

OVERVIEW



LIGHTS OUT?

*The Outlook for Energy
in Eastern Europe
and Central Asia*



THE WORLD BANK



This report is part of a series undertaken by the Europe and Central Asia Region of the World Bank. Earlier reports have investigated poverty, jobs, trade, migration, demography, and productivity growth. The series covers the following countries:

- | | |
|------------------------|--------------------|
| Albania | Latvia |
| Armenia | Lithuania |
| Azerbaijan | Moldova |
| Belarus | Montenegro |
| Bosnia and Herzegovina | Poland |
| Bulgaria | Romania |
| Croatia | Russian Federation |
| Czech Republic | Serbia |
| Estonia | Slovak Republic |
| FYR Macedonia | Slovenia |
| Georgia | Tajikistan |
| Hungary | Turkey |
| Kazakhstan | Turkmenistan |
| Kosovo | Ukraine |
| Kyrgyz Republic | Uzbekistan |

LIGHTS OUT?

The Outlook for Energy in Eastern Europe and the Former Soviet Union

OVERVIEW



THE WORLD BANK
Washington, D.C.

This unproofread booklet contains the Overview as well as a list of contents from the forthcoming book, *Lights Out? The Outlook for Energy in Eastern Europe and the Former Soviet Union*. To order copies of the full-length book, published by the World Bank, please use the form at the back of this booklet.

The manuscript for this overview edition disseminates the findings of work in progress to encourage the exchange of ideas about development issues. The text is not final and is not for citation.

©2010 The International Bank for Reconstruction and Development / The World Bank
1818 H Street NW
Washington DC 20433
Telephone: 202-473-1000
Internet: www.worldbank.org
E-mail: feedback@worldbank.org

All rights reserved.

This volume is a product of the staff of the International Bank for Reconstruction and Development / The World Bank. The findings, interpretations, and conclusions expressed in this volume do not necessarily reflect the views of the Executive Directors of The World Bank or the governments they represent.

The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgement on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Rights and Permissions

The material in this publication is copyrighted. Copying and/or transmitting portions or all of this work without permission may be a violation of applicable law. The International Bank for Reconstruction and Development / The World Bank encourages dissemination of its work and will normally grant permission to reproduce portions of the work promptly.

For permission to photocopy or reprint any part of this work, please send a request with complete information to the Copyright Clearance Center Inc., 222 Rosewood Drive, Danvers, MA 01923, USA; telephone: 978-750-8400; fax: 978-750-4470; Internet: www.copyright.com.

All other queries on rights and licenses, including subsidiary rights, should be addressed to the Office of the Publisher, The World Bank, 1818 H Street NW, Washington, DC 20433, USA; fax: 202-522-2422; e-mail: pubrights@worldbank.org.

Book Contents

Foreword

Acknowledgments

Overview

Appendix

1. Introduction

Notes

2. The Impending Energy Crunch

The Demand Outlook

The Outlook for Primary Energy Supplies

The Outlook for Electricity Supply

Efficiency as a Potential Energy Resource

Notes

3. The Potential Supply Response

The Primary Energy Supply Response

The Electricity Supply Response

Total Investment Requirements in the Energy Sector

The Regional Cooperation and Trade Response

Reducing Energy Waste

Notes

4. The Potential Demand Response: Increasing Energy Efficiency

The Potential Benefits of Energy Efficiency
 Barriers to Energy Efficiency
 The Potential for More Efficient Energy
 Financing and Managing Energy Efficiency
 The Need for a Comprehensive Action Plan
 Notes

5. The Environmental Conundrum

Policies and Instruments for Reducing Carbon Emissions
 Integrating Environmental Protection across Sectors
 The Need to Embrace Mitigation and Adaptation
 Notes

6. Creating an Enabling Environment for Investment

Creating an Attractive Business Environment
 Ensuring the Financial and Commercial Viability of the Sector
 Structuring the Energy Sector to Attract Investment
 Addressing Affordability Concerns

References

Index

Boxes

- 2.1 Assumptions about Efficiency Gains: The Base Case
- 2.2 Ominous Implications for CO₂ Emissions
- 4.1 Subsidizing Energy Efficiency Investments by the Poor in the United Kingdom
- 4.2 Very Low-Energy Buildings
- 4.3 District Heating and Combined Heat and Power Systems: Big Efficiency Gains for the Money
- 4.4 The Poland Efficient Lighting Project
- 4.5 The Serbia Energy Efficiency Project
- 4.6 Eco-Cities
- 4.7 The Bulgarian Energy Efficiency Fund
- 4.8 A Utility Energy Service Company in Croatia
- 4.9 An Energy Efficiency Checklist for Governments

- 6.1 Components of an Effective Tax System for the Petroleum Sector
- 6.2 A Legal Framework for the Petroleum Sector

Figures

- 1.1 Changes in Real Output in the Region, 1990–2008
- 1.2 Primary Energy Production in the Region, by Type, 1990–2008
- 1.3 Primary Energy Consumption in the Region, 1990–2008
- 2.1 Actual and Projected Energy Intensity in the Russian Federation and Selected Groups of Countries in the Region, 1990–2030
- 2.2 Actual and Postcrisis Projected Demand for Electricity in Region, by Sector, 1990–2030
- 2.3 Actual and Projected Baseline, Optimistic, and Pessimistic Scenarios for Natural Gas Production in the Russian Federation, 2005–30
- 2.4 Actual and Projected Baseline, Optimistic, and Pessimistic Scenarios for Natural Gas Production in Turkmenistan, 2005–30
- 2.5 Actual and Projected Natural Gas Production in Azerbaijan and Kazakhstan, 2005–30
- 2.6 Actual and Projected Crude Oil Exports by Azerbaijan, Kazakhstan, and the Russian Federation, 1990–2030
- 2.7 Actual and Projected Net Energy Exports by Europe and Central Asia, by Type, 1990–2030
- 2.8 Actual and Projected Net Oil Exports by Europe and Central Asia, 2005–30
- 2.9 Actual and Projected Net Gas Exports by Europe and Central Asia, 2005–30
- 2.10 Changes in Installed Generating Capacity, by Type of Energy and Subregion
- 2.11 Actual and Projected Electricity Production, 2005–30, by Energy Source
- 3.1 Regional Gas Pipelines Proposed in Southeastern Europe
- 3.2 Actual and Projected Fiscal Revenues from Oil in Azerbaijan, Kazakhstan, and the Russian Federation, 2005–24

