This project is co-financed by the European Union and the Republic of Turkey
Bu Proje Avrupa Birliği ile Türkiye Cumhuriyeti tarafından finanse edilmektedir

"Improving Emissions Control"
"Emisyon Kontrolünün Geliştirilmesi"
Technical Assistance Project / Teknik Yardım Projesi

CFCU

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Project Background

Air pollutants such as sulphur dioxide (SO_2), nitrogen oxides (NOx), non-methane volatile organic compounds (NMVOC) and ammonia (NH_3) adversely affect human health. So the competent authorities in many countries around the world have made improvements in human health central to their air quality management policies, strategies and plans. In addition to other initiatives the EU's National Emissions Ceilings Directive (NECD, 2001/81/EC) sets national ceilings for SO_2, NOx, NMVOC and NH_3 (the NECD pollutants) for each EU Member State.

The Republic of Turkey has taken many steps in recent years regarding air quality management and at an increasing pace since its formal acceptance as a candidate country to join the EU. Co-financed by the European Union and the Republic of Turkey, the 'Improving Emissions Control' Project was designed to assist the Turkish Government to transpose the NECD. The Technical Assistance (TA) component (March 2011 – November 2012) focused on providing technical support to the MoEU, which was the main beneficiary.

Health and Other Impacts of NECD Pollutant Emissions

NECD pollutant emissions to air cause problems for human health (illness and premature death) and adversely affect agricultural productivity, the natural and the built environments. Studies funded by the European Environment Agency have suggested that significant damage costs (at year 2010 prices) result from NECD pollutant emissions, e.g.

- €3,640/ tonne SO_2 emitted in Turkey
- €2,280/ tonne NOx emitted in Turkey
- €5,450/ tonne NH_3 emitted in Turkey

Emission reduction results in significant health and economic benefits, which often go unrecognised.

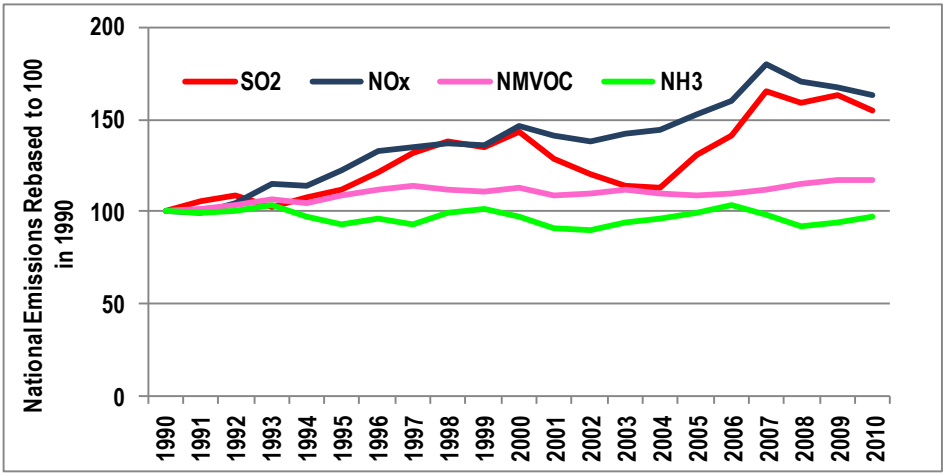
Project Goals and Outputs

The TA Project was implemented over a 20-month period with the objectives of:

1. Helping to determine national emission ceilings for Turkey of SO_2, NOx, NMVOC and NH_3 based on an emissions inventory and projections;
2. Preparing a regulatory impact assessment of NECD implementation based on a cost-benefit analysis (CBA) for a number of sectoral emission management strategies (EMS); and
3. Preparing guidelines for updating the NECD emissions inventory and projections.

Emissions Inventory 1990 - 2010

Based on information made available to MoEU and the Project Team by other Ministries and other sources, a national inventory for the emissions in Turkey of the NECD pollutants was prepared for the period 1990 – 2010. As shown below, the inventory indicates that, over this period, SO_2, NOx, NMVOC and NH_3 emissions have risen by 55%, 63%, 17%, and -2%, respectively.



An inventory guideline has been prepared for the MoEU, so as to help its staff update the inventory annually, improve its future accuracy and sustainability.

Many economic sectors contribute to the emissions of the four pollutants. However, a small number are responsible for most emissions of a particular pollutant. These are shown below for the latest year of the emissions inventory. Emissions management strategies were prepared for each of these sectors, with the aim of reducing or limiting emissions in future years.

