

## **Clean Technology Fund Investment Plan for Ukraine Executive Summary**

### **Introduction**

1. This Clean Technology Fund Investment Plan for Ukraine proposes CTF co-financing of \$350 million to support the Government of Ukraine's ambitious goal of keeping emissions 50 percent below 1990 levels, i.e. net zero emissions growth, by 2050. Specifically, the Investment Plan proposes CTF co-financing for reducing risks and overall costs of investing in renewable energy, energy efficiency in residential and government buildings, district heating and industry, introduction of Smart Grid components in the transmission system, and zero emissions power generation from the gas network. The CTF investments will mobilize financing of about \$2.255 billion from multilateral financiers, Ukrainian counterparts, and private sector financing.

### **Country and Sector Context**

2. After a decade of steep economic decline, which halved the country's recorded economic output and raised poverty rates to almost a third of the population, economic growth rebounded in 2000 and GDP grew by an annual average of about 7.5 percent until 2007. However, the current global financial crisis has hit Ukraine's industrial sector particularly hard, as a result of which GDP is expected to decline 10 percent. For Ukraine to recover its economic growth, it will need to improve the energy efficiency of the economy and thereby reduce its vulnerability to further import price shocks. Ukraine's energy intensity, although improving in recent years, is still more than two times higher than the EU average. The energy sector is characterized by inefficient utilization of gas (due to historically low prices and an aging asset base) – currently 41 percent of primary energy supply -- and a growing share of coal (due to increasing natural gas prices and the need for security of energy supply) – currently 19 percent of primary energy supply.

3. Reflecting the steep economic decline, greenhouse gas emissions (GHG) decreased between 1990 and 2000 at an average annual rate of 8 percent. With the resumption of growth, emissions increased between 2001 and 2006, but total emissions remained less than half of 1990 levels. Given the high baseline figure, Ukraine's current GHG emissions of about 400 million tons per year means that it remains one of the largest CO<sub>2</sub> emitters globally. In 2006, the energy sector was responsible for 69% of emissions and industrial processes 22%. Emissions are expected to grow once the economy recovers; without the crisis impact, Ukraine's emissions were forecast to return to 1990 levels by 2020.

### **Priority Sectors for GHG Abatement**

4. A Business as Usual scenario was developed on the basis of Ukraine's Energy Strategy. According to the BAU scenario, Ukraine's GHG emissions in 2020 would be 83 percent of its 1990 emissions, based on the following interventions:

- (a) Thermal generation would increase in absolute and relative terms – the share of fossil fueled power generation increasing from 45 percent to 51 percent, with coal increasing from 52 percent to 85 percent;
- (b) Increase nuclear generation by about 14 percent;
- (c) Nearly doubling Ukraine's hydro power generation capacity; and,
- (d) Increase non-hydro renewable generation capacity (mostly wind) from about 0.1 MW to 1.6 GW;
- (e) Reduce the consumption of energy in existing industries and restructure the economy to make it less energy intensive.

However, implementing a “Business as Usual” program of this size would be challenging for the Government, particularly in the current economic crisis, which threatens to derail implementation of Ukraine’s energy strategy.

5. The Government has identified additional measures as part of the Energy Strategy, which could be categorized as a Low Carbon Development (LCD) Case, and which could reduce annual emissions by an additional 134 million tons per year by 2020. If both the BAU and LCD programs are implemented, then the level of GHG emissions will be 18 percent below the BAU case by 2020 and would put Ukraine on track to achieving its ambitious goal of reducing GHG emissions by 50 percent by 2050.