- 3.3 Projected Capacity Additions, Rehabilitations, and Retirements to Region's Electricity Infrastructure, 2006–30
- 3.4 Gas Venting and Flaring by the Russian Federation, Kazakhstan, Azerbaijan, Uzbekistan, and Turkmenistan, 2006
- 4.1 Estimated Effect of Energy Efficiency Improvements on Energy Use in 11 OECD Countries, 1973–97
- 5.1 Total CO₂ Emissions in the Region, by Country, 2005
- 5.2 Carbon Intensities in CSE/CIS Subregions and Other Countries, 2005
- 5.3 Actual and Projected CO₂ Emissions in the Region, 1990–2030
- 5.4 NO_x and Particulate Matter Standards for New Gasoline Vehicles Sold in the European Union, 1992–2005
- 5.5 Cost of Abating Emissions
- 6.1 Average Collection Rates in the Region, 1995–2008
- 6.2 Weighted-Average Residential and Nonresidential Electricity Tariffs in the Region, by Economy, 2008
- 6.3 Horizontal and Vertical Unbundling in the Region's Electricity Markets, 2008
- 6.4 Population of the Region, by Poverty Status, 1998/99–2005/06

Tables

- 2.1 Average Annual Growth Projections, 2005–30
- 2.2 Gas Reserves and Production, by Country, 2008
- 2.3 Oil Reserves, Production, and Consumption in Azerbaijan, Kazakhstan, and the Russian Federation, 2008
- 2.4 Total Primary Energy and Coal Supplies in the Region, by Country, 2005
- 2.5 Gas Imports by the European Union, 2008
- 3.1 Estimated Investment Requirements in Russia's Gas Sector, 2010–20
- 3.2 Projected Investment Needed in Generation, Transmission, and Distribution, by Subregion, 2006–30

-
- 3.3 Projected Energy Sector Investment Needed in the Region by 2030–35
 - 4.1 Potential Energy Efficiency Savings in the Russian Federation in 2030
 - 5.1 Policy Instruments for Addressing Adaptation to and Mitigation of Problems of Greenhouse Gas Emissions and Global Warming
 - 6.1 Total Projected Energy Sector Investment Needed in the Region by 2030–35, by Subsector
 - 6.2 Status of Regulatory Institutions in the Region, by November 2008 by Country
 - 6.3 Total Technical and Commercial Losses in CSE/CIS Economies
 - 6.4 Benefits and Shortcomings of Various Social Mitigation Schemes for Tariff Increases

Foreword

Before the current economic crisis hit the Europe and Central Asia (ECA) region in 2008, energy security was a major source of concern in Central and Eastern Europe and in many of the economies in the former Soviet Union. Energy importers were experiencing shortages leading to periodic brownouts and blackouts. An energy crisis seemed imminent.

The unexpected fall in economic activity due to the financial crisis staved off the energy crunch. But this is a temporary reprieve. As economic production begins to grow, the energy hungry economies in the region will again face shortages. This is especially true of ECA's energy importers, who will again be squeezed between their wealthier neighbors to the west and the big oil and gas suppliers in the east.

The countries in the region can avert this potential energy crunch. But given the long lead times associated with most energy investments they need to act now. In addition, they need to act responsibly. This involves pursuing environment-friendly options to manage demand. It involves creating an enabling environment to attract the large investments that are needed. The countries also need to cooperate at the regional level to optimize supply security and cost effectiveness.

This report analyzes the outlook for energy demand and supply in the region. It estimates the investment requirements and highlights

the potential environmental concerns associated with meeting future energy needs, including those related to climate change. The report also proposes the actions necessary to create an attractive environment for investment in cleaner energy. Greater regional cooperation for smart energy and climate action is an important part of the World Bank's engagement in Europe and Central Asia. I hope this report will promote a greater understanding of energy sector issues in the region and encourage actions that will improve the lives of people in and around the ECA region.

Philippe Le Houverou
Vice President
Europe and Central Asia Region

Acknowledgments

This report was put together by a team comprising John Besant-Jones, Henk Busz, Franz Gerner, Thomas Hogan, Ranjit Lamech, Arto Nuorkivi, Christian E. Petersen, John Strongman, Gary Stuggins, Claudia Vasquez, and Andrea Zanon. Peter Thomson and Indermit Gill directed and managed the team. Valuable contributions and comments were received from Jane Ebinger, Adriana Eftimie, Peter Johansen, Iftikhar Khalil, Kari Nyman, Dejan Ostojic, Robert P. Taylor, Alexandrina Platonova-Oquab, Pekka Salminen, Gevorg Sargsyan, Michael Stanley, and Bent Svensson. Outside comments from Fatih Birol (International Energy Agency [IEA]), Brendan Devlin (European Commission [EC]), Ann Eggington (IEA), Bernd Kalkum (Consultant), and Jefferey Piper (EC) are gratefully acknowledged. Richard Auty (University of Lancaster) and Marcelo Selowsky (ECA former chief economist) peer reviewed the report.

Rozena Serrano provided administrative support. Barbara Karni edited the book. The World Bank's Office of the Publisher coordinated the design, production, and printing of the book.

Overview

Summary

- Emerging Europe and Central Asia, the region made up of the countries of Central and Eastern Europe (CEE) and the Commonwealth of Independent States (CIS), is a major energy supplier to both Eastern and Western Europe. However, the outlook for both primary and derivative energy supplies is questionable, with a real prospect of a significant decline during the next two decades.
- Western Europe is heavily dependent on energy imports from this region. It will therefore be affected by declines in primary energy supplies. But Western Europe has the financial capacity to secure the energy supplies it needs (albeit at the expense of others). In contrast, the region's energy-importing countries are caught between Western Europe, which has increasing import needs, and the region's exporters, whose exports will likely decline. These countries face the prospect of being squeezed both financially and in terms of energy access.
- This difficult prospect is compounded by the deterioration of the region's energy infrastructure, including power generation and district heating. Although the public sector will have to finance a portion of these investments, it will not have the capacity to meet the full investment needs. It is therefore essential that countries in the region move quickly to put in place an enabling environment to support investment in the sector.

(continued)

Summary

(continued)

- Overlaying all of this are environmental concerns, in particular concern about climate change. Member states of the European Union (EU) and those with EU ambitions will need to meet the challenging EU greenhouse gas emissions targets. At the same time, a number of countries in the region will face the temptation to use environmentally unfriendly technology to meet their immediate energy needs.
- Policy responses need to emphasize demand-side management and the use of energy efficiency measures. The Russian Federation, as the region's major energy exporter, needs to direct additional resources to energy production over the longer term if export levels are to be maintained. Incentives need to be devised and implemented to encourage countries to avoid environmentally unfriendly solutions.