Sector	National Emission in 2010 by Sector %			
	SO_2	NOx	NMVOC	NH_3
Electricity generation	60%	34%		
Industry	23%	11%	44%	
Road transport		40%	13%	
Residential combustion	17%		38%	
Agriculture - livestock				68%
Agriculture - fertiliser				30%

Emissions Management Strategy & Cost-Benefit Analysis

Emission management strategies (EMS) targeted at NECD pollutants were prepared for each of the major sectors, adopting measures based on national policies and internationally proven techniques. Each sectoral EMS consists of one or more of four complementary elements:

- Primary policy measures whose implementation has a direct and purposeful impact on at least one NECD pollutant emission;
- Secondary policy measures whose primary goals are not to reduce NECD pollutant emissions, but whose implementation have significant impacts;
- Efficiency measures adopted by private sector firms especially, driven by competitive pressures regarding costs, prices and market positioning; and
- Other policy measures such as funded Outreach Programmes designed to inform producers and consumers and influence their future behaviour.

Electricity Generation EMS

- Expand zero-emission energy sources such as hydro, wind, geothermal and solar.
- Control SO_2 and NOx emissions at lignite and coal-fired stations.
- Adopt good practices to increase the efficiencies of electricity generation & transmission.
- Consumers to manage their electricity demand.

Cost-benefit analysis (CBA) shows that the economic benefits of SO_2 emissions control adopting flue gas desulphurisation (FGD), and NOx emissions prevention using low-NOx burners and staged-air supply, should substantially exceed the financial costs incurred by this sector in Turkey.

However, CBA also shows that the costs of NOx emissions abatement using techniques such as Selective Catalytic Reduction are likely to exceed the benefits substantially. Such techniques are not recommended for adoption in Turkey.

Other Industrial Combustion EMS

- Adopt good practice to improve energy efficiency in process plant, boilers, furnaces and heat exchange systems – stimulated by IPPC regime in future - and supported by the provision of information and guidance.
- Control SO_2 and NOx emissions at cement and iron & steel sector installations.

Energy efficiency improvements of up to 10% should be achievable in most sectors at minimal or zero net costs.

It was not possible to determine the costs of emissions control in the Turkish cement and iron & steel sectors.

Residential and Commercial Heating EMS

- Maintain coal and lignite use at current levels; and encourage the declines in wood, waste and oil burning to continue.
- Geothermal and solar to maintain their market shares.
- Expand natural gas distribution & use.
- Building insulation standards and efficiency of combustion units.

Road Transport EMS

- EURO standards for emissions from engines in new vehicles.
- Testing regime for older vehicles.
- Petrol Vapour Recovery at storage & distribution terminals and at petrol service stations.
- Additional measures may be needed to reduce NOx emissions in future.

Solvent Use EMS

- Minimise the use of organic solvents by industry through the regulatory permit system – solvent management plans, controls to meet emission limit values.
- Impose limits on the organic solvent content of certain paints, varnishes and vehicle refinishing products.
- Information and guidance to industry.

Agriculture EMS

- IPPC regulation of intensive poultry units and the voluntary adoption of good practice at housed cattle units – feeding, ventilation and waste management.
- Control N-fertiliser use in areas designated as “nitrate vulnerable zones”.
- Outreach programme to support farmers with information and guidance on good practice.

CBA suggests that overall benefits are likely to exceed costs. Controlled N-fertiliser application should result in the optimal use of fertiliser and cost savings.

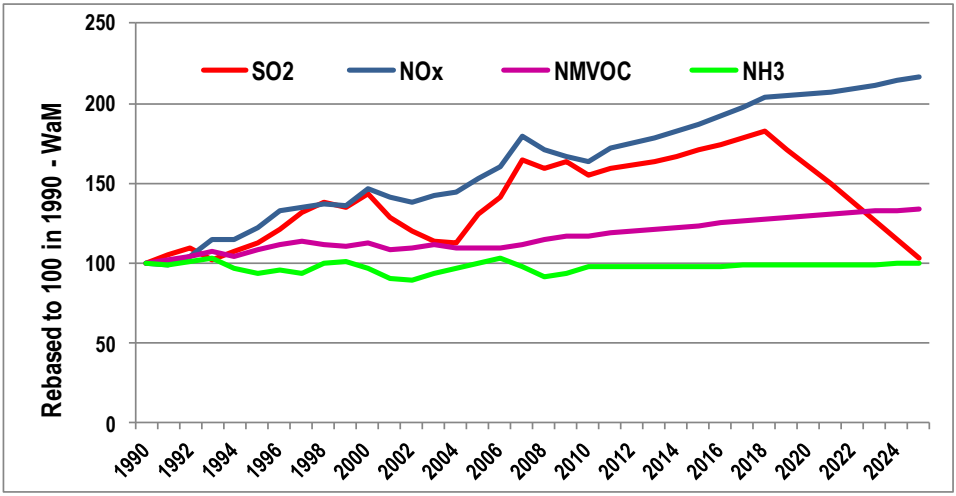
Emission Projections

Three scenarios for emissions growth from 2011 to 2025 were developed and evaluated. An emissions projection guideline was prepared and handed over to MoEU staff for their future use. The scenarios evaluated were:

Without Measures (WoM): this allows for population and economic growth but doesn't propose any emissions management measures other than those that are already the norm. By 2025, national emissions of SO_2, NOx, NMVOC and NH_3 are estimated to grow to 433%, 355%, 198% and 109%, respectively, of the 1990 national levels.

