Chapter Three
Effective policies to induce mitigation

Effective policy is essential to facilitate the implementation of economy-wide emission reductions. "Marginal abatement cost" curves, which rank emission-reduction opportunities in increasing order of costs, can be used to analyse the impacts of general economic and specific climate change-targeted policies, and measures on the commercial viability of emission-reduction opportunities.
Chapter 3 demonstrates how a portfolio of policies – energy pricing, improvements in the business environment, support mechanisms for renewable energy and carbon trading – can turn carbon abatement into a major investment opportunity in Russia and Turkey.

3

Effective policies to induce mitigation

Introduction

The carbon performance of a country is determined to varying degrees by its economic structure, geography, and its level of economic activity (see Chapter 1). However, carbon performance is also a function of policy. A mix of effective policies encourages carbon and energy efficiency, and can make low-cost emission-reduction investments commercially attractive to those who undertake and pay for them.

This chapter explores what policies are needed to make the emission-reduction trajectories of Chapter 2 a reality. The concept of marginal abatement cost (MAC) is used to demonstrate how the costs and profits of investments in carbon-abating projects are sensitive to policy choices. The results show what policies make a particular difference to investors. This is the case not just for targeted climate policies, such as carbon taxes, energy-efficiency standards or emissions trading schemes, but also for the broader economic policy context.

The analysis is applied in detail to Russia and Turkey. Both countries have unique emission-reduction challenges, which are arguably among the most testing in the EBRD region.[1] Yet the lessons that can be learned from these countries are relevant for the transition region as a whole. The historical emission trends in Russia are typical for former Soviet Union countries, where both energy use and carbon emissions rose fast in the 1980s, dropped sharply after the collapse of central planning and have recovered slowly over the past 10 years. In contrast, Turkey's energy use and greenhouse emissions have risen steadily over the last two decades. Even so, Turkey is much more carbon efficient than the former Soviet countries and is ahead of many transition countries in terms of pricing energy at cost-recovery levels.

Climate policies and outcomes

The debate on domestic carbon policies typically focuses on targeted climate policy instruments, such as economic incentives (including taxes, subsidies, cap-and-trade systems and tradeable green certificates) and administrative instruments (such as energy or emission-performance standards, products or process requirements) or their softer versions (such as energy-performance labelling or building certificates).[2] In a similar vein, the Stern review identifies three essential elements of climate change policy.[3] These include:

- carbon pricing (through taxes, trading or regulation)
- technology policy (e.g. research and development, demonstration, and market support to drive innovation)
- policies to remove barriers to behavioural change, particularly in relation to the take-up of opportunities for energy efficiency, changing preferences and entrenched behaviour.

However, there is a growing realisation that climate policies need to be integrated into broad development and economic policies. A sound macroeconomic environment can reduce country risk perceptions and reduce the financing costs for climate mitigation investments. Policies that reduce or eliminate subsidies to fossil fuels and energy-intensive economic activities will at the same time increase the opportunities for, and returns to, climate-mitigation activities.

Instead of pursuing a narrow policy goal of reducing emissions, policy integration offers opportunities to embed climate objectives into the aims of specific sectors that reflect the core objectives of a society, such as energy security or the quality of infrastructure services.

Policy integration has played a significant role in the success of the transition economies in meeting their Kyoto targets. As shown in chapter 1, making markets and prices work in formerly centrally planned economies has triggered massive economic restructuring and general improvements in efficiency. These have resulted in a partial decoupling of economic growth from carbon emissions.

Liberalised energy prices formed in competitive markets and cost-recovery tariffs for regulated energy services can improve the fundamentals for sustainable growth and provide incentives to use less energy and improve service quality. Conversely, persistent energy price subsidies make otherwise economically sound investments unattractive to investors. A poor business environment, resulting in steeper risk premiums and higher capital costs, can have a similar effect. This can offset the intended impacts of dedicated low-carbon policies, such as feed-in tariffs, carbon taxes and energy-efficiency regulations.

International policy instruments can financially enhance the effectiveness of national climate-friendly policies. Under the UN Framework Convention on Climate Change (UNFCC), finance may flow into countries through the flexible (carbon-finance) mechanisms of the Kyoto Protocol – Joint Implementation (JI), the Clean Development Mechanism (CDM) and International Emissions Trading. The transition region has so far exploited only a fraction of its potential for carbon-finance transactions. Public climate finance – distributed through bilateral or multilateral mechanisms – is available for technical assistance or less commercial activities.

Monitoring sustainable energy progress

The EBRD's Index of Sustainable Energy (ISE), introduced in 2008 and updated in 2010,[4] is a composite index of institutions, market incentives and outcomes relating to sustainable energy. The index tracks how targeted policies and generic reforms combine to achieve environmental outcomes.

[1] The specific features of Russia include its reliance on export of energy resources, vast territory with massive transport needs or harsh and diverse climatic conditions.
[2] OECD (2009).
[3] Stern (2007).
[4] For more details on the methodology and structure of the ISE, see www.ebrd.com/pages/research/publications/brochures/securing.shtml

Box 3.1 The Index of Sustainable Energy

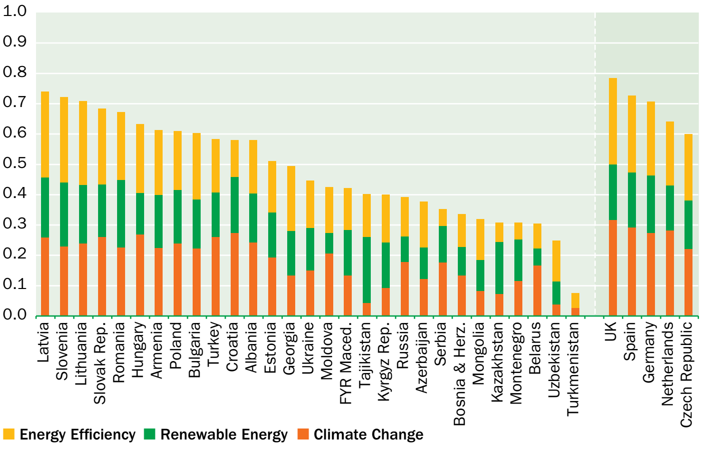
The Index of Sustainable Energy (ISE) rests on three pillars – institutions, market incentives and outcomes. These are applied to the three main areas of sustainable energy: energy efficiency (EE), renewable energy (RE) and climate change (CC). EE and RE refer to the energy use and energy supply in the economy. CC refers to climate-specific institutions and mechanisms, including international commitments to reduce country emissions, carbon-related taxes and emissions trading scheme, and the domestic institutions focused on climate policy. Each area is given equal weight in scoring.

Institutions – this metric captures the development of key institutions that enable and foster sustainable energy investment. Four main components of the institutional set-up are considered: laws (specific laws related to EE, RE and CC); agencies (their existence and assessment of their quality and functions); policies (their existence, extent, targets and sectoral regulations); and projects – the track record of sustainable energy and climate change project implementation in the country (implementation capacity).

Market incentives – this measure tracks pricing and other mechanisms that encourage energy savings, renewable energy generation and reductions in greenhouse gas emissions. Its main components are energy pricing (cost-reflective energy tariffs are a key driver of rational energy use); enforcement and waste (collection rates of electricity bills and transmission and distribution losses in the electricity system); renewable support mechanisms (tradeable certificate schemes and feed-in tariffs); and carbon taxes and emissions trading (cap-and-trade mechanisms and market-based carbon finance such as the Joint Implementation and the Clean Development Mechanism).[5]

Outcomes – measures of sustainable energy outcomes provide an indication of each country's room for improvement. The key measures are energy intensity, carbon intensity of GDP and carbon emissions per capita. Each is compared against world-leading countries and internationally accepted benchmarks.[6]

Chart 3.1
ISE scores across the transition region and relevant comparator countries



Source: EBRD.
Note: The data used for the index is the most recent available for each class of information: for institutions as of mid-2010, for energy use 2008 and carbon emissions 2007. The indicator ranges from 0 to 1. A value of 0 is the lowest in terms of sustainable energy (absence of institutions and market mechanisms coupled with the worst outcomes in terms of energy efficiency, renewable electricity generation, carbon footprint and carbon intensity). A maximum score of 1 denotes an ideal economy with strong sustainable energy institutions and market mechanisms, and which also ranks top in sustainable energy outcomes.

In so doing, it provides a snapshot of where each country stands in terms of institutions and market incentives, and the potential for improvements in sustainable energy outcomes compared with best practice (Box 3.1).

There is considerable variation in progress towards sustainable energy among countries in the transition region, but all EBRD and comparator countries have room for improvement.

The new EU member countries tend to score the highest within the EBRD region, reflecting institutional and policy reforms undertaken in the context of EU accession. Croatia and Turkey follow closely. Countries in the Eastern Europe and the Caucasus (EEC) region rank in the middle of the distribution, with higher scores in Armenia and Georgia. The weakest performers are the countries of the South Eastern Europe region (SEE) and the energy-rich countries of the former Soviet Union. Lastly, but equally importantly, the comparator-advanced EU countries score better on average than the new EU member states, but the gap between them and the advanced EBRD countries is much smaller than the gap between the most and least advanced of the EBRD countries.

The scores in energy efficiency and climate change are broadly comparable for the more advanced new EU member states. This is not surprising, as it reflects a better institutional setup, good market incentives and adoption of EU-wide policies. The comparator countries in western Europe are significantly more advanced than the EBRD countries in both energy efficiency and climate change. Outcome indicators in climate change – carbon intensity of GDP and carbon emissions per capita – are relatively poor in the transition region, but comparable with and often better than in the advanced EU countries, where high per-capita carbon footprints are the norm (see Chapter 1).

ISE scores for renewable energy are relatively low across all countries, including the comparator EU countries. Although the institutional setup is advanced in most EU countries, renewable energy outcomes are weak, reflecting the continuing strong reliance on fossil fuels to meet energy needs. Among the leading countries in the region, the relatively high scores are generated either by a mix of reasonably good institutions and market incentives with reasonably good outcomes (as in Romania), or strong institutional and market-incentive systems with a poorer outcome indicator (as in Poland). The relatively high scores in some less advanced EBRD countries (e.g. Albania and Tajikistan) are driven by high scores for renewable outcomes, as a result of exploitation of hydro resources in large plants. However, the institutional set-up for renewables is weak and no market mechanisms have been introduced to foster the renewables industry.

The relationship between the institutional framework and energy outcomes is complex. The creation of a suitable institutional environment does not lead immediately to improved outcomes, as changes occur over a relatively long time. Similarly, good outcomes as measured by the ISE may have arisen independently of the creation of sound institutions and policies, and should not necessarily be seen as evidence that all is well in the energy sector more broadly. Some countries may have a high share of renewable energy resources in the energy balance because of their location (and consequent abundance of hydro resources), despite having done little to strengthen their institutional framework.