Following the break-up of the Soviet Union, the countries of Central and Southeastern Europe (CSE) and the Commonwealth of Independent States (CIS) experienced six years of dramatic economic decline, starting in 1990. The CEE/CIS region then stagnated for three years, through 1998 until, in 1999, a vigorous economic recovery began for the region as a whole, enabling it to become one of the most economically dynamic in the world. With the onset of the economic and financial crises in 2008, the region's economic performance experienced a sharp reversal, with economic declines that were among the largest in the world.

This economic performance was reflected in the region's energy sector. The initial economic decline was accompanied by a sharp reduction in the production and consumption of energy. Maintenance and upgrading of the stock of energy assets became an early investment casualty of the economic decline. As the region's economy recovered, both production and consumption increased. However, the deterioration in the asset base and the associated loss of both capacity and efficiency proved such that by the end of 2007, a number of countries in the region were experiencing periodic energy shortages, and a serious energy crunch appeared imminent.

The rapid rise in energy prices in 2008 followed by the onset of the financial and economic crises dampened demand significantly, creating some breathing room before energy availability again becomes a serious concern. But this is only a temporary respite. Energy prices have moderated, and the assumption in this report is that although significant price volatility will continue to be the norm, prices will average out at a level close to long-run marginal cost. In the case of oil, this is estimated to be \$60–\$70 a barrel in 2008 dollar terms.

TABLE 1

Average Annual Growth Projections for GDP, Electricity Consumption, and Primary Fuel Consumption in the Region, 2005–30

Item	Annual growth (percent)
GDP	4.4
Electricity consumption	3.1
Primary fuel consumption	1.9

Source: World Bank staff calculations.

Although the region has been hit hard by the crisis, focused efforts are being directed at mitigating the impact, with the objective of avoiding another “lost decade.” Nonetheless, the expectation is that the region as a whole will recover to the 2008 level of output only by 2013. There are reasonable prospects that, with policy reforms, the region as a whole can expect a resumption of long-term average economic growth of almost 5 percent a year after 2011. This translates into an average growth rate for the period 2005–30 of 4.4 percent a year. The assumption of a 4.4 percent growth rate results in an expected annual increase in electricity consumption of about 3.1 percent and an annual increase in primary fuel consumption of about 1.9 percent (table 1).

The Energy Supply Outlook

The region is a major energy supplier to both Eastern and Western Europe. But the outlook for increasing primary energy supplies is not promising, with a real prospect for a decline over the next 20–25 years. There is also the prospect of a shift in primary energy supplies. Concern about gas availability and a political push toward supplier diversification could increase both reliance on coal—more polluting but locally available—and resistance to shutting down aging nuclear reactors.

The demand for primary energy in the region is expected to increase by 50 percent over 2005 levels by 2030. The underlying resource base has the capacity to meet at least a portion of this increase, provided adequate funds are directed to the upstream sectors. However, in the case of oil, unless substantial new discoveries are made, the region’s oil production could peak in the next 10–15 years and then start to decline, although the decline could be delayed if investment in the Russian Federation were to increase significantly. For gas, unless Russia, the dominant producer, mobilizes the needed funding and technology to develop its known gas deposits and associated infrastructure, production is likely to plateau in the next 15–20 years. Increased investment could delay the onset of the production plateau (box 1).

BOX 1.**Proposed Russian Gas Exports to China**

On October 14, 2009, during Russian Prime Minister Vladimir Putin's visit to Beijing, Russia reportedly entered into an agreement with China for the future supply of 68 billion cubic meters a year of gas.

It will be interesting to see how Russia supplies these additional volumes. Just to maintain gas production levels in Russia, Gazprom would need to invest about \$15 billion a year. To meet potential increases in demand, capital investment would have to increase to \$20 billion a year. Between 2001 and 2008, however, Gazprom's capital investments for upstream gas exploration and development totaled about \$36 billion, according to Gazprom financial statements. Although capital spending increased between 2006 and 2008, it remains below the required level (\$8.6 billion was spent in 2008, according to Gazprom's financial statements).

In the absence of an increase in production, a reduction in domestic demand would free up additional supplies for export. Also, Russia has been purchasing gas from the Central Asian producers, primarily Turkmenistan.

Many of the countries in the region have domestic coal resources that can be developed. Exploitation of these resources, however, will conflict with growing concerns about greenhouse gas emissions and their impact on climate change. These concerns will limit the extent to which domestic coal will substitute for oil and gas in Member countries of the European Union (EU) and countries with EU membership aspirations, although some of these countries may increasingly turn to nuclear power as an alternative. Other countries, however, will be tempted to use environmentally unfriendly technology to meet their immediate energy needs.

If primary energy production is to be maintained or increased, significant investment will be required. The projected needs for primary energy development for 2010–30 are estimated at almost \$1.3 trillion. While these funds are expected to be available in Russia and other oil- and gas-producing countries in the region, they must be targeted to develop the necessary upstream production facilities, transportation infrastructure, and refinery capacity to meet Europe's primary energy requirements. Governments will have to transfer responsibilities for operation, maintenance, rehabilitation, and investment from state budgets to state-owned or private enterprises and facilitate their operation on commercial lines. Prices should be market based and aim at full cost recovery. Under these conditions,

internal cash flow would be adequate to support the required program of investment.

Without such targeted investments, primary energy supplies will decline. Western Europe, which is heavily dependent on energy imports from the region, will be affected by declines in primary energy supplies. But countries in Western Europe have the financial means to secure their energy needs, albeit at the expense of other countries. The CSE/CIS energy-importing countries will be squeezed between Western Europe, with its increasing import needs, and the region's exporters, whose exports will likely decline.

Compounding these difficulties is the region's deteriorating energy infrastructure, especially for power generation and district heating (box 2). The region's power infrastructure is in desperate need of upgrading. Electricity capacity in the region has barely increased since

BOX 2.

Business Concerns about Electricity Supply

The fourth World Bank/European Bank for Reconstruction and Development Business Environment and Enterprise Performance Survey (BEEPS)—conducted in 2008, before the onset of the financial and economic crises—shows that electricity supply is a major concern to businesses throughout the region. In Albania, for example, electricity supply is the top concern for businesses of all sizes and types. Widespread electricity supply disruptions over the past few years have prompted many businesses to invest in back-up diesel generators, which are expensive to operate and maintain. Their excessive use during blackouts contributes heavily to local air and noise pollution.

