricity, in order to assure ICE CHP project increased feasibility;

c) by 2014, allocate correctly the costs for heat and electricity at existing regulated CHP, otherwise the price for heat at ICE CHP cannot compete with one generated at existing CHPs.

- Ministry of Environment will develop a framework in order to share social responsibility on GHG emissions harmful impact. The right population attitude to climate change problems will boost incentive to energy efficient best technologies implementation.

More detailed Action Plan on ICE CHP diffusion along with the priority of measures is presented in the Table 1.2.4-1.

Table1.2.4-1 Action Plan on ICE CHP diffusion

Domain	Action	Why the measure/action is needed	Who (government agency, private sector etc.)	How should they do it?	When (0-5 years, 5-10 years, or 10-20 years)	How much the measure/action will cost, how can it be funded (domestic funding, or international funding)	Indicators of success, risks	Monitoring, reporting and verification for measure	Priority
Legislation and regulation: legislation, standards and labeling	To develop a legal framework to attract foreign investments in efficient power plant development, including in ICE CHP	The country is poor. There is small chance for local investments	Ministry of Economy	ME will: a) include the realization of action in its plan of activity; b)apply to donor countries to get a technical assistance	2013-2014	2000US$-domestic, 10000US$-foreign assistance	A technical assistance obtained to develop a legal framework to attract investments in ICE CHP would be considered as indicator of success	ME will verify the action implementation on regular bases during the years	3
	To identify the concrete locations where ICE CHP is feasible	There is not identified the concrete location where ICE CHP technology is feasible, i.e. where heat demand exceed as higher as 4500 h/year of installed heat capacity use	Ministry of Economy and Energy Efficiency Agency	ME will apply to donor countries to get a technical assistance. EEA will include the realization of action in its plan of activity	2013-2015	5000US$-domestic, 15000US$-foreign assistance	The location for ICE CHP construction identified would be an indicator of success	ME will verify the action implementation on regular bases during the years	1

Domain	Action	Why the measure/action is needed	Who (government agency, private sector etc.)	How should they do it?	When (0-5 years, 5-10 years, or 10-20 years)	How much the measure/action will cost, how can it be funded (domestic funding, or international funding)	Indicators of success, risks	Monitoring, reporting and verification for measure	Priority
	To approve Feed-in tariffs for energy produced at new CHP, if the energy is destined for public purposes	Lack of Feed-in tariffs introduces an uncertainty for investors to return their investments	National Energy Regulatory Agency	To elaborate, approve and publish	2013-2015	2000US$-domestic, 5000US$-foreign assistance	Approved Feed-in tariff would be an indicator of success	The action should be written into ME plan and monitored respectively	1
	To allocate correctly the costs for heat and electricity at existing regulated CHP	The price for heat at ICE CHP cannot compete with one generated at existing CHPs	ANRE	To undertake a commitment	2013-2014	No costs	Excluded cross-subsidies at CHP energy price calculation would be an indicator of success	EEA will monitor the Action implementation	3
	To create a framework for negotiating the price for surplus of non-regulated electricity	To increase the project feasibility	ANRE	The Market Rules should be amended respectively	2013-2014	Low costs	Market rules amended would be an indicator of success	EEA will monitor the Action implementation	3

Domain	Action	Why the measure/action is needed	Who (government agency, private sector etc.)	How should they do it?	When (0-5 years, 5-10 years, or 10-20 years)	How much the measure/action will cost, how can it be funded (domestic funding, or international funding)	Indicators of success, risks	Monitoring, reporting and verification for measure	Priority
Financial incentives	To exempt from import duties the ICE CHP installations bought from abroad	To assure the project feasibility	ME	Publishing a Government Decree	2013-2015	Low costs	A respective GD published would be an indicator of success	ME will verify the action implementation on regular bases during the years	2
Information and awareness raising	To share the ICE CHP experience	Knowledge on ICE CHP projects in Moldova is very limited	EEA	Seminars, EEA site, mass media	2013-2018	2000US$-domestic, 8000US$-foreign assistance	The appropriate knowledge disseminated would be an indicator of success	EEA will verify the action implementation on regular bases during the years	3
	To share social responsibility on GHG emissions harmful impact	To enforce incentive to energy efficient best technologies implementation	Ministry of Environment	By introducing the appropriate subject in the schools, organizing seminars, using its web site and mass media	2013-2020	5000US$-domestic	More initiative in the domain of energy efficiency would be an indicator of success	MEn will verify the action implementation on regular bases during the years	3