



= 2,300 t

## Accounting for Emissions

A new Emissions-Calculating tool  
tested in six energy-related projects

gtz



On behalf of  
Federal Ministry  
for Economic Cooperation  
and Development

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# Making emissions visible

As the effects of climate change manifest themselves across the globe in the form of rising temperatures, melting glaciers, longer periods of drought, and extreme weather events, the international community is grappling with how to stave off or even reverse the impacts.

Scientific advancements have led to a broad understanding of the causes of climate change, namely the release of greenhouse gases (GHG) into the atmosphere that contribute to global warming and subsequent changes within the climate system. Along with greater scientific understanding has come greater awareness of the threats that climate change poses to advances in international development. As a result, the establishment of indicators that can help monitor the GHG-related impacts is of growing importance in development cooperation. Not only does it help to create awareness of different alternatives to reach a specific development goal, it also improves contributions to GHG mitigation in a specific partner country.

Climate protection is a crucial part of Germany's commitment to promote sustainable devel-

opment through development cooperation programmes and projects. That is why the Climate Protection Programme implemented by the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) developed an Emissions-Calculating tool. The tool facilitates regular monitoring of GHG impacts in GTZ's energy-related projects. GTZ has tested the tool on six such projects and presents the results on the following pages.

With the Emissions-Calculating tool, GTZ combines aspects from existing accounting