The 2008 survey shows a dramatic increase in concerns about electricity supply since the previous survey, conducted in 2005. In every country surveyed, the percentage of firms that considered electricity supply a problem rose, in many cases dramatically. The legacy of abundant electricity infrastructure that characterized the first decade and a half of transition had disappeared by 2008.

BOX TABLE

Percentage of Firms that Consider Electricity a Problem in Doing Business

Subregion	BEEPS 2005	BEEPS 2008
Europe and Central Asia Region	17	47
EU-10 (Central Europe)	11	41
Southeastern Europe	26	48
CIS North	9	58
CIS South	21	51

Source: World Bank and EBRD 2008.

the early 1990s, and plants are getting old. Most thermal plants, especially coal-fired plants, pollute well above EU standards, use fuel inefficiently, and operate unreliably (box 3). The deteriorating capacity has not yet become a full-blown crisis, because of the decline in demand during the 1990s and the current drop-off in demand related to the economic crisis. But construction lead times of several years mean that action is required now.

About \$1.5 trillion in investment is needed in the power sector over the next 20–25 years, and another \$500 billion is required for district heating. Total energy investment requirements in the region thus amount to almost \$3.3 trillion, or about 3 percent of cumulative GDP (table 2). This level of investment cannot be provided in the region by the public sector alone. Attracting private sector investors will require improving the investment climate to make it conducive to such investment.

BOX 3.

The 2006 Disaster in Alchevsk, Ukraine

Many Ukrainian families rely on district heating, and district heating accounts for a large share of energy consumption in Ukraine. But low tariffs have prevented district heating companies from making critically needed investments for maintenance and upgrading. About 70 percent of the Ukrainian district heating system is in need of renovation. This means that many systems are not only in financial trouble but also at high risk for outages and technical failures.

On January 22, 2006, the worst-case scenario was dramatically demonstrated when the district heating system in Alchevsk, a town of 120,000 people in southeastern Ukraine, collapsed. The winter was very cold, with temperatures dropping to -30°C . When a boiler failure was not repaired quickly, the main district heating pipes froze and the system collapsed within several hours. The damage was extensive—almost all the pipes were damaged—and there was little room for substituting alternative energy sources. As a result, hundreds of buildings, including schools and hospitals, were cut off from the heating system and left to rely on individual electric heaters.

The vulnerable population—about 4,500 children and elderly people—was evacuated to southern Ukraine, where they were put up in hotels and other facilities. Until the spring, the city of Alchevsk was largely deserted, with only a few residential areas and businesses able to function. The entire system had to be replaced, at significant expense to the government, in a nationally declared emergency.

TABLE 2

Projected Energy Sector Investment Needed in the Region by 2030–35*(billions of dollars)*

Sector	Investment required
Crude oil	900
Refining	20
Gas	230
Coal	150
Electricity	1,500
Heating	500
Total	3,300

Source: World Bank staff calculations.**The Outlook for Regional Cooperation**

Regional cooperation on electricity production and gas transport is needed to boost supply security and cut costs. The driving factors are the large mismatches between supply and demand between countries and the uneven concentration of resources, especially the focus on supply from Russia. Committing to international trade offers substantial potential for confronting the region's huge needs for investing in new capacity. It enables interconnected power systems to work as one larger system, capturing economies of scale with joint planning and implementation for capacity additions and coordinated dispatch of generating plants. A major issue for electricity trade is dealing with the risks for investments in new supply capacity and the risks for supply security. Most countries in the region have yet to develop the institutional arrangements to manage such risks.

In Southeastern Europe, for example, countries that plan to rely on gas-fired power-generating capacity must be confident that other countries will also follow this regional priority, rather than pursue self-sufficiency in generating capacity through non gas sources. Otherwise, the base load will not be sufficient to justify the large investments required in gas transmission systems. But many countries have announced plans to build new generating capacity without a gas-fired component—not a promising development for gas supply infrastructure in the subregion. Such large regional commitments require that gas supplies be assured, something that is uncertain in both the near and long terms.

Central Asia has considerable potential for exporting electricity—within its boundaries and beyond—but the prospects for realizing this potential are uncertain, because of the long history of distrust among countries and their lack of institutional and financial capacity. Water and hydropower politics are deeply intertwined. Irrigation water is needed in the summer; electricity is needed more in the winter.

The Central Asian Regional Economic Cooperation (CAREC) is helping coordinate matters. Two changes are needed for success: regional cooperation and government willingness to create a business climate that attracts the huge investments required. These conditions are vital for ensuring adherence to contract commitments (including payments), stopping side deals that undermine investment viability, and countering the prevailing nonperformance of obligations.

The Outlook for Reducing Waste

The countries in the region waste too much energy in production and transmission, especially through gas flaring and venting. Some flaring and venting is needed to ensure safe operation. But most associated gas is flared and vented because there is no infrastructure or market to use the gas, leaving it stranded. And because of the relative demand for oil and gas, operators have little incentive to delay oil production to find uses for the associated gas.

Russia is the largest gas flarer in the world, flaring and venting 55 billion cubic meters of associated gas in 2005, according to estimates by the World Bank Global Gas Flaring Reduction public-private partnership (box 4). During the same period, Kazakhstan flared and

BOX 4.

Reducing Waste in Russia

Satellite images of the earth at night are sometimes used to map the world's economic geography. The lights identify human settlements, illuminating the parts of the world where wealth is concentrated. Satellites over Russia can also identify waste. Gas flaring shows up as brightly lit areas in sparsely populated parts of the country.

One of these parts is near Gubkinsky City, in the Yamal-Nenets Autonomous District in Western Siberia, where the Associated Gas Recovery Project for the Komsomolskoye Oil Field processes gas that would otherwise be flared at the Komsomolskoye oil field. With revenues provided by the Carbon Fund for Europe, the Danish Carbon Fund, the Italian Carbon Fund, and the Spanish Carbon Fund, the project developer will be able to implement a technical solution that allows full utilization of the previously flared gas.

One of the first joint implementation projects in Russia aimed at reducing gas flaring, the project is expected to deliver emission reductions of 6.6 million tons of carbon dioxide equivalent between 2010 and 2012. The four funds will purchase 5.3 MtCO₂e reductions. The project is also expected to deliver about 2 billion cubic meters a year of consumer-grade dry gas to Gazprom plus about 23,000 tons of petroleum liquids.