[5] Joint Implementation and the Clean Development Mechanism are two flexible project-based mechanisms for emissions reductions allowed under the Kyoto Protocol.
[6] Outcome measures are not corrected for climate, economic structures or resource endowment.

Nevertheless, even with a simple snapshot of each of the indicators, breaking the ISE into institutional (institutions and market incentives) and outcome measures reveals several important findings (see Chart 3.2). First, the range of outcomes scores is extremely wide, with countries such as Albania, Georgia and Latvia scoring very highly,[7] even compared with advanced comparator countries. At the other end of the spectrum, Kazakhstan, Mongolia, Turkmenistan and Ukraine, as well as Bulgaria and Estonia, are among the least advanced, even by global standards. Second, it is clear that some countries in the region, particularly the new EU member states and a handful of others (e.g. Armenia, Moldova and Ukraine), have made substantial progress in establishing a supportive institutional framework and implementing effective price incentives to encourage sustainable energy outcomes.

Third, there is a group largely composed of countries in the South-Eastern Europe (SEE) and the Central Asia and Mongolia (CAM) regions where both institutions and outcomes are poor. In these areas, institutions and incentives are not yet set up, and the poor outcome measures reflect the legacy of the Soviet economic model and its associated distortions in the energy sector.

Modelling the impact of climate policies

An effective way to assess the impact of policies on greenhouse gas emissions is to compare how policies affect the incremental cost of reducing emissions by one unit (known as the marginal abatement cost, or MAC).[8] This approach is applied in depth to two countries, Russia and Turkey. Limited information is also available for other countries.

A MAC curve is built from the bottom-up engineering assessment of the country-specific costs of reducing greenhouse gas emissions by one tonne for different technologies (or more broadly "measures") available in a country. Following this, the total volume of emissions that can be realistically reduced in a country by each of these measures is estimated. The curve is constructed from individual rectangular blocks, each representing one specific abatement measure. The width of each block represents the incremental emission-reduction potential (in tonnes) relative to the reference high-carbon alternative.

The height of the block represents the incremental cost per tonne of implementing this emission-reduction measure relative to the reference high-carbon alternative. The typical cost formula is the annualised capital costs (and interests) over the lifetime of the assets plus the operational costs (including revenues, e.g. from energy savings). These costs are then compared with a reference scenario for each technology, yielding relative costs. The blocks are ranked from the lowest relative cost measures (on the left side of the graph) to the highest relative cost measures (the right side of the graph).

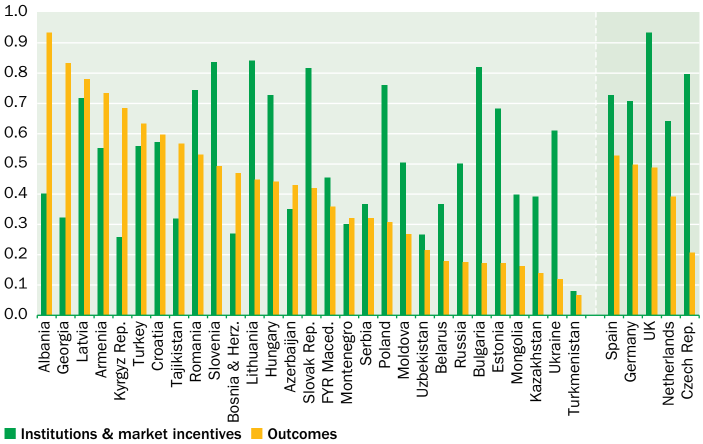
Most MAC curve tools calculate the cost of carbon-reducing investment projects from the perspective of a social planner, where costs are engineering resource costs, discount rates reflect the government cost of borrowing and investment risks are ignored. These models produce a very optimistic picture of a vast abatement potential that could be realised at no cost (or even at a profit) to society. However, because many of the abatement opportunities deemed to be money-saving are unlikely to be financially viable in the marketplace, societal-abatement cost curves have been viewed with scepticism by project developers and financial institutions.

In reality abatement is not achieved by governments, but by a myriad of private and public investors who have different perspectives from social planners. These investors pay taxes and receive subsidies, and they often pay less for energy than it costs society to extract fuels, convert them to a useful form of energy and deliver them to the point of use. Further complicating the picture, company- and project-related risks prevent firms from accessing capital on the terms the government enjoys when issuing treasury bonds. The actual costs experienced by market players are usually higher and include price distortions (taxes, fees and subsidies), transaction costs and several "hidden costs" related to sector- and technology-specific risks and barriers.

Recently some attempts have been made to conduct simple sensitivity analysis of abatement costs with respect to higher cost of capital, and to introduce some transaction costs into the formulas.[9] These efforts represent initial steps towards better representation of investment realities on the ground.

The analysis in this chapter deviates from the traditional societal perspective and goes well beyond simple sensitivity analyses. It is one of the first efforts to capture comprehensively the costs that different groups of investors actually face in the real marketplace, including consequences of policy interventions and market distortions. This makes it easier to study the effectiveness of various policies, which can be assessed by estimating the impact of different policy scenarios on the investors' costs and their expected willingness to invest.

Chart 3.2
ISE decomposition: institutional structures (institutions and market mechanisms) versus outcomes



Source: EBRD.

Note: The data used for the index is the most recent available for each class of information: for institutions as of mid-2010, for energy use 2008 and carbon emissions 2007.

[7] Two main factors account for this: (i) the large amount of renewable resources and the relative extensiveness of their use in large hydroelectric power plants (in Albania and Georgia, the share of electricity generated from renewable sources exceeds 80 per cent); and (ii) an economic structure with little energy-intensive industry.

[8] The analysis builds upon the modelling work from McKinsey for Russia and from NERA/Bloomberg New Energy Finance for Turkey.

[9] See, for example, McKinsey & Company (2009).

[10] The two modelling teams supporting this chapter have used slightly different concepts for the reference case (or reference baseline) in their modelling. In the McKinsey study for Russia, the reference baseline is based on the "natural" growth patterns of economic output by sector, which does take into account some efficiency improvements as new, more energy-efficient equipment and buildings gradually replace older

Investors' MAC curves should be interpreted carefully. Unit costs in the MAC do not represent the prices at which equipment or services can be purchased on the market. Nor do they represent the net present value of investments in the form that is used by firms in their feasibility studies or pricing models. The costs in MAC curves are *relative* and *incremental*, rather than absolute, costs. They are statistical averages rather than estimates that can be used to appraise specific investments. A positive cost of a mitigation measure indicates how much higher the cost of a given measure is than that of the more polluting reference measure that investors would normally choose. In other words, the height of the bar represents the price of carbon emissions at which a given measure becomes the preferred choice of investors relative to other, more carbon-intensive, alternatives. For negative cost measures (left-hand side of the graph), the height of the bar represents the cost advantage of investing in the abatement measure rather than the more carbon-intensive reference project.

The status quo scenario

The starting point of the policy analysis is a hypothetical baseline, which assumes that the policies that prevailed in Russia and Turkey in 2009 will remain in place and unchanged until 2030. In this status quo scenario, no new policies emerge to encourage energy efficiency, renewable energy or other emissions abatement. Where policies and measures are already in place, they are not strengthened and their effectiveness does not improve. Policies that have been declared but not yet implemented or not enforced are also ignored. As for all other policy scenarios, the abatement potential and costs of the status quo scenario are calculated against a reference case.[10]

The status quo scenario allows non-policy factors to evolve during the modelling period. One such factor that affects abatement costs and is allowed to change over time is technological progress. It is assumed that at the end of its economic life, currently employed equipment is replaced by new assets that are more efficient than the current vintage. Similarly, any new demand is assumed to be met through investment in new, more efficient equipment. In addition, abatement measures introduced in the status quo scenario are assumed to become more efficient and cheaper over time.

In short, the status quo represents current policies together with an assumption about how average emission intensities and technology costs will, by themselves, evolve from today until 2030. Some of the main policy drivers that affect abatement costs are reviewed next.

Policy variable I: investment risk

Investors have to identify, evaluate and mitigate a number of development, construction and operational risks. More capital can be raised at lower costs if these risks can be mitigated or avoided. A lower cost of capital translates into a lower cost of carbon abatement and a larger volume of profitable abatement investments, because abatement measures usually require additional investments compared to the high-carbon references, and are relatively capital intensive.

Most low-carbon projects are perceived as high-risk investments. To the extent that unsecure financing is provided, it is done with high interest rates, on short maturities and against a large equity cushion, unless creditors benefit from long-term power off-take agreements at guaranteed prices. This is the case for some renewable energy projects such as wind farms in the most stable jurisdictions that are extensively and successfully financed with long-term, relatively cheap debt capital. The viability of energy-efficiency investments, in particular small projects in the residential and small-and-medium-enterprises sectors, is hampered by high-risk related discounts applied by financial institutions and project sponsors to the potential savings. Generally, low-carbon projects are often dependent on an uncertain regulatory environment and are vulnerable both to increases in the cost of capital and regulatory inconsistency.

Overcoming these barriers requires dedicated policies, many of which reduce investment risks generally, not only for low-carbon investments. These include macroeconomic policies that support stable interest rates, prudent fiscal policies, fair and predictable regulations affecting business, a deep and competitive financial sector, an effective property rights regime, and an effective, rule-based judicial system.

Policy variable II: fossil-fuel prices

In a low-carbon economy, it is important to price energy at a level that covers the full economic cost of using the resources. This includes both direct costs and external costs borne by other parties, such as the cost of environmental damage. Cost-reflective prices provide incentives to use energy efficiently and to invest in energy-saving projects. Under-pricing of fossil fuels erodes the returns to energy-saving projects and makes clean energy less attractive to investors in comparison with carbon-emitting alternatives.

The Russian status quo scenario assumes that 2009 prices will remain frozen until 2030. This is not a likely scenario, but it helps to illustrate the potential climate-mitigation benefits of energy-pricing reforms that Russia has undertaken very recently and continuous to implement consistently, especially in the electricity sector.

By contrast, Turkey's 2009 prices are liberalised and already quite high. The model assumes that they will grow further in line with international trends, reflecting fewer distortions and a higher degree of openness in the Turkish energy market.

Policy variable III: transaction costs

Transaction costs encompass the costs of economic and administrative activities that are additional to the technical costs of an investment. The analysis distinguishes two distinct categories of transaction costs:

- **Project transaction costs.** These are associated with project preparation under standard financial structures and may include investment appraisal (e.g. time costs, consultancy fees, feasibility studies and overheads), procurement and legal costs (e.g. contracts, negotiation and finding vendors), compliance costs (e.g. permits and applications), and bribes.