6. In the energy sector, the LCD measures give priority to:

- (a) Rehabilitation of fossil fuel power plants, potentially increasing efficiency by about 6 percentage points and reducing CO<sub>2</sub> emissions by 18 million tons per year;
- (b) Accelerating the construction of new nuclear power plants (6 GW more than BAU), resulting in emissions savings of 53 million tons of CO<sub>2</sub> per year;
- (c) Switching to high efficiency combined cycle/combined heat power plants; assuming that Ukraine builds five 500 MW CCGT/CHP plants by 2020, total CO<sub>2</sub> emissions could be reduced by 14 million tons per year compared to the BAU scenario;
- (d) Increasing electricity production from hydro power plants from 12 TWh in 2005 to 17 TWh in 2020, resulting in CO<sub>2</sub> emission savings of 5 million tons;
- (e) Renovation of the gas transmission network, particularly replacing all outdated and inefficient compressor units could reduce gas consumption by about 30 percent and decrease about five million tons of CO<sub>2</sub> emissions annually.
- (f) Improving the efficiency of the industrial sector would lead to a savings of 29 TWh of electricity by 2020, which corresponds to 32 million tons of CO<sub>2</sub> emissions savings; and,
- (g) Improving efficiency in the housing and communal services sector, particularly replacing low-capacity and low-efficiency boilers, refurbishing heat distribution networks, and increasing thermal building insulation, would translate into annual CO<sub>2</sub> emissions savings of 8.7 million tons.

### **Rationale for Selected Sectors for CTF Co-Financing**

7. The Government of Ukraine is seeking MDB and CTF support in implementation of its Energy Strategy to both accelerate the low carbon options in the BAU scenario and to facilitate a move from the BAU case to the Low Carbon Development scenario through a combination of energy efficiency and renewable energy interventions. The priority activities selected for CTF co-financing are:

- (a) Direct financing to 100 MW generated from large-scale private sector renewable energy development (particularly wind farms) and funding through financial intermediaries for 80 MW generated from smaller/medium scale projects (such as small hydro and biomass). The CTF program would reduce risk and overall cost of investing in renewable energy in Ukraine by supporting the first commercial-scale projects and addressing barriers such as insufficient access to longer term funding, additional transaction and development costs, and lack of business skills and information.
- (b) An energy efficiency program that implements the Government’s ambitious target to reduce energy intensity by 50% by 2030 through reconstruction and refurbishment of municipal and mixed ownership housing stock; upgrading Government-owned buildings, such as schools and hospitals; decreasing losses in district heating supply; and, industrial energy efficiency. The

program's transformational effect would result from buying down the cost of energy efficiency projects to address barriers such as perceived technical and financial risk, absence of financing of suitable tenor and cost, and high transaction costs of developing projects.

- (c) Design and implementation of the next generation of modern grid management and control systems, which is necessary to support system loss reduction through demand management measures, as well as large-scale integration of intermittent renewable energy, thereby catalyzing the Government's strategy for scaling-up of renewable energy capacity from 1.5 GW to 5 GW.
- (d) Commercial-scale demonstration of zero-emissions power generation from waste heat recovered from compressors in Ukraine's gas network. The project would add roughly 350 MW of Heat Recovery Steam Generators (HRSG), Organic Rankine Cycle Engines, or Turboexpanders to one of the primary transmission lines. The replication of such technologies has the potential to displace coal-fired power in Ukraine.

8. *Potential for GHG reduction:* The proposed investments in renewable energy would result in cumulative CO<sub>2</sub> emissions savings of 16 million tons per year by 2020. Efficiency improvements in the industrial and residential sectors are estimated to result in emissions savings of more than 3 million tons of CO<sub>2</sub> annually. Smart Grids provide more indirect emissions savings by better integrating intermittent renewable energy through improved flexibility of generation and load dispatch. Smart Grids could also support energy efficiency programs by making loads more responsive to price signals. The addition of HRSG/ORCE/Turboexpanders to gas compressor substations throughout the network could save about 11 million tons of CO<sub>2</sub> per year.

9. *Demonstration potential:* The renewable energy program will serve as a catalyst in attracting financial institutions to the renewable energy sector and developing a competitive market for these new projects by overcoming the risk perception. Experience from other countries has demonstrated that ignition of a critical mass of privately-financed renewable energy projects has only occurred in markets that rapidly reach a critical threshold in terms of cumulative installed capacity (for wind it is roughly 500 MW). Reaching such a level sends a positive signal to the global industry and also sets in motion a virtuous feedback loop where ancillary economic development begins to also scale.