Source: World Bank 2008a.

vented 8.8 billion cubic meters, putting it fifth worldwide. Azerbaijan, Turkmenistan, and Uzbekistan together flared and vented 7 billion cubic meters of associated gas. Piped natural gas trades at \$150 to more than \$300 per thousand cubic meters, putting the annual value of the region's gas flared and vented at \$10–\$20 billion. The region's 70 billion cubic meters a year of wasted gas could provide feedstock for 70 gigawatts of combined-cycle gas turbine plants. In 2006, gas flares in the five countries alone contributed 165 million tons of carbon dioxide equivalents (MtCO₂e) into the atmosphere. During the same period, they vented 88 MtCO₂e, for a total of 253 MtCO₂e in emissions.

Gas is lost not only during production in fields such as Komsomolskoye. Technical and commercial gas transmission and distribution losses are also high. In Russia, for example, the International Energy Agency estimated in 2005 that 3 percent (or 5.3 billion cubic meters) of the gas distributed through medium- and low-pressure pipelines is leaked into the atmosphere, equivalent to 80 MtCO₂e.

These losses cost money and harm the environment. To reduce gas flaring and leakages, governments of oil- and gas-exporting countries can take the following steps:

- Provide guidelines and incentives to state-owned and private companies to capture unused gas that would otherwise be flared, prevent and repair gas pipeline and oil storage leakages, and reduce gas losses through theft and inadequate or absent metering.
- Open oil and gas pipelines to independent producers, including to associated gas from oil producers.

The Outlook for Energy Efficiency

Investing in energy efficiency achieves three goals simultaneously and at least cost: it reduces greenhouse gas emissions, improves energy security, and contributes to more sustainable economic growth. Energy efficiency is thus a triple win for governments, end users, market participants (public and private), and society in general. An additional \$1 invested in energy efficiency may avoid more than \$2 in supply-side investment. Energy efficiency should therefore be considered as an energy resource, on a par with—and even preferred to—supply-side resources. Much potential remains untapped because of the many obstacles to investments in energy efficiency: inadequate energy prices and lack of payment discipline, insufficient information on suitable technologies, too few contractors and service companies, and financing constraints.

Governments have a major role to play in energy efficiency (box 5). Of course, they must allow energy tariffs to reflect costs. But they must also be proactive in setting and updating energy efficiency standards for homes, equipment, and vehicles—and in enforcing them. Few consumers will take action on energy efficiency on their own; the issue is not significant enough to them. Equipment choices should therefore be limited to equipment with optimal energy efficiency characteristics. To set an example, governments should undertake energy efficiency programs in the public sector, disseminating the results through long-term information campaigns. Doing so would stimulate consumer interest and help develop an energy efficiency industry. Designing cities with alternative means of transportation in mind is another important way for governments to raise energy efficiency.

BOX 5.

Improving Energy Efficiency in Belarus

Belarus relies heavily on the import of primary energy resources, and it imports some electricity. Russia is the main source of these energy imports. In an effort to reduce its dependence on imported energy, the government of Belarus has placed high priority on increasing energy efficiency. Its role in designing and enforcing a comprehensive policy on energy efficiency is one of the main reasons behind the remarkable reduction in the amount of energy consumed per unit of production.

Energy intensity in Belarus decreased by almost 50 percent between 1996 and 2008. The main elements of this success story include the following:

- Establishing energy efficiency institutions with a clear mandate. A Committee for Energy Efficiency was established in 1993 with a mandate to develop and implement the energy efficiency improvement strategy. This committee evolved into the Energy Efficiency Department of the Committee of Standardization, which has pursued a number of countrywide educational campaigns, including awareness raising through television, radio, print media, and special courses for state officials, decision makers, and students.
- Allocating adequate financial resources to implement energy efficiency measures. The financing of energy efficiency measures increased from \$47.7 million in 1996 to \$1,213.9 million in 2008. Over this period, total investments in energy efficiency amounted to about \$4.2 billion.
- Continuing political commitment on the part of the government. The first national energy efficiency program—the National Program for Energy Savings to Year 2000—was approved in 1996. The second national energy efficiency program, for 2001–06, was approved in 2001; the third, for 2006–10, was approved in 2006. The Law on Energy Savings was introduced in 1998.

Globally, the technical potential for better energy efficiency through 2030 is greatest in construction (30 percent reduction), followed by industry (21 percent) and transport (17 percent). Reliable estimates for the region are not yet available, but given the region's generally poor record on energy efficiency, its potential is believed to be much higher. Modernizing district heating networks on densely built areas, rehabilitating combined heat and power plants, and building new plants would reduce total primary energy consumption by 17 percent, or 860 MtCO₂e, by 2030.

Commercial banks are ideal vehicles for energy efficiency financing, but banks in the region have shown limited interest in this line of business. The experience of several member countries of the Organisation for Economic Co-operation and Development (OECD) shows that a dedicated energy efficiency fund is essential, both as an originator of bankable projects and as a lender of last resort. Energy service companies specializing in implementing energy efficiency projects are a good solution for large energy consumers (the public sector, industry, and pooled residential projects), but they require sophisticated clients and a good legal and contractual framework. There is a broad range of business models for energy service companies; countries should assess which have the most potential for their market.

Utility demand-side management programs have worked well in some OECD countries where the regulatory framework provides the proper incentives. Together with integrated resource planning and electronic markets, utility demand-side management deserves a new look. It is one of the quickest and most effective ways to boost energy efficiency, especially in reaching small consumers with standard solutions—say, through efficient lighting and appliance replacement programs.

The Outlook for Addressing Climate Change

Although consensus is not complete, many signs point to accelerating global climate change. The impact could be severe, even with immediate and drastic measures to abate emissions.

Greenhouse gas emissions in the Europe and Central Asia region fell during the 1990s, as economic production declined. But with economic recovery in the 2000s, emissions rose again until the economic crisis of 2008. The current slowdown in economic activity will provide only temporary respite. Carbon emissions in the region relative to GDP are among the highest in the world. In 2005 Russia was the

third-largest CO₂ emitter in the world, after the United States and China. The region's EU members—despite their reliance on domestic coal—have already started tackling climate change, improving energy efficiency, developing renewable energy technologies, and tapping into carbon finance. Other countries in the region will face increasing pressure to catch up—and quickly.

There is a disconnect between global efforts to reduce carbon emissions and the region's national energy strategies for the next 20 years. The region's policymakers and businesses will have to rethink these strategies and engage seriously in global efforts. Demands for carbon reductions will only intensify. The countries of the region must do their share, but transitioning to a low-carbon economy can be costly. By tapping into carbon finance, countries in the region can reduce their carbon footprint and attract critical capital to rebuild their energy infrastructure and industrial base using efficient and cleaner technologies.