- **Policy-induced transaction costs** (or trading transaction costs). These are costs that economic entities must bear to respond to

installations. In the NERA/Bloomberg New Energy Finance model used for Turkey, the reference case assumes zero technology progress – all assets are assumed to have fixed energy and emission intensities throughout the entire modelling period. In this sense, the reference baselines are not "business-as-usual" scenarios as applied in some studies, although the McKinsey approach is closer to this concept. The benefit of having such a conservative definition of reference baseline is that it avoids guessing what is "usual" in an uncertain world, and gives a useful benchmark against which the impact of existing and planned policies can be measured. On the other hand, the conservative reference improves the commercial viability of abatement measures in the status quo scenario.

policy interventions. They include a range of administrative costs associated with obtaining access to carbon finance, such as Joint Implementation projects in Russia and voluntary emission-reduction trades by Turkish firms. They also include the costs of obtaining government subsidies.

Average transaction costs in Russia are estimated at €7 per tonne of CO_2-equivalent (CO_2e) abated, with significant variations between measures. For smaller energy-efficiency projects, the transaction costs are estimated to reach €60 per tonne of CO_2e reduced; for large projects in industry or thermal power sectors, transaction costs account for a negligible fraction of underlying investments. Among policy-induced transaction costs, a preparation of a small Joint Implementation project may cost up to €40 per tonne of CO_2e reduced – almost four times more than the market price of a credit. Turkish project transaction costs are assumed to vary between 10 per cent and 30 per cent of capital expenditures.

Effective mitigation policies in Russia

The effect of policy interventions on Russian greenhouse gas emissions was analysed by comparing the status quo scenario and four bundles of policies against the reference case. The policy bundles build on each other and represent an increasing level of ambition to stimulate emission-reduction investments. Compared with the status quo, these policies increase the total volume of profitable[11] abatement investments and consequently the reduction in emissions that can be achieved by commercially attractive projects.

Status quo scenario

According to the previous study (McKinsey, 2009), the societally beneficial abatement potential in Russia – that is, the level by which emissions may be reduced in 2030 at no cost to society – is an astounding 50 per cent of 1990 emissions, or 567 million tonnes of CO_2e (Mt CO_2e).[12] This represents the minimum emission reductions that Russia should contemplate from a purely social-economic point of view, even before taking into account benefits of avoided negative impacts of climate change, avoided adaptation costs or local ancillary benefits such as the health benefits of reduced local air pollution.[13]

However, very little of this abatement will be delivered in Russia's current policy environment. The present study shows that under the status quo scenario, where current policies are frozen, Russia would barely meet its emission-reduction pledges under the Copenhagen Accord – a reduction of up to 25 per cent of annual emissions compared to 1990 levels by 2020.

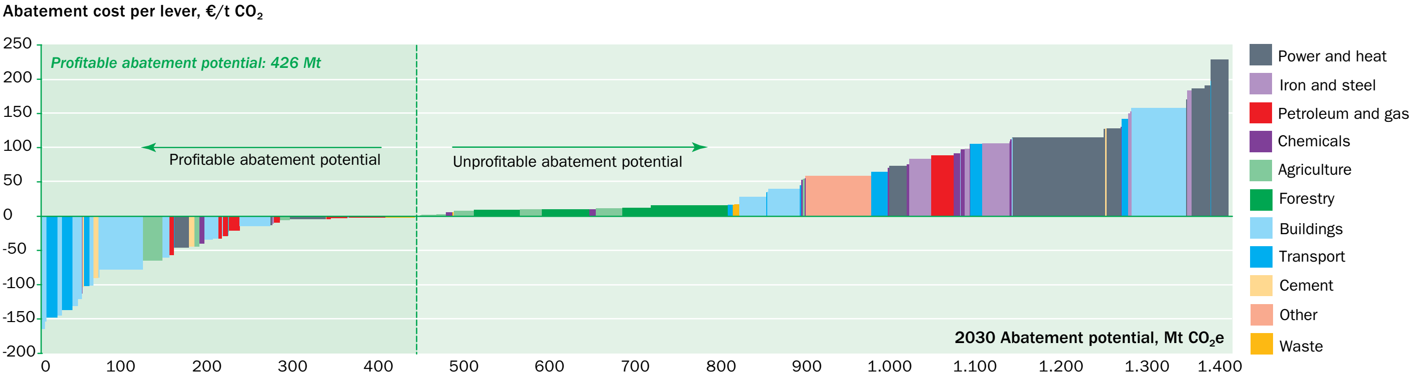
The status quo scenario assumes that the 2009 energy prices, taxes and subsidies (for oil, gas, electricity and heat) in different consumer classes remain in place. Other market conditions, including investment risks[14] and transaction costs, are also held constant. No renewable support or carbon price is introduced.

Chart 3.3 shows the MAC curve under the status quo scenario. It indicates a profitable annual abatement potential of almost 300 Mt CO_2e in 2020 and 426 Mt CO_2e in 2030, even with frozen energy prices and in the absence of any other energy and climate policies. This is not insignificant, but much lower than implied by McKinsey (2009). The assumption is that this is the abatement that would actually be implemented under the status quo.

The total investment needed to realise all profitable projects would amount to €57 billion over the period 2010–2030,[15] by which time savings of €118 billion per year would be realised. The savings would continue to be enjoyed beyond 2030 until the end of these investments' economic lifetime.[16]

The total emission-reduction potential of an estimated 1,409 Mt CO_2e – that is, summing profitable and non-profitable abatement opportunities represented in Chart 3.3[17] – could be achieved at the modest average cost of €32 per tonne of CO_2e. This reflects an average between the profitable opportunities on the left of Chart 3.3, and the costly opportunities on the right. At the margin, realising this full potential would be very expensive, with costs for the most expensive measures of almost €230 per tonne of CO_2e.

Chart 3.3
Status quo scenario for Russia



Source: EBRD on the basis of the Russian cost curve (McKinsey & Company, 2009).
Note: Abatement expected to be achieved under status quo is assumed to be equal to the sum of profitable abatement opportunities in this chart as indicated by the dotted line.

[11] "Profitable" measures in the MAC curve mean that over their lifetime these measures are cheaper than the alternative technologies that achieve the same economic output but with higher carbon emissions. In extreme cases such relatively profitable measures may not be profitable in absolute terms, but their high-carbon alternatives yield even higher losses.
[12] McKinsey & Company (2009).
[13] All these omitted benefits can significantly underestimate the social-economic return on low carbon investments in the societal MAC curves.
[14] Weighted average cost of capital is estimated between 20 per cent and 30 per cent for different measures.

Box 3.2 Why do profitable measures remain in the status quo scenario?

The scenarios run the simulations of the measures that would or could be implemented between 2010 and 2030. Their expected results should not be confused with the experience from the past, when framework conditions were even worse than assumed, even in the status quo scenario. There are a few reasons for the likelihood of "win-win" abatement measures in the status quo scenario:

- **External, non-policy factors,** such as technology progress or world energy prices, will improve the financial attractiveness of abatement over time.
- **Present policies** provide some incentives for profitable investment opportunities with climate change benefits; the EBRD portfolio of commercial energy-efficiency projects provides evidence that there were bankable project opportunities even under less than favourable conditions.
- **Market inertia and entrenched behaviours,** which means that market participants respond sluggishly to policy incentives. Long-term price elasticities of demand are always larger than short-term responsiveness. Models simulate the future expected behaviour until 2030. Over time, with improved availability of more efficient technologies and accumulated demonstration effects of groundbreaking projects, more abatement measures will attract investors, even in the absence of new policy incentives.
- **Residual barriers** not captured in the model through transaction costs and capital cost variables. Some non-price barriers, such as split incentives, legal barriers and access to capital, require additional interventions that cannot be meaningfully modelled in the MAC framework.

The chart indicates that by 2030, the largest improvements in emissions intensity that would occur naturally, without any new policies, are in thermal modernisation of commercial and residential buildings and cropland nutrient management in agriculture. This does not necessarily imply that every project in these sub-sectors would be commercially viable (for the reasons explained in footnote 10, as well as those highlighted in Box 3.2 left).

The results of the status quo scenario challenge financial institutions to structure adequate financial products that can harness commercially viable project opportunities, even within an unfavourable policy framework.

Policy mix 1: Economic and pricing reforms

The first bundle of additional policies covers the implementation of a series of policy reforms currently being contemplated or implemented in the area of electricity tariffs, gas tariffs and municipal services.

Since 2001 Russia has unbundled its vertically integrated electricity utilities, privatised parts of the generation, distribution and supply sectors, and put in place competitive market mechanisms that have stimulated investment. Wholesale prices were liberalised in a series of steps leading to full deregulation in January 2011. Household retail prices are still regulated and remain below the levels required to recover investment costs. Households, however account for approximately 15 per cent of total consumption, while prices for non-residential customers (i.e. 85 per cent of electricity consumption) are now fully liberalised, exactly in line with the announced schedule. The average prices of 2009 were maintained in the status quo scenario, but the economic and pricing reforms scenario assumes the full liberalization of both wholesale and retail electricity prices.

Reform in the gas market has been limited. Gazprom maintains an effective monopoly in the downstream sector, domestic tariffs are depressed and third-party access to the gas infrastructure network is constrained. An export tax on gas and oil products continues to work as a subsidy to domestic consumers. Gas price liberalisation is moving more slowly than electricity but nonetheless there have been significant price increases in recent years. There are plans to gradually liberalise domestic gas prices for industrial users although household tariffs are likely to remain subsidised until at least 2015. The economic and pricing reforms scenario assumes these planned measures are implemented successfully.

In municipal services, the federal legal framework allows for cost-reflective heat and water tariffs. However, various factors hamper tariff-setting at adequate levels in most municipalities. Tariffs are at or very close to full cost-recovery levels for some utilities, but the level of variation remains very high. Cross-subsidies for heat prices, while generally reduced compared with earlier years or even eliminated in certain utilities (e.g. Surgut and Yaroslavl), remain pervasive in others, particularly in remote areas. In addition, low payment-collection rates for heat remain a serious problem, even in Moscow. A large proportion of residential and many non-residential energy users continue to pay utility bills according to norms rather

[15] Here and thereafter, the investment figures are always provided as the sum of expected, undiscounted incremental capital expenditures needed to implement profitable abatement measures over the period 2010–2030 in real prices and exchange rates (as of 2005 Euros for Russia and 2009 Euros for Turkey).
[16] In this and the following charts the annual savings represent the net savings accumulated from all profitable projects in the last year of a period (usually given for 2030), undiscounted, that will accrue to these investments until the end of the economic lifetime of assets. It is not the integral of the left side of curve, which also includes capital costs.
[17] Here and thereafter the abatement potential is always annual for specific year (2020 or 2030) and irrespective when the measure itself was implemented during the period.

than metered consumption. In the economic and pricing reforms scenario, all municipal services are assumed to be priced at full cost-recovery level.[18]

In the economic and pricing reforms scenario, the fundamental shift is assumed in two key variables: energy prices and investment risks. The scenario assumes that, from the 2009 prices base, energy prices gradually increase to cost recovery levels: residential consumer prices increase by €13/bcm for gas, €14/MWh for electricity and €8/GCal for heat. Industrial prices increase by €11/MWh for electricity and €4/GCal for heat.