10. With respect to energy efficiency, the investment needs and potential in Ukraine are estimated to exceed \$1 billion per year and the International Financial Institutions are establishing an Energy Efficiency Action Plan that would be instrumental in deepening interventions in the industrial sector, district heating, and power and water utilities. Smart Grids are at their early stages of deployment globally, and the CTF investment provides the opportunity to develop implementation experience in emerging economies for more rapid scale-up. Application of zero emissions power generation from waste heat recovery has significant scale-up potential given the size of Ukraine's gas network, and could also have a replication effect in countries and regions with large gas transit systems.

11. *Development impact:* The CTF program addresses a top economic priority of the Government – energy security and efficiency – as a result of the global increase in energy prices and the changes in Gazprom's gas pricing formula for Ukraine. This two-punch price impact has created twin priorities for more efficient utilization of gas and fuel switching from gas to alternative fuels. The renewable energy program would have other significant co-benefits, such as business and employment generation in the renewable energy industry (assembly, fabrication, services), as well as reduction in NO<sub>x</sub>, SO<sub>x</sub> and particulate emissions from avoided coal-fired power.

12. *Implementation Potential:* The Government has established a "Green Tariff" for renewable energy, as well as a National Agency for the Effective Use of Energy Resources, whose mandate is to guide Government policy on energy efficiency. Although Ukraine has a proven implementation record of

MDB-financed projects in the energy sector, the investment program could be affected by Ukraine’s high credit risk arising from its vulnerability to international liquidity problems. The policy framework agreed with the support of the IFIs may serve as an anchor to maintain an appropriate macroeconomic framework that is necessary for Ukraine’s economic recovery. The World Bank is also preparing a Development Policy Loan focused on structural reforms to facilitate business entry and exports, to generate fiscal space for needed investments, and to help ensure sustainability in the gas sector.

13. *Additional costs and risk premiums:* One of the key limitations for wider project implementation of renewable energy financing is the lack of financial resources, both direct funding and lending facilities, because private investors and financial institutions view the sector as higher risk due to lack of technical capacity on the part of lenders to evaluate such projects and potential borrowers to establish the bankability of their projects. Energy efficiency lending has attractive returns, but market penetration has been limited due to similar barriers and experience has shown that subsidies are required to overcome these barriers. Furthermore, the recent economic crisis has made investments difficult due to financial sector constraints, while central and local governments lack the funds to make significant investments. Smart Grids are an innovative and complex concept which requires positive incentives for deployment. Finally, the recovery of exhaust heat to produce electricity in the gas network faces the barrier of non-dispatchable power, like renewable energy options. As a result, a buy-down of the capital costs is needed to address the financial viability gap.

**Table 1: Results indicators for the Ukraine CTF Investment Plan**

<b>Project</b>	<b>Primary indicator</b>	<b>Projected CO<sub>2</sub> emissions reduction</b>
Renewable Energy (RE)	Renewable energy supply in the grid	0.7 million tons/year
Energy Efficiency (EE)	20% improvement in energy intensity by 2014	3.2 million tons/year
Smart Grids	Long term impact: fostering the scale-up of RE after 250MW target is achieved	Indirect; will provide enabling environment for RE and EE.
Zero Emissions Power from Gas Network	Installation of waste heat recovery generation capacity of 350 MW	1.8 million tons/year

**Table 2: Indicative Financing Plan  
(in US\$ millions)**

<b>Program</b>	<b>Ukraine Counterpart</b>	<b>MDBs</b>				<b>Private Sector</b>	<b>CTF</b>			<b>Total</b>	<b>Of which CTF Grant Funds</b>
		<b>EBRD</b>	<b>IBRD</b>	<b>IFC</b>	<b>Other</b>		<b>EBRD</b>	<b>IBRD</b>	<b>IFC</b>		
Ukraine Renewable Energy Financing Facility		250		50		30	50		25	<b>405</b>	1
Energy Efficiency	250	200	250	25		200	37.5	50	37.5	<b>1,050</b>	1
Smart Grids	100		300					50		<b>450</b>	0.5
Zero Emissions Power from the Gas Network	100	250	250				50	50		<b>700</b>	0
<b>Total Stage 1</b>	<b>450</b>	<b>700</b>	<b>800</b>	<b>75</b>	<b>0</b>	<b>230</b>	<b>137.5</b>	<b>150</b>	<b>62.5</b>	<b>2,605</b>	<b>2.5</b>
		<b>1,575</b>					<b>350</b>				