The Kyoto Protocol and the development of the carbon trading market have created instruments to leverage investments in greenhouse gas reductions: project-based carbon financing, the cap-and-trade EU Energy Trading Scheme, the International Emission Trading scheme, and trading of assigned amount units (rights to emit). All could provide big opportunities for countries in the region. Governments should ensure that national policies and legislation facilitate these instruments, foster rapid technological modernization, and spur a revolution toward energy efficiency. In addition, carbon taxes and standards-setting can create incentives for corporations and consumers to change (box 6).

Putting a price on carbon emission makes alternative energy sources viable. The region's large contribution to global warming reflects its high energy and high carbon intensity. The causes? Outmoded generation technology and reliance on coal. Fuel switching means replacing high-carbon fuels with low-carbon fuels. Energy efficiency measures for buildings, transportation, heating, cooling, lighting systems, and so on pay off no matter what the carbon price is. The cost of alternative energy—wind, solar, biomass, and geothermal—is falling. The switch is already taking place in Central and Eastern Europe, where the joint implementation provisions of the Kyoto Protocol have catalyzed renewable energy projects. In general terms, though, the region's renewable energy development is underfunded, and several governments remain unpersuaded of the profitability of renewable energy projects or the environmental benefit deriving from such projects.

BOX 6.**Climate Action in Turkey's Landfills**

Not long ago, visitors driving into Turkey's capital city of Ankara from the airport were assaulted by a horrible smell from the decomposing waste at the Mamak landfill alongside the highway. The residues caused environmental and social problems, including air pollution and health risks.

With financing support from the World Bank through the Industrial Development Bank of Turkey (TSKB), the landfill was converted into a garbage-recycling station that creates heat and energy for local greenhouses. A biodigester at the facility treats organic waste and produces biogas. Gas from a landfill gas recovery system and from the biodigester is then used to generate power and heat in a power plant with 14.6 MW of capacity—enough to power 31,000 households in Turkey. Recyclable waste such as glass and plastics are processed and sold. What remains is less than 10 percent of the incoming waste mass, which is placed back in landfills. The landfill, now covered with soil, is being reforested. The excess heat generated by power generation and waste processing is fed to a greenhouse in which tomatoes are grown. Heat will also be provided to a new café on the site.

People living in the area have experienced a big improvement in the quality of life. The rehabilitated landfill no longer poses a health hazard; it has become a generator of both power and local jobs. The project also contributes to the global imperative of climate action by reducing methane gas and carbon dioxide emissions and producing renewable energy.

The Outlook With Higher Energy Prices

Energy prices have been subject to significant volatility over the past several years. Overall, however, the oil- and gas-producing countries in the region have enjoyed the benefits of prices above historic averages (in constant dollar terms). The downside to this, however, is that many resource-rich economies have suffered from a “resource curse” that includes oil price volatility, Dutch disease, deterioration of political systems and state institutions, and underinvestment in human capital. The evidence suggests an adverse impact of resource abundance on long-term growth, but prudent fiscal policies and progressive institutional mechanisms may have provided some protection to producing countries in the region, so far. Wise management of oil revenues requires sustainable public spending to preserve intergenerational equity and macroeconomic stability. A well-functioning and transparent governance framework covering the entire value chain is central to sustaining oil prosperity.

Although rising incomes dramatically reduced poverty in the last decade, inequality is growing in the region, and the current economic and financial crises, coupled with higher energy and food prices, have increased the risk of poverty and vulnerability (box 7). Utility access, quality, and affordability have improved since the 1990s, particularly

BOX 7.

The Potential Impact of Higher Energy Prices

Establishing cost-recovery tariffs is key to ensuring the financial viability of energy enterprises. However, it can also generate adverse consequences. For example, as residential tariffs are increased to cost-recovery levels, households, particularly in low-income groups, may switch to cheaper traditional fuels, such as wood, peat, and coal, which contribute to indoor and outdoor air pollution. Although there are no comprehensive data on household emissions, survey evidence indicates that in the wake of higher prices, households do substitute fuels if an effective social protection system is not in place.

Armenia

A survey undertaken in Armenia in the early 2000s (World Bank 2007a) showed that 80 percent of households and 95 percent of poor households reported using alternative fuel sources (primarily wood) in response to rising energy prices. The increased reliance on wood was particularly acute among the urban poor. When asked if they made an effort to reduce their reliance on electricity over the previous 12 months, about 65 percent of the poor and 54 percent of the non-poor said they had, with the effort highest among the rural poor (71 percent). Although the inefficient practice of heating with electricity has declined, increased wood consumption has created potential environmental problems, such as deforestation and increased air pollution.

Turkey

In the 1980s, natural gas began being supplied to Ankara, reducing pollution in the city. In contrast, Istanbul remained dependent on lignite for heat and thermal power generation. The city was classified by the British Foreign Office as the second most polluted duty station for British diplomats (Mexico City was the most polluted).

With the introduction of natural gas to Istanbul, the city dropped in rank. In recent years, however, as natural gas prices have increased, the use of lignite has started to increase and pollution levels have risen.

in electricity and gas coverage in low-income countries—but these gains are now at risk, particularly if countries elect not to invest in critically needed maintenance activities. Many households continue to use dirty fuels, because coverage and reliability problems persist. Fuel prices need to be set at market levels if investment is to take place, but raising them may push energy prices out of the reach of the poor and vulnerable. Lifeline tariffs, burden limits, and earmarked and non earmarked cash transfers have all proven effective in aiding the poor. In addition to these social protection instruments, governments in the region should bring their legislation, regulations, procedures, and practices in line with good international practices of social mitigation.

The Outlook for a Better Investment Climate

The total projected energy sector investment requirements for the region over the next 20–25 years are huge—about \$3.3 trillion in 2008 dollars, or some 3 percent of accumulated GDP over the period. Although the public sector in these countries will clearly have to finance a portion of these investments, it will not have the capacity to meet the full investment needs. The countries in the region will therefore need to call on the financial depth and technical know-how of private sector investors and energy companies. Although the current financial crisis is a serious impediment to private sector investment in any activities or countries seen as high risk, as the financial crisis passes, the prospects for such investment will improve. However, in order to attract these investors, countries will need to create enabling environments that provide secure ownership rights, are subject to the rule of law, foster transparency, and enable reasonable risk mitigation. In addition, individual sectors will have to be viewed as financially and commercially viable. This will be particularly critical in those sectors, such as electricity and heat, that are largely dependent on their domestic markets (box 8).