The complex set of policies described above is also assumed to reduce investment risk factors, so that the cost of capital would decrease gradually from the 20-30 per cent observed in the past to 9 per cent on average by 2030. Chart 3.4 illustrates the effect of these combined reforms. Profitable abatement opportunities in 2020 would reach 334 Mt CO_2e in 2020 and 547 Mt CO_2e in 2030, 28 per cent higher than under the status quo.

The total investments needed for profitable investments would amount to €145 billion in the period until 2030, but this would save €244 billion per year by 2030 and beyond. The total emission-reduction potential identified in the analysis could be achieved at a benefit (negative average cost to investors) of €9 per tonne of CO_2e. The marginal cost of the most expensive measures is still considerable but would drop to just under €94 per tonne of CO_2e.

The measures that are most responsive to the reduced risks and increased energy prices include basic and advanced thermal retrofitting of residential and commercial buildings, fuel efficiency improvements in passenger vehicles, and improved energy efficiency of industry. Capital intensive energy generation, such as nuclear and large hydropower plants would also reduce costs significantly as a result of lower cost of capital, although this would not make them commercially attractive to investors without additional support instruments.

While this package would fall well short of stabilising emissions in Russia, as we show below, it would exceed the pledge Russia made under the Copenhagen Accord and more recently in Cancún. Emissions would be 31 per cent below the 1990 level in 2020 and 26 per cent below the 1990 level in 2030.

This is not to say that this achievement would be effortless. Market-based energy pricing and sound economic policies are a win-win option for economic development and the environment, but entail significant adjustment costs, shifts in competitiveness between sectors, and the reallocation of labour and capital from high-emitting to low-carbon sectors. This requires a committed, skilled and consistent government that is willing to face short-term political challenges in order to complete reforms that would improve people's lives and make industry more competitive in the long term.

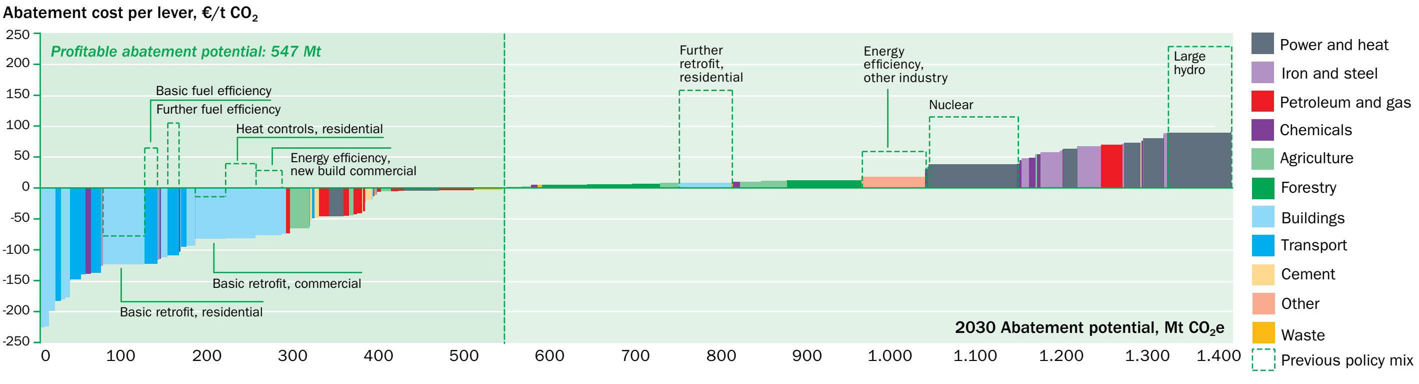
Policy mix 2: targeted energy-efficiency policies

The second policy bundle targets the transaction costs for energy-efficiency and low-carbon-power investments. These measures are added to the general reform steps considered in Policy mix 1.

Russia adopted an Energy Efficiency Law in November 2009, but implementing the pieces of secondary regulation stipulated by the Law, which number more than 90, will take time. The law envisages the gradual phase-out of certain energy-intensive products, energy-efficiency labelling for goods, and improved building standards. Consumer tariffs are to be differentiated depending on time and metered use. The targeted programme for energy efficiency was announced with earmarked funding of €17.3 billion.[19] In June 2008 President Medvedev signed a decree targeting a 40 per cent reduction in energy intensity (relative to 2007) by 2020. The government's energy strategy until 2030, approved in November 2009, makes energy efficiency a priority but only in the second stage of programme implementation.[20] The second policy scenario assumes that most provisions of the Energy Efficiency Law are implemented, and that this will result in an estimated 90 per cent decrease in the transaction costs of carbon-abatement projects.

Chart 3.5 shows the combined impact of economic reforms and energy-efficiency policies. The labelled and dotted-line bars indicate the measures that are most responsive to reducing transaction costs. The profitable abatement potential would increase to 610 Mt CO_2e.[21]

Chart 3.4
Economic and pricing reforms for Russia (Policy mix 1)



Source: EBRD on the basis of the Russian cost curve (McKinsey & Company, 2009).
Note: Labelled measures are those that are the most impacted by economic and pricing reform. The height of dotted line bars represents their cost in a status quo scenario.

[18] No assumptions about the protection of the most poor and vulnerable households is made here. Full cost pricing would require the establishment and proper funding of a social safety net for those affected above their affordability limits.
[19] Available at: http://energohelp.net/news.
[20] See *Energheticheskaya strategija Rossii na period 2030 goda*; www.minenrgo.gov.ru
[21] This result should be compared very cautiously with the 567 million tonnes of CO_2e Mt CO_2e that the McKinsey estimated in 2009 study as being in narrowly defined self-interest of Russia. Definition of self interest according to the McKinsey (2009) study does not include avoided costs of climate-change damages to Russia, avoided costs of adaptation or local co-benefits, such as health improvements due to the reduction of local air pollution. It is also difficult to consider McKinsey (2009) estimates as socially optimum emission-

The scenario leads to emissions that are 32 per cent below 1990 levels in 2020 and 28 per cent below 1990 levels in 2030.

The total profitable investment in the period 2010–2030 would increase to €220 billion. Net annual operational savings would increase to the level of €255 billion per year in 2030 and beyond.

The premium (negative average cost per tonne of CO_2e) of achieving the entire emission-reduction package analysed would increase from €9 to €12 in 2030, and the marginal cost of the most expensive measures would decrease to less than €85 per tonne of CO_2e.

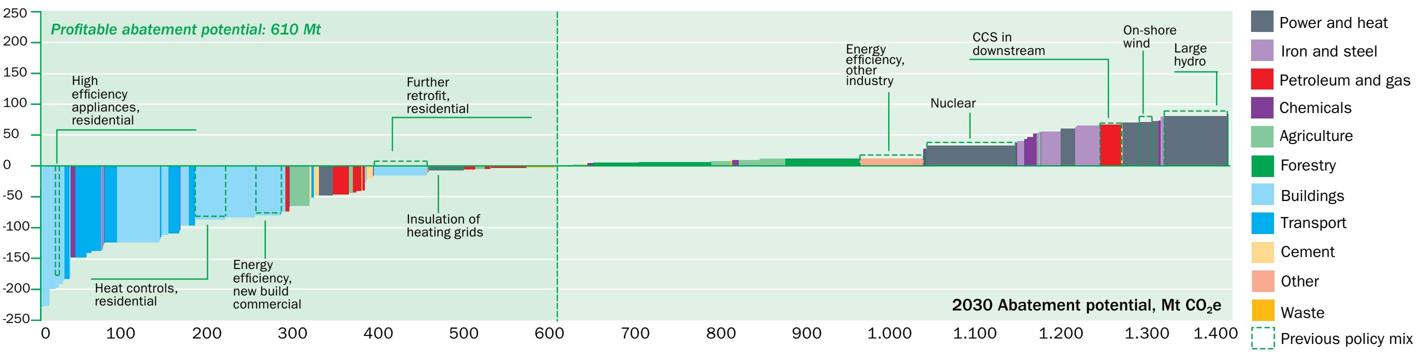
Policy mix 3: renewable support systems

The third policy bundle targets the renewable energy sector. Support for renewable energy is added to the previous policy mix of economic reform and reduced transaction costs for energy efficiency.

Russia's renewable energy sector is at an early stage of development, but institutional and regulatory mechanisms are emerging. Renewable capacity is confined largely to large Soviet-era hydro plants. Most of them are operated by RusHydro, a regulated but commercial company. The total installed capacity of RusHydro amounts to 25 gigawatts (GW), approximately 12 per cent of Russia's total installed capacity. In November 2007 the government approved an amendment to the Federal Law on Electricity, which outlines the general framework for the use of renewable energy sources. This includes possible mechanisms for renewable energy support, such as feed-in tariff premiums, subsidies for grid connection, and obligatory off-take by grid companies. As of today, the government approved three pieces of secondary regulation, which, along with other regulations, sets the target for renewable energy production at 4.5 per cent of total power production by 2020.

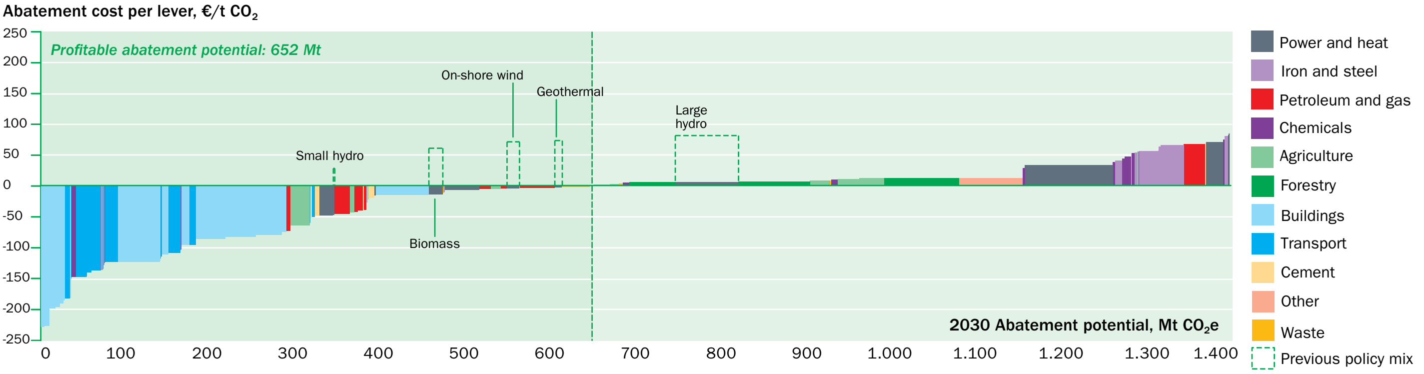
Adding a feed-in tariff premium of €30 per megawatt-hour (MWh) – €75/tonne of CO_2e – to the previous two policy bundles (economic and pricing reform and lower transaction costs) does not dramatically change the overall profitable abatement potential. It does, however, make a big difference for renewable energy. All forms of renewables, besides some large hydro facilities, would become commercially competitive (Chart 3.6). The abatement potential would increase by an additional 7 per cent to 652 Mt CO_2e.