With Measures (WM): this accommodates a range of national policies – a partial EMS. By 2025, national emissions of SO_2, NOx, NMVOC and NH_3 are estimated to grow to 218%, 256%, 174% and 109%, respectively, of the 1990 national levels;

With Additional Measures (WaM): this assumes the full application of all sectoral EMS to minimise emissions growth. By 2025, national emissions of SO_2, NOx, NMVOC and NH_3 are estimated at 103%, 217%, 134% and 100%, respectively, of the 1990 national levels - see below.



Possible National Emission Ceilings – Interim Proposals

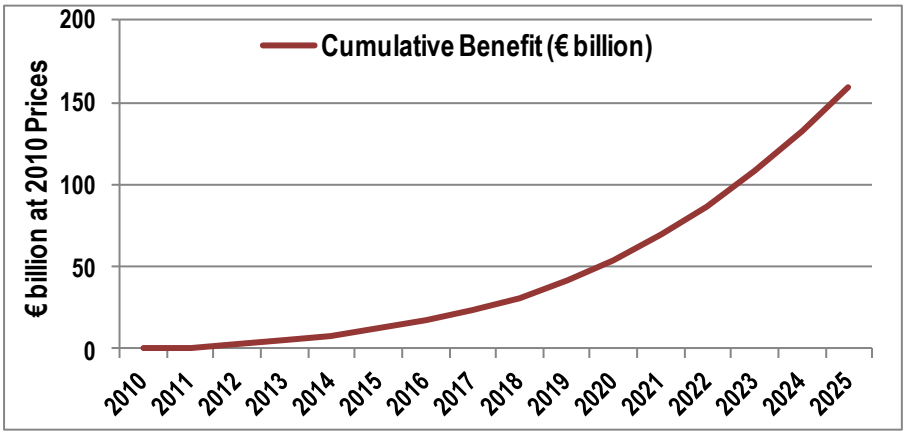
Possible national emission ceilings (NEC) for Turkey for 2025 have been identified based on the WaM emission projection results, moderated to take account of the CBA and other findings of the Project.

SO_2	NOx	NMVOC	NH_3
2,340 ktonne	1,360 ktonne	890 ktonne	530 ktonne

However, the possible NEC identified above must be regarded as ***interim values*** pending a thorough review by the Government of the Republic of Turkey, which will wish to carefully reconsider all the underlying bases.

Regulatory Impact Assessment (RIA)

The RIA has estimated the total gross benefits and costs of applying the full EMS to meet the above NEC. Comparing the emissions projections under the WaM scenario with those under the WoM scenario, annual gross benefits (at 2010 price levels) increase progressively to reach over €25 billion/y in 2025. *Cumulative gross benefits from 2011 to 2025* of the *WaM vs WoM emission projections* are estimated to be *over €150 billion – see below*.



Most of the expected benefit results from SO_2 emissions control; and most from FGD applied in the electricity generating sector. Relative to emissions levels in 2010, net benefits of the EMS in the WaM scenario are predicted after year 2021, i.e. an ***improvement in air quality relative to 2010***.

The *cumulative costs to 2025* (at 2010 price levels) of emissions control to meet the identified possible ceilings are estimated as lying in a *range from €15 billion to over €20 billion* with the full EMS in place.

Most of the implementation costs lie in the electricity generating sector. An affordability assessment of the EMS for this sector was undertaken, therefore:

- Annual expenditure (capital investment and O&M) on emissions control in the electricity generating sector would peak at about 0.2% of national GDP in the 2020's, suggesting the strategy is ***affordable at a national level***;
- Assuming the costs of emissions control are spread evenly across all electricity users, households and industrial consumers may see ***affordable price increases*** of about 3% and 4.5% respectively over the projection period.

Based on the analyses undertaken in this Project, ***NECD implementation should be substantially advantageous to Turkey and its people***.

First, a number of technical uncertainties in the emissions inventory and projections will need to be resolved. The proposed ***inter-Ministerial Coordination Board*** is ideally placed to undertake that task.

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