In order to create an attractive environment for investment, countries will need to adhere to 10 key principles (box 9). Although these principles are not equally important, all have significant bearing on perceptions of the overall climate for investment. Government actions that are consistent with these principles will go a long way toward creating an attractive and competitive investment climate in the energy sector.

BOX 8.**Addressing Payment Discipline in the Electricity Sector**

One of the key challenges for utility companies operating in the region, particularly in the former Soviet republics, has been finding ways to improve payment discipline. The following are anecdotal examples of some of the approaches that have been taken.

Tractabel in Kazakhstan

In the mid-1990s, Tractabel acquired the electricity distribution assets in Almaty, Kazakhstan. In the first six months of operation, the company succeeded in increasing payment levels from less than 30 percent to more than 90 percent, through a ruthless approach to cutting off supply for nonpayment that included cutting off the Ministry of Finance in the middle of a presentation by the minister to potential foreign investors. Tractabel also reportedly became the most unpopular company in Kazakhstan. It subsequently had difficulties in agreeing to the interpretation of the contractual tariff policy. The company's involvement in Kazakhstan was ultimately resolved when the government agreed to buy back the assets.

AES in Georgia

In the late 1990s, AES acquired the Telasi distribution company (covering Tbilisi) and the Gardabani power plant in Georgia. The company had enormous difficulties enforcing payment discipline. At one point, after bills had not been paid for electricity supplied to the presidential palace, AES threatened to cut off supply right before a scheduled visit of a senior European dignitary. The presidential administration pleaded with AES not to cut off supply, and AES accommodated the request. However, the bill remained unpaid, and AES again threatened to cut off supplies. This time the plea was to hold off pending the visit of James Wolfensohn, then president of the World Bank. This time AES was not accommodating. The bill was paid the next day. AES eventually sold out to RAO UES of Russia, which has also struggled with payments.

USAID in Georgia

USAID funded a management contract for the distribution operations of United Energy Distribution Company (UDC) in Georgia. The contract was assigned to PA Consulting, which established meter connections to villages and small towns and then advised local leaders and residents that it was their collective responsibility to make their payments. If payments were made on time, UDC promised 24/7 supply. The approach proved to be very effective, paving the way for UDC privatization to the Czech company CEZ.

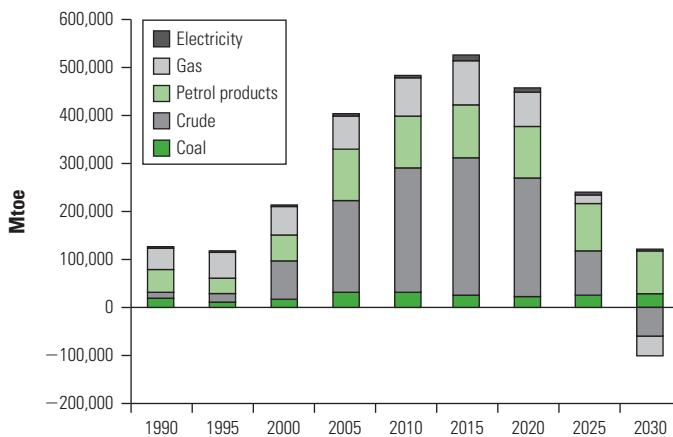
BOX 9.**Seven Do's and Three Don'ts for Creating a Better Investment Climate**

1. Don't impose a punitive or regressive tax regime.
2. Do introduce an acceptable legal framework.
3. Do provide supporting regulations administered by an independent and impartial regulator.
4. Do create an environment that facilitates assured nondiscriminatory access to markets.
5. Don't interfere with the functioning of the market place.
6. Don't discriminate among investors.
7. Do honor internationally accepted standards.
8. Do abide by contractual undertakings and preclude the use of an administrative bureaucracy to constrain investor activities.
9. Do prevent monopoly abuses.
10. Do ensure that the sector is kept free of corruption.

Given the long lead times required to implement projects in the energy sector, countries need to position themselves to secure funding support for such progress as quickly as they can. Failure to introduce an enabling environment to support investment in the sector will translate into a shortfall in investment that, in turn, could constrain economic activity. A 10 percent shortfall in energy availability could lead to a 1 percent reduction in economic growth; a larger shortfall could have even more detrimental impacts. Time is of the essence.

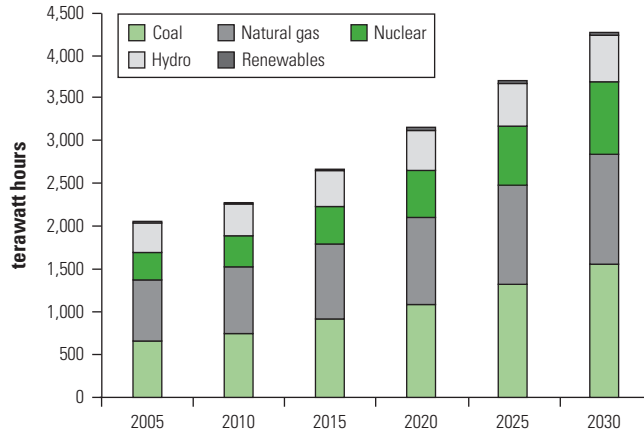
Appendix

Actual and Projected Net Energy Exports by Europe and Central Asia, by Type, 1990–2030



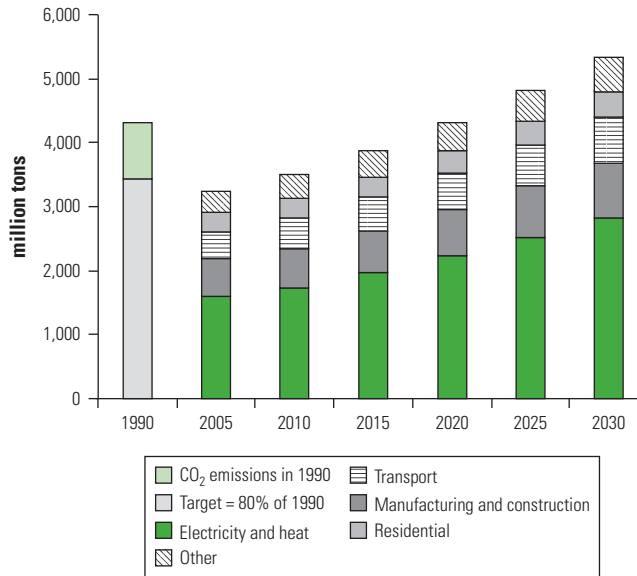
Source: Data for 1990–2005 are from IEA 2008a and 2008b; data for 2010–2030 are World Bank staff projections.

Actual and Projected Electricity Production, 2005–30, by Energy Source



Source: Data for 2005 are from IEA 2008a and 2008b; data for 2010–2030 are World Bank staff projections.

Actual and Projected CO₂ Emissions by Europe and Central Asia, 1990–2030, by Sector



Source: Data for 1990–2005 are from IEA 2007b; data for 2010–30 are World Bank staff projections.

Gas Reserves and Production, by Country, 2008

Country	Reserves (trillion cubic meters)	Production (billion cubic meters)	Consumption (billion cubic meters)	Reserves-to- production ratio	Reserves-to- consumption ratio
Russian Federation	43.3	601.7	420.2	72	>100
Turkmenistan	7.9	66.1	19.0	>100	>100
Kazakhstan	1.8	30.2	20.6	60	95
Uzbekistan	1.6	62.2	48.7	26	33
Azerbaijan	1.2	14.7	9.3	82	>100
Ukraine	0.9	18.7	59.7	48	15
Romania	0.6	11.5	14.5	52	41

Source: BP 2009.

Oil Reserves, Production, and Consumption in Azerbaijan, Kazakhstan, and the Russian Federation, 2008

(million tons, except where otherwise indicated)

Country	Reserves	Production	Consumption	Reserves-to- production ratio	Reserves-to- consumption ratio
Azerbaijan	1,000	44.7	3.3	22	>100
Kazakhstan	5,300	72.0	10.9	74	>100
Russian Federation	10,800	488.5	130.4	22	83
Total	17,100	605.2	144.6	28	>100

Source: BP 2009.

Total Primary Energy and Coal Supplies in the Region, by Country, 2005

Country	Total primary energy supply (Mtoe)	Coal supply (Mtoe)	Coal supply as percentage of primary energy supply	Coal consumption as percentage of total fuel consumption for heat and power	Coal consumption for heat and power as percentage of total coal supply
Russian Federation	647	103	16	22	74
Central Europe	203	85	42	65	71
Poland	93	55	59	94	73
Czech Republic	45	20	45	62	71
Caspian Sea and Central Asia	136	29	21	38	65
Kazakhstan	52	28	53	83	65
Black Sea	264	60	23	20	37
Ukraine	143	37	26	19	34
Turkey	85	22	26	36	43
Southeastern Europe	101	31	30	53	79
Romania	38	9	23	42	68
Bulgaria	20	7	35	47	82
Serbia	17	9	52	79	84
Total	1,351	309	23	31	66

Source: IEA 2008a and 2008b.

Four easy ways to order

Online:

www.worldbank.org/publications

Fax:

+1-703-661-1501

Phone:

+1-703-661-1580 or
1-800-645-7247

Mail:

P.O. Box 960
Herndon, VA 20172-0960, USA

PRODUCT	STOCK #	PRICE	QTY	SUBTOTAL
Lights Out? : The Outlook for the Energy Sector in Eastern Europe and the Former Soviet Union (ISBN 978-0-8213-8296-7)	18296	US\$35		
				Subtotal
				Geographic discount*
				Shipping and Handling**
				Total US\$

* *Geographic discounts apply – depending on ship-to country. See <http://publications.worldbank.org/discounts>*

** *Within the US, charges on prepaid orders are \$8 per order, plus \$1 per item. Institutional customers using a purchase order will be charged actual shipping costs. Outside of the US, customers have the option to choose between nontrackable airmail delivery (US\$7 per order plus US\$6 per item) and trackable couriered airmail delivery (US\$16.50 per order plus US\$8 per item). Nontrackable delivery may take 4-6 weeks; trackable delivery takes about 2 weeks.*

MAILING ADDRESS

Name _____

Organization _____

Address _____

City _____

State _____ Zip _____

Country _____

Phone _____

Fax _____

Email _____

METHOD OF PAYMENT

Charge my

Visa Mastercard American Express

Credit card number _____

Expiration date _____

Name _____

Signature _____

Enclosed is my check in US\$ drawn on a U.S. bank and made payable to the World Bank

Customers outside the United States

Contact your local distributor for information on prices in local currency and payment terms

<http://publications.worldbank.org/booksellers>

THANK YOU FOR YOUR ORDER!



WORLD BANK
Publications

The reference of choice on development

Emerging Europe and Central Asia, the region made up of the countries of Central and South East Europe (CSE) and the Commonwealth of Independent States (CIS), is a major energy supplier to both Eastern and Western Europe. However, the outlook for both primary and derivative energy supplies is questionable, with a real prospect that there will be a significant decline during the next two decades.

Western Europe is heavily dependent on energy imports from this region and therefore will be affected by declines in primary energy supplies. But Western Europe has the financial capacity to secure the energy supplies it needs (albeit at the expense of others). In contrast, the region's energy-importing countries are caught between Western Europe, which has increasing import needs, and its own exporters, whose exports will likely decline. These countries face the prospect of being squeezed not only financially but also in terms of energy access.

This difficult prospect is compounded by the deterioration of the energy infrastructure, including power generation and district heating. Although the public sector will have to finance a portion of these infrastructure investments, it will not have the capacity to meet the full needs. It is essential, therefore, that the countries in the region move quickly to put in place an enabling environment to support investment in the sector.

Further complicating these issues are environmental concerns, in particular concern about climate change. EU member states and those with EU ambitions will need to meet the challenging EU greenhouse gas emissions targets. At the same time, a number of countries in the region will face the temptation to use environmentally unfriendly technology to meet their immediate energy needs. *Lights Out?* analyzes key measures that can help countries address all of these challenges.





This report is part of a series undertaken by the Europe and Central Asia Region of the World Bank. Earlier reports have investigated poverty, jobs, trade, migration, demography, and productivity growth. The series covers the following countries:

- | | |
|------------------------|--------------------|
| Albania | Latvia |
| Armenia | Lithuania |
| Azerbaijan | Moldova |
| Belarus | Montenegro |
| Bosnia and Herzegovina | Poland |
| Bulgaria | Romania |
| Croatia | Russian Federation |
| Czech Republic | Serbia |
| Estonia | Slovak Republic |
| FYR Macedonia | Slovenia |
| Georgia | Tajikistan |
| Hungary | Turkey |
| Kazakhstan | Turkmenistan |
| Kosovo | Ukraine |
| Kyrgyz Republic | Uzbekistan |