Chart 3.5
Economic and pricing reforms and reduced transaction costs for Russia (Policy mix 2)



Source: EBRD on the basis of the Russian cost curve (McKinsey & Company, 2009).
Note: Labelled measures are those that are the most impacted by lowering transaction costs. The height of dotted line bars represents their cost in the previous scenario economic and pricing reforms, before transaction costs were lowered.

Chart 3.6
Economic reforms, reduced transaction costs and a feed-in tariff premium for Russia (Policy mix 3)



Source: EBRD on the basis of the Russian cost curve (McKinsey & Company, 2009).
Note: Labelled measures are those that are most impacted by feed-in tariff premiums. The height of dotted line bars represents their cost in the previous scenario with lower transaction costs, before the feed-in tariffs were applied.

reduction because it does not account for the macroeconomic long-run growth stimulus for example through diversification of economy away from over-reliance on resource extractive sectors. This concept of self-interest also omitted the expected international incentives.

The total investment into profitable emission reductions would increase to €247 billion up to 2030, and the net operational savings would be €255 billion per year in 2030 and beyond. The average surplus to investors for the total abatement package would increase to €18 per tonne of CO_2e. The marginal cost of the most expensive measures would remain at about €85 per tonne of CO_2e, as these are not activities affected by renewable energy policies. All renewable energy-generation technologies modelled would become commercially viable except large hydro, which is the most capital intensive.

The price premiums added to the wholesale electricity price simulated in this scenario would involve a financial transfer, from either electricity consumers or taxpayers to renewable power generators, of about €3.1 billion in the whole period until 2030. This would increase the wholesale power price by about 2.4 per cent on average in 2030.

Policy mix 4: carbon price

In the fourth policy bundle, a price is put on carbon emissions, in addition to the policy measures considered before. There are various ways to put a price on carbon (Box 3.3).

Russia has full access to carbon-finance mechanisms under the Kyoto Protocol, including Joint Implementation and international emissions trading between countries (so-called Assigned Amount Units trading), but has exploited only a fraction of opportunities so far. The necessary regulatory and institutional framework was developed late and is controversial for many market participants. The scenario assumes that over time Russia will establish a domestic emissions trading scheme linked to the European Union Emissions Trading Scheme (EU ETS), and projects not eligible under the domestic cap-and-trade system will participate more actively in the future international project-based carbon-market mechanisms (such as Joint Implementation or Sectoral Approaches). It is assumed that the regulatory and institutional framework to make active use of these mechanisms will be put in place, and that the domestic carbon price will rise to €40 per tonne by 2030. Alternatively, the same incentive effect could be achieved by an economy-wide carbon tax with this rate.

Box 3.3 Putting a price on carbon

A carbon price can be established in many different ways. These include a cap-and-trade scheme, an emission tax, a carbon-offset mechanism, or penalties for non-compliance with emission standards. Although all these carbon-pricing instruments would have a similar effect on the incentives to invest at the margin, their impact on the ability to invest would differ. For example, revenues from a carbon-offset mechanism, such as Joint Implementation, or revenues from grandfathered emission allowances (meaning polluting firms are given emission permits for free) would transfer rents and cash to investors, enhancing their ability to invest.

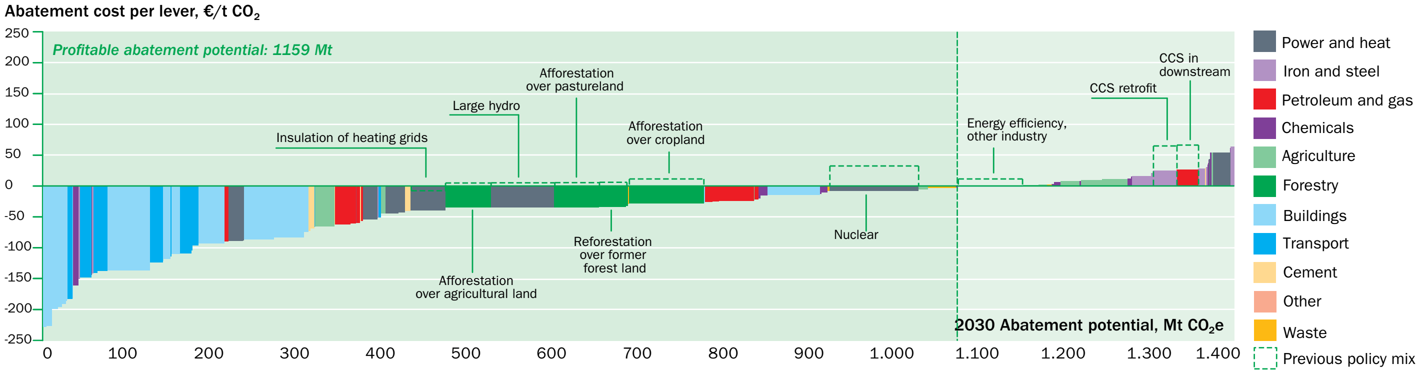
However, carbon taxes or auctioned emission allowances would transfer money in the opposite direction – from project sponsors to the government. This is generally seen as more consistent with the “polluter pays” principle, but may also decrease investors’ equity and hence their ability to raise debt to finance investments, unless governments establish credit-enhancement mechanisms or pay direct subsidies.

Command-and-control measures leave funds in the real economy but cause transfers between sectors. However, such administrative policies would increase the overall cost of abatement to the economy, because abatement efforts would not be allocated in a cost-effective way (as marginal abatement costs would differ from one plant to another). Our simulations show that the transaction costs of participation in carbon-market mechanisms would need to be dramatically reduced and additionality test-reviewed if they are to become investment instruments.

EBRD countries already apply various energy and product taxes, which can be further differentiated by their energy and carbon content in a revenue-neutral way. The EU member states of the EBRD region are already part of the EU ETS, the biggest and the most predictable carbon market to date globally. Belarus, Kazakhstan and Ukraine are already considering their own trading schemes, which would link up with the EU ETS. These and other countries may seek to benefit from sectoral approaches or new generation project-based credits that could succeed Joint Implementation and the Clean Development Mechanism.

Chart 3.7

Economic reforms, reduced transaction costs, a feed-in tariff and a €40 carbon price for Russia (Policy mix 4)



Source: EBRD on the basis of the Russian cost curve (McKinsey & Company, 2009).
Note: Labelled measures are those that are most influenced by carbon prices. The height of dotted-line bars represents their cost in the previous feed-in-tariff scenario, before the carbon price was introduced.

An economy-wide carbon price of €40 per tonne of CO_2e on the top of all previous policies would greatly increase the incentive to invest in low-emission projects. The commercially attractive abatement potential would increase by 78 per cent from 652 Mt CO_2e to 1,159 Mt CO_2e (Chart 3.7).

The total investment in profitable measures would increase to €424 billion in the period to 2030, and net annual operational savings would amount to €276 billion per year by 2030 and beyond. The average premium in the entire abatement programme would increase to €39 per tonne of CO_2e, and the marginal cost of the most expensive measures would decrease to €64 per tonne of CO_2e.[22]

A high carbon price would particularly increase the return to afforestation and reforestation activities. These do not benefit significantly from targeted policies in the other policy scenarios, but there is great potential. This potential could be realised if land use and forest carbon-sequestration credits become internationally tradeable under a future international climate agreement. Poland and Russia have proposed this in international negotiations.

Even a €40 carbon price would not lead to the commercial breakthrough of carbon capture and storage. Given the importance of this technology in both industry and the power sector, additional policy support may be warranted.

Comparison of scenarios

Sound economic policies have the biggest impact on investors' costs across sectors. An economy-wide carbon price has an equally powerful impact on the expected demand for investments (Chart 3.8). Reducing transaction costs and increasing renewable support again make a selected impact in the targeted sectors. However, their impact on the entire economy is mitigated because transaction costs account for a small fraction of the total cost in large emission-reduction projects, and feed-in tariffs affect a relatively small number of sectors.

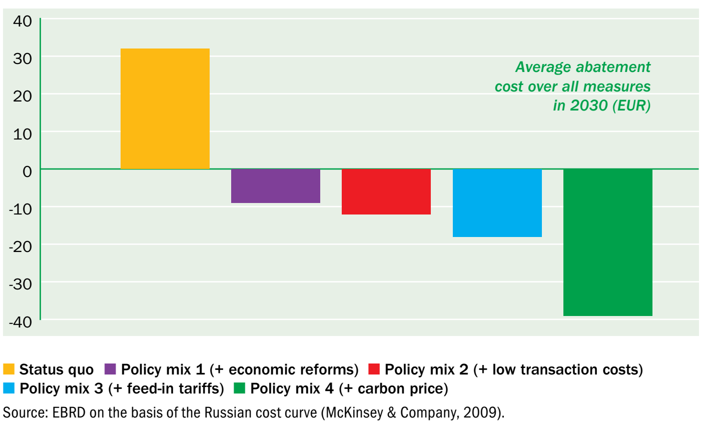
A price on carbon (€40 per tonne of CO2e) followed by sound economic policies (including energy tariff reform) are the most effective policies to stimulate emissions abatement. Reducing transaction costs and introducing feed-in tariffs for renewable energy would have a smaller impact on national emissions, although these policies are crucial for this sector, at which they are aimed (Chart 3.9).[23]

Status quo policies would keep Russian greenhouse gas emissions around 30 per cent below 1990 levels in 2020 and 23 per cent below 1990 levels in 2030 (see Chart 3.9). This is because new technologies that will naturally replace obsolete equipment and buildings will have higher efficiency and lower costs, and thus will become more financially attractive to firms and households. However, without additional policies, emissions would continue to rise relative to their 1998 low point.

General market reforms, such as the planned liberalisation of gas and electricity prices, would increase the potential for financially attractive abatement investments. If they were followed by a lowering of transaction costs and price support for renewable energy sources, this policy bundle would allow Russia to confidently meet its 25 per cent Copenhagen Accord pledge for 2020. The emissions would be kept 32 per cent below 1990 levels in 2020 and 29 per cent below 1990 levels in 2030. It would not, however, be sufficient to stabilise emissions; these would continue to rise, although at a slower pace.

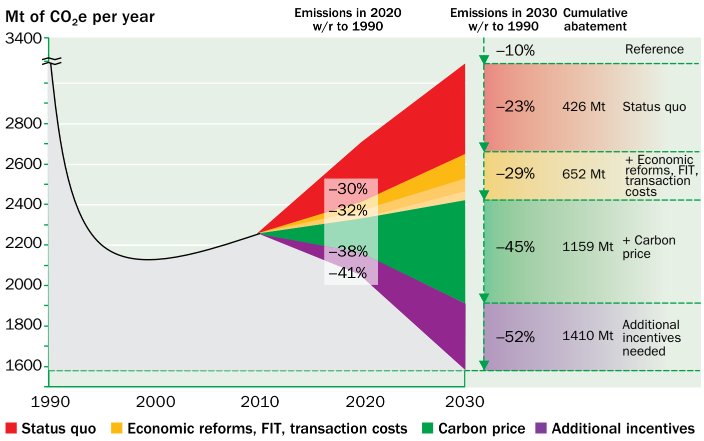
Additional carbon-specific policies are needed to reverse a trend of growing emissions. Greenhouse gas emissions would fall 38 per cent below 1990 levels in 2020 and 45 per cent below 1990 levels in 2030. The incentive provided by a price for carbon emissions would mobilise sufficient commercially driven investments to steadily decrease Russia's carbon footprint below 2010 levels. This could happen through more active participation by Russian entities in the international carbon market, the introduction of a domestic emissions trading scheme, or an emissions tax.

Chart 3.8
Average abatement costs for Russian investors in 2030 under different policies



Source: EBRD on the basis of the Russian cost curve (McKinsey & Company, 2009).
Note: The bars show the cumulative effects of the different policy scenarios.

Chart 3.9
Emission pathways under different policies in Russia



Source: EBRD on the basis of McKinsey cost curve.

[22] This can be seen as an additional carbon price that would be needed to make this marginal abatement projects attractive to investors.

[23] The impact of investment subsidies (30 per cent of capital costs) was also simulated but was found to have a much weaker impact on expected demand for abatement investments than carbon price or economic reforms.

Effective mitigation policies in Turkey

The effect of policy on greenhouse gas emissions in Turkey was analysed by comparing the status quo with two alternative scenarios. In the planned policies scenario, any emission-reduction policies that are currently planned but not yet implemented or enforced are put in place. The enhanced policy scenario includes additional policies to promote a reduction in emissions.

Status quo scenario

The status quo assumes that over the next two decades, current policies and institutions continue as they are now. Only external factors may change, including technology costs and world market prices. These factors would influence emissions, as Turkey is a relatively open economy that is well integrated into the global market through trade and investment flows.

Unlike Russia, Turkish energy prices are allowed to grow and follow international trends,[24] as the Turkish energy market is less distorted, more open and more dependent on trade. Wholesale electricity prices and retail prices have been mostly liberalised. Demand for electricity is expected to continue its recent rapid growth by 5 per cent per year until 2030.

Consistent with government plans to expand the use of indigenous lignite reserves to reduce external energy dependency,[25] all proven lignite reserves are potentially available for electricity generation. However, none of the declared policies to promote the use of lignite or limit the use of gas will be implemented under the status quo scenario. Government support for the Akkuyu nuclear power plant is omitted from the projections, but privately and commercially financed nuclear developments are allowed.

The 1995 Renewable Energy Law is assumed to remain in place (a proposed amendment, published in January 2011, is considered in the planned policies scenario). Under the law, renewable plant operators can choose between selling electricity through the balancing market (thus taking a market-price risk), or at the fixed feed-in tariffs. For many years, balancing-market prices were consistently higher and most operators chose them over the feed-in tariff. The status quo assumes that investments in renewable energy will be driven mainly by relatively high prices on the wholesale market.

Reducing energy intensity is one of the Turkish Government's priorities, alongside security of supply and the sustainable development of the energy sector.[26] The 2007 Energy Efficiency Law sets out the principles and procedures for promoting energy efficiency across sectors. However, implementation regulation is yet to be adopted and institutions have yet to be set up. Similarly, Turkey has various policies to encourage energy efficiency in buildings, but they are not strictly enforced. Under the status quo scenario, current practice remains the norm.

As a non-signatory to Annex B of the Kyoto Protocol, Turkey is not eligible to participate in its flexible mechanisms. Carbon-finance projects in Turkey are instead developed under the Protocol's voluntary schemes, in which Turkey is one of the most active participants. However, because of rapidly decreasing sale volumes (from 7.5 Mt CO_2e in 2008 to 2.4 Mt CO_2e in 2009)[27] and falling prices, voluntary trading is not included in the status quo.

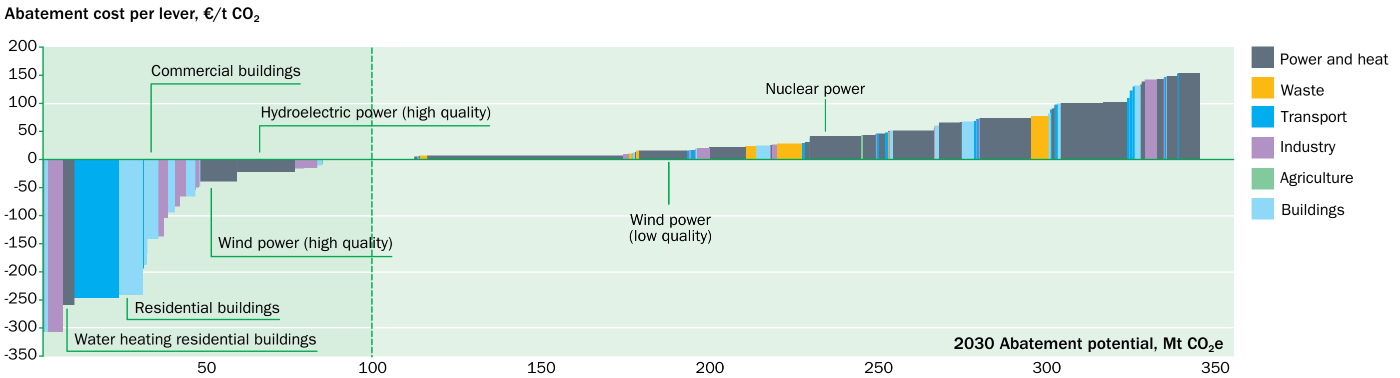
The emission-reduction potential that follows from these assumptions is shown in Chart 3.10. According to the MAC, an abatement potential in 2030 of around 111 Mt CO_2e is profitable to investors even without any energy and climate policies. Accounting for baseline emissions growth, this would imply emissions that are three times higher than in 1990, much of this due to an expanding power sector (Box 3.4).

Considering all the potential measures identified in the study, including those with a positive abatement cost, potential abatement could increase to 344 Mt CO_2e in 2030. Across the entire MAC curve, the average cost is around €1 per tonne of CO_2e.

Total incremental investments in profitable measures would amount to €45 billion in the period until 2030, and yield annual net savings of €15 billion by 2030 and beyond.

By 2030, the most attractive commercial investment opportunities would be in residential buildings, more efficient new passenger vehicles, new renewable power plants (hydro and wind), and more efficient new gas power stations.

Chart 3.10
Status quo scenario for Turkey



Source: EBRD on the basis of National Economic Research Associates (NERA) Economic Consulting and Bloomberg NEF.

[24] We use the IEA (2010a) World Economic Outlook forecasts of gas prices, which start from relatively low current levels and rise over the analysed period. Coal prices are also based on IEA projections, with an additional transport cost for Turkey. Lignite prices assume costs in Turkey will remain broadly at current levels (in line with IEA data) in real terms. Biomass prices start at current low levels, reflecting primarily traditional uses of the fuel and limited use in the power sector, but prices rise to reflect the expected increase in the international trade of biomass fuel as a low-carbon energy commodity. Wholesale electricity prices are modelled, with end-user power prices scaled up, based on historical retail costs.

[25] See Ministry of Energy and Natural Resources, Electricity Energy Market and Supply Security Strategy Paper, May 2009.

[26] Energy Strategy of the Turkish Government and Turkey's Ninth Development Plan (2007-13).

[27] Ecosystem Marketplace & Bloomberg New Energy Finance (2010).

Policy mix 1: currently planned policies

The first policy scenario considers major new policies that are planned or announced and are likely to have an effect on emissions. Where policies currently exist but are not well enforced (e.g. building standards), it is assumed that they are enforced more strictly.

The scenario assumes that the government achieves its 2023 target to reduce the share of gas in power generation from 50 per cent to 30 per cent.[28] At the same time, electric capacity is expected to approximately double. The 2023 target, driven by energy-security concerns about rising dependence on gas imports, is achieved in part through a switch to renewable energy and nuclear power.

The scenario assumes a strengthened feed-in-tariff policy to provide incentives to develop renewable power. New feed-in tariff rates, of between €5.5 per MWh for wind and small hydro to €10 per MWh for biomass and solar photovoltaics, will become effective in the first quarter of 2011 and are included in the planned policy scenario. Although the tariff levels will in several cases remain lower than expected wholesale prices, they provide a revenue floor during periods when wholesale prices are lower. This leads to a lower risk premium for the financing of renewables, thereby boosting their uptake. A further assumption is that the completion of an EBRD-financed interconnector between Turkey and Georgia allows Turkey to import hydropower from Georgia.

The scenario assumes support for the construction of Turkey's first nuclear power plant at Akkuyu, with a capacity of 4.8 GW, will begin in 2013, according to the government's contract with Rosatom of Russia. With the government offering price guarantees and setting up long-term funding for decommissioning and long-term waste disposal costs, the scenario allows for up to 15 GW of nuclear capacity by 2030.

With the removal of remaining electricity-price cross-subsidies, the price differential between industry and the residential and commercial sectors increases; residential and commercial prices increase and industrial prices fall by an equivalent amount.

The partial and delayed liberalisation of the gas market leads to somewhat higher gas prices from 2016 to 2020, as BOTAS, the incumbent company, is assumed to be able to exercise market power. Between 2020 and 2030 gas prices are assumed to rise in line with IEA (2010b) forecasts, with the import markets for gas opening and full liberalisation of the domestic gas market likely to keep the prices at world market levels.

Energy-efficiency regulations are strengthened, for example through information and energy-performance certification schemes and better enforcement of building regulations (including mandatory inspections). This leads to greater uptake of shared heating systems with higher efficiency, condensing boilers, insulation and heat meters.

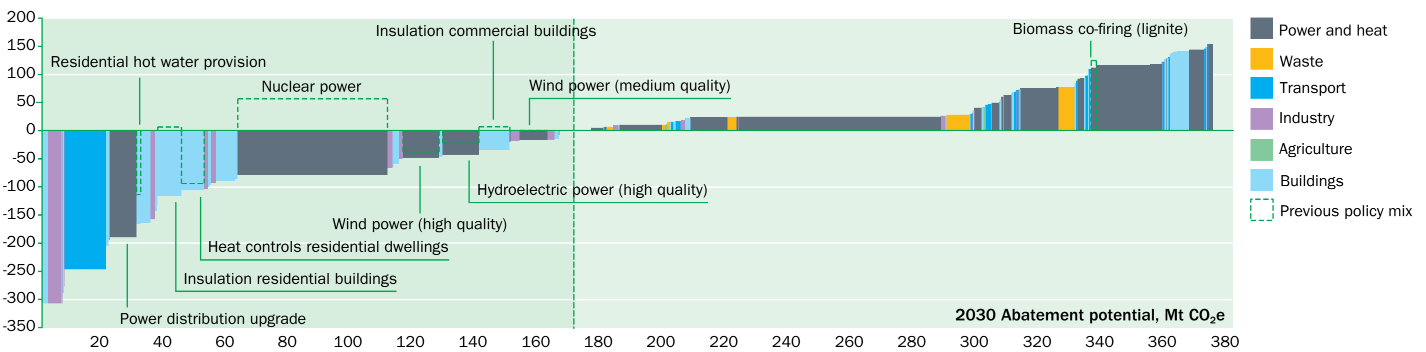
The abatement potential that is profitable to investors increases to 166 Mt CO_2e in 2030, or by 49 per cent compared with the status quo scenario. This planned policy scenario (Chart 3.13) implies emissions that are 275 per cent higher than in 1990.

Total investments in profitable measures would amount to €69 billion in the modelling period until 2030, but these investments would yield net annual savings of €28 billion to investors by 2030 and beyond. Across the entire MAC the average benefit (negative cost) of all measures rises to €20 per tonne of CO_2e in 2030.

The greatest impact of the planned policies will be felt in the power sector, where the rapid expansion of nuclear power would displace a great deal of gas capacity (see Box 3.4). These policies would not fulfil the Turkish Government's aspiration to generate 30 per cent of electricity from renewable sources by 2030, including an additional 20 GW in new wind capacity and a doubling of the current hydropower capacity.

Outside the power sector, the planned policies would markedly increase the commercial viability of thermal modernisation and the installation of heating controls in residential and commercial buildings. The number of dwellings without appropriate insulation declines by almost half between 2010 and 2030, compared with a decline of 7 per cent in the status quo scenario. The total share of dwellings without any insulation is just under a quarter by 2030.

Chart 3.11
Planned policies scenario for Turkey



Source: EBRD on the basis of NERA and Bloomberg NEF.
Note: Labelled measures are those that are most impacted by planned policies. The height of dotted line bars represents their cost in the previous status quo scenario.

[28] See Ministry of Energy and Natural Resources, Electricity Energy Market and Supply Security Strategy Paper, May 2009.

Policy mix 2: enhanced policies

The enhanced polices scenario considers a range of additional measures that the authorities could designed to promote energy efficiency and reduce emissions. They are either at the early stages of consideration by the authorities or being promoted by different interest groups.

The feed-in tariff could be increased by a further €10–15 per MWh on top of the levels in the planned policy scenario. This would bring the feed-in tariffs above the expected wholesale power prices and match some of the more generous levels provided internationally.

There could be a more complete liberalisation of the gas market, with the early entry of major international rivals providing competition to BOTAS. This would have long-term benefits for consumers, reducing gas prices even before 2020.

In the status quo and planned policy scenarios, the limitations on gas and support for lignite-fired generation led to higher emissions. These constraints are removed in the enhanced policy scenario, so that there is no specified minimum or maximum deployment of these technologies. Instead, they are taken up according to their modelled financial attractiveness. Sufficient gas imports are available after the completion of the Nabucco and other gas pipelines or through a significant expansion of the liquefied natural gas market.

The scenario includes a price on carbon for the power and industry sector, which may be linked to the EU ETS. The price of allowances is assumed to be €40 per tonne of CO_2e in real prices (2010 Euro), which is consistent with recent industry forecasts that show strong fundamentals for €40 prices of EU ETS allowances in phase three (2013–2020). The sectors not eligible for the EU ETS – waste and coal mining, gas pipelines and agriculture – are assumed to benefit from credit-based carbon-finance mechanisms with a carbon price of €20 per tonne of CO_2e. This price difference is consistent with the analysts' forecast of a growing spread between EU allowance prices and the prices of international project-based credits.[29] The scenario adds the transaction costs of participation in carbon markets.[30]

Free provision of lignite to households is phased out and replaced with a more general policy that supports home heating or provide lump-sum income support. This allows for a gradual shift away from lignite to other fuels, according to their relative attractiveness depending on the characteristics of the relevant buildings.

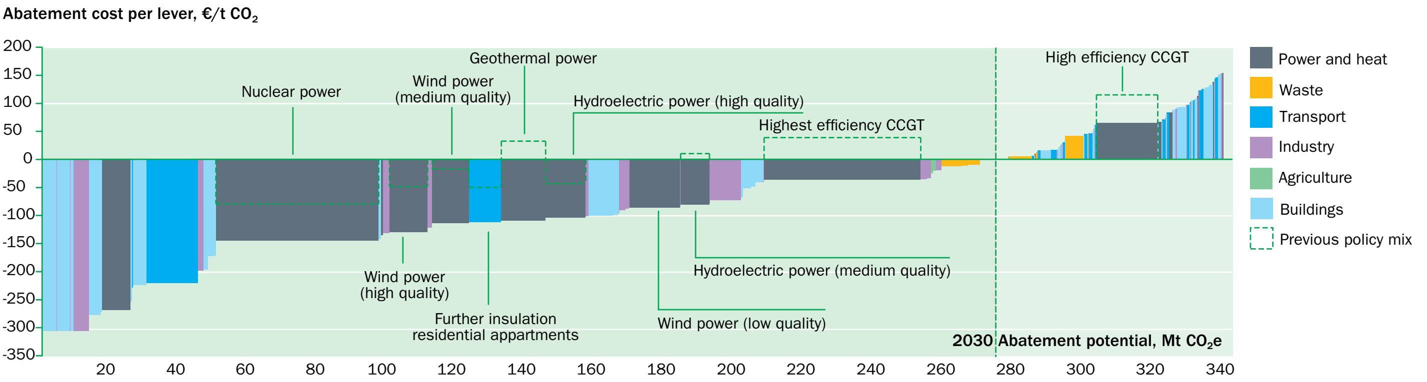
Additional requirements for alternative energy systems in buildings are included to reduce transaction costs, along the lines of EU Directive 2010/31 on the energy performance of buildings. Soft-loan programmes, supplier obligations, industrial benchmarking programmes and the expansion of commercial lending opportunities are assumed to reduce capital costs and the risks of household and industrial energy-efficiency measures, including insulation and solar or thermal hot-water heating.

The abatement potential that is profitable to investors increases to 276 Mt CO_2e in 2030, or by 54 per cent compared with planned policies (Chart 3.12). This would imply emissions increase by 163 per cent with respect to 1990 (Chart 3.13).

Total investments in profitable measures would amount to €100 billion in the period until 2030, but these investments would yield annual benefits of €40 billion to investors in 2030 and beyond. Across the entire MAC curve, the average benefit (negative cost) rises to €84 per tonne of CO_2e in 2030.

Enhanced policies will have the largest impact in the power sector if generous feed-in tariffs and carbon markets are available to spur renewable energy investments. Gas would become dominant among fossil fuels (Box 3.4). In the buildings sector, enhanced policies would promote insulation measures and the share of residential and commercial buildings with no insulation would fall to 20 per cent by 2030. Overall, there would only be a small shift in the fuel mix for heating by households compared with the planned policies scenario. Commercial buildings, however, would significantly reduce the use of coal for space heating. Finally, there would be a significant shift towards the use of more efficient lighting, particularly in residential dwellings.

Chart 3.12
Enhanced policies scenario for Turkey



Source: EBRD on the basis of NERA and Bloomberg NEF.
Note: Labelled measures are those that are most impacted by enhanced policies. The height of dotted line bars represents their cost in the previous planned policies scenario.

[29] Barclays Capital (2011), Make or Break: Carbon Market Outlook January, London.
[30] The €20 per tonne of CO_2e reflects the transaction costs and risk – it is a net price to primary credit developers.

Box 3.4 Case study: Policy impacts on the Turkish power sector

Power-sector development under status quo scenario
Under the status quo scenario, electricity production increases more than 2.6 times by 2030, but in the absence of incentives to reduce emissions, power-sector emissions more than triple as a result of the addition of significant coal and lignite capacity (as well as additional gas).

Gas-fired generation continues to be the lowest-cost option for new power plants during the period 2010–20, but the expected rising gas-import prices and constraints on available lignite combine to make hard coal the favoured source of new generation capacity beyond the 2020s.

By 2030, hard coal and gas provide similar shares of the total generation mix, with coal providing substantial baseload generation. There are also gradual additions of coal and lignite. Attractive wind power and hydropower sites are also developed, but not to the scale needed to meet ambitious government targets for renewables by 2023.

The resulting fuel mix broadly conforms to current government aspirations for fuel diversity, but in the absence of any significant expansion of renewables, this leads to a substantial increase in the overall emissions intensity of the power sector.

Impact of planned policies on power-sector development
The main difference between the planned policy scenario and the status quo is the addition of 15 GW of nuclear power – a result of underwriting of long-term contracts by the Turkish Government. By 2030 this would provide around one-sixth of Turkey's power generation. The expansion of nuclear power comes at the expense of gas-fired generation, due mainly to high projected gas prices after the 2020s. The policy support assumed under this scenario makes nuclear power viable. (This appears in the cost-effective portion of the MAC, with emission reductions relative to the reference case of over 50 Mt CO_2e by 2030.)

Planned policies do not lead to a significant additional expansion of wind power or hydropower. This is because the feed-in tariff levels for wind and hydro, although increased, remain below the modelled wholesale prices for electricity and are insufficient to make lower quality wind sites attractive.

However, an additional 5 terrawatt hours of imported hydropower from Georgia are made available, with abatement of just under 3 Mt CO_2e. Overall, non-fossil sources of generation account for just under 40 per cent of generation by 2030.

Under this scenario, the total amount of abatement in the power sector at a zero carbon price is 92 Mt CO_2e in 2030. In addition, cost-effective investments in upgraded grid infrastructure help reduce transmission and distribution losses and provide additional emission reductions.

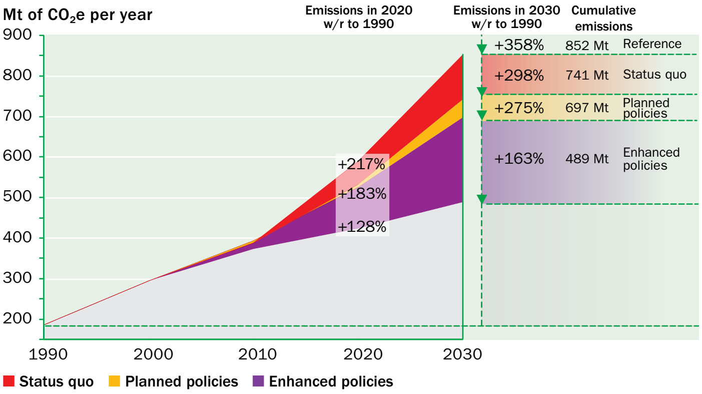
Enhanced policies impact on power-sector development
The enhanced policy scenario goes a long way towards significant decarbonisation of the Turkish power sector. Apart from the substantial contribution from nuclear power (also found in the planned policy scenario), there is a significant expansion of renewables on the back of generous feed-in tariffs and a substantial carbon price. By 2030, hydropower generation doubles to exploit its full estimated potential, while 30 GW of wind are added. Overall, 60 per cent of capacity and just over half of production come from non-fossil sources by 2030.

This is also a "high-gas" scenario. The strong carbon price and relaxed energy-diversity requirements make gas the preferred investment option relative to other fossil fuels. No new coal plants are constructed and the demand for gas increases in absolute terms compared with the planned policies scenario.

These developments substantially reduce emissions. Although generation increases by more than 2.5 times, emissions increase by no more than 50 per cent. Emissions are halved compared with the status quo.

Because all available hydropower and wind-power developments are rendered financially attractive, the cost-effective portion of the MAC is significantly larger in the enhanced policy scenario than in either the status quo or planned policy scenarios. By 2030, commercially attractive emission reductions in the power sector would increase to 120 Mt CO_2e relative to the reference case. In addition, cost-effective investments in upgraded grid infrastructure would help reduce transmission and distribution losses and provide additional emission reductions of 8 Mt CO_2e by 2030.

Chart 3.13
Emissions pathways under different scenarios in Turkey



Source: EBRD on the basis of NERA and Bloomberg NEF.

Comparison of the scenarios

If the Turkish economy grew by 5 per cent on average per year as projected over the period 2010–30, but remained stuck at its current carbon intensity, its emissions would reach 852 Mt CO_2e by 2030 (the reference case). However, the relative openness of Turkey's energy market will help to curtail emissions growth. Technological progress and energy prices that follow the global market under the status quo scenario could reduce 2030 emissions by about 111 Mt CO_2e compared with the static technology (reference) scenario. Technological improvements for new and replacement equipment bring greenhouse gas emissions down to 533 Mt CO_2e in 2020 and 741 Mt CO_2e in 2030 (Chart 3.13). However, this is still almost four times the 1990 level.

The implementation of policies that are already planned or being implemented would improve the commercial attractiveness of abatement projects and make emission reduction attractive for a range of measures (Chart 3.14). Under the status quo, the average cost of abatement for the entire cost curve is €1 per tonne of CO_2e. Planned policies would turn this into a €20 surplus per tonne of CO_2e, limiting emissions to just 697 Mt CO_2e in 2030 – over three times the 1990 level.

Enhanced policies would harmonise Turkey's climate framework with the EU climate-policy package. This would make a big difference to overall emissions and the economics of emission reduction. The average premium of abatement for the entire cost curve would rise further to €83 per tonne of CO_2e, ensuring that emissions would not exceed 500 Mt CO_2e in 2030 (although this is still more than double 1990 levels). This suggests that in Turkey, even the most ambitious policy mixes simulated here could not ensure emissions would stabilise at 2009 levels, let alone 1990 levels.

Conclusions

Greenhouse gas emissions cannot be reduced without effective investments. This chapter explored the responsiveness of expected demand for emission-reduction projects to the policy environment in which they occur. This analysis focuses on incentives to invest, and as such complements the existing literature on the factors that influence ability to invest (e.g. access to finance), institutional barriers to investments, the macroeconomic consequences of mitigation actions (the focus of Chapter 2) and related social and political consequences.

The quantitative modelling conducted for Russia and Turkey indicates that a combination of a sound economic environment and targeted climate policies, could induce significant abatement investments. However, the 2009 policy framework in Russia and Turkey is shown to be patently insufficient, and if unchanged it would prevent countries from realising energy-efficiency measures that are in their self-interest, even without climate change.
In Russia and other former Soviet countries, the legacy of an industrialised but inefficient economy combined with an unfinished agenda of policy reforms leaves many low-cost emission-reduction opportunities still to be realised. The incentives to invest in climate-friendly projects in 2009 were greater in Turkey, primarily because of Turkey's earlier progress towards the market-based pricing of energy. The recent electricity pricing reforms and vigorously developing regulatory framework for energy efficiency in Russia will hopefully change the incentive structure, and this is captured in the scenario analysis.

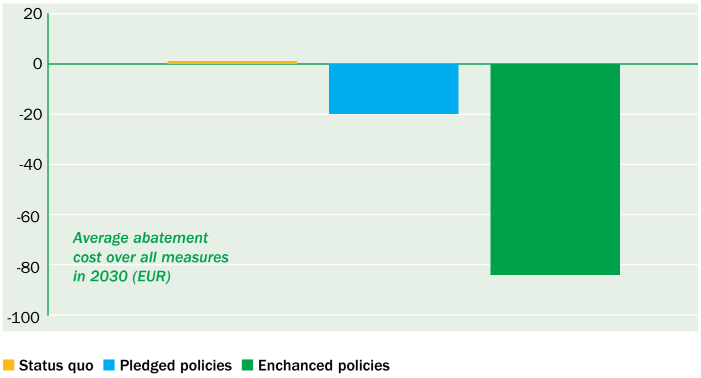
Under a status quo scenario, where the policy environment is effectively frozen at the 2009 level, Russia is likely to slow down emissions growth in the next two decades, emissions will continue to grow at a fast pace. Emissions growth under the status quo is likely to be even faster if remaining non-price barriers (not captured in this model) are included. A similar conclusion holds for Turkey, where emissions are expected to grow aggressively in the absence of counteracting policies.

Future abatement costs will rise more steeply in Turkey, because the country does not have a legacy of inefficient industrial development that would create vast opportunities for low-cost emission-reduction projects. Therefore, unlike Russia, Turkey will find it extremely challenging to even stabilise its emissions by applying the most ambitious climate policies during the modelling period. On the other hand, other studies show that the expected damages of climate change are going to be more severe in Turkey. This should increase self-interest to actively participate in domestic and global abatement efforts.

The policies required to facilitate emission reductions are often already planned and prioritised by governments. Many have already been approved but are being implemented slowly or are poorly enforced. Energy-efficiency standards and building regulations fall into this category.

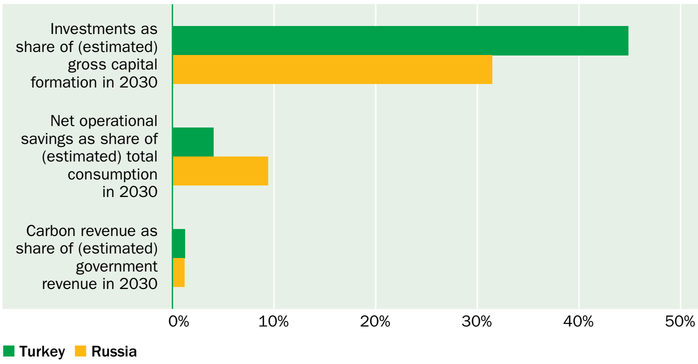
This analysis shows that many of the most powerful policies are not those specifically targeted at climate change, but are general economic reform policies that form part of the transition process and would bring wider economic benefits. Energy pricing, market liberalisation and a sound business environment that reduces investment risks are perhaps the most prominent examples.

Chart 3.14
Average abatement costs for Turkish investors in 2030 under different policies



Source: EBRD on the basis of NERA and Bloomberg NEF.
Note: The height of the bars represents the average for the integral of the entire curve (i.e. all measures available). The average abatement cost to investors starts from being positive with status quo policies and decreases to become a surplus with more ambitious policies applied.

Chart 3.15
Macroeconomic comparison



Source: EBRD on the basis of NERA and Bloomberg NEF.

Among carbon-specific measures, the most effective policy would be to put an economy-wide price on carbon. No alternative policy instrument can reasonably deliver a comparable scale of abatement investments. Without a high, economy-wide carbon price the demand for abatement investments will be weak in the future.

Carbon pricing is necessary but not sufficient for effective abatement. It must be complemented not only with economic and energy-pricing reform policies, but also with targeted support measures to nascent energy-efficiency and renewable-energy industries. Investors' responsiveness to price signals must be enhanced by a set of complex and specific interventions to remove institutional barriers and change entrenched behaviours, which are well documented in the literature and international experience. Various policy mixes are part of a comprehensive policy system of mutually reinforcing components and not all these mutual interactions could have been modelled here.

Chart 3.15 illustrates that under the most ambitious policies, including carbon prices, profitable carbon-abatement investments would become a core part of total investments in the economy, with almost half the gross capital formation in Turkey and above 30 per cent in Russia. The financial attractiveness of these investments would be higher on average in Russia than in Turkey; net operational savings compared to the reference would reach 10 per cent of total final consumption in Russia versus 5 per cent in Turkey. If a carbon price (a flat price of €40 per tonne of CO_2e in Russia and €20-40 in Turkey) is introduced as a tax or as auctioned emission permits, government revenue would increase by 1 to 2 per cent in both countries.

The results of the calculations should be interpreted carefully and should not be confused with cost estimates used in feasibility studies or pricing models. The costs in MAC curves are relative and incremental, rather than absolute, costs. They are statistical averages, rather then feasibility study figures and indicate the relative attractiveness of different abatement measures.

Achieving ambitious mitigation targets will not be effortless. The policies simulated here will provide effective signals to investors. Many are a win-win option for economic development and the environment. However, they entail significant adjustment costs, shifts of competitiveness between sectors, and the reallocation of labour and capital from high-emitting to low-carbon sectors. These are reflected in the economy-wide cost of climate change mitigation that was studied in chapter 2. The MAC model does not capture the impacts of these factors. However, like chapter 2 models - neither does it capture the economic benefits of avoided climate change damages, avoided adaptation costs or collateral benefits of climate mitigation policies, such as health benefits of reduced local air pollutants and lower resource dependence and higher long run growth in the current energy exporting countries.

As members of the international community, the transition countries will be under growing pressure to play their part in climate change mitigation in accordance with their "common but differentiated responsibilities".[31] The self-interest in curtailing global warming is likely to become stronger as knowledge of the harmful impacts of climate change and understanding of the co-benefits of abatement become more widespread in the region.

This self-interest may be further strengthened by negative and positive incentives introduced by the international community or bilaterally by the main trading partners. Probably the best that the advanced OECD countries, such as Canada, Japan and the US, and the EU could do is to adopt stringent emission caps so as to establish a predictable demand for emission allowances or low-cost offsets originated in the EBRD and developing countries that agree on monitorable ambitious abatement efforts.

The form in which a carbon price is introduced will have profound impact on investments. Some carbon prices will take cash away from investors; others will bring them additional revenues.

The design of international carbon markets or tax schemes may have significant impact on the ability of and incentives for these countries to implement ambitious climate policies. The transition region has under-used the potential of carbon markets in the past. In the future, however, the design of flexible international mechanisms may need to include provisions that would significantly reduce transaction costs and revise additionality tests. This would allow carbon finance to leverage abatement investments to a much larger scale in EBRD countries.

The interests of transition countries and the advanced market economies in seeking cooperative solutions to reduce global emissions and tackle climate change need to become aligned. The effective domestic policy mixes identified in this chapter, combined with the use of international carbon markets and other international policy instruments as both "sticks" and "carrots" could achieve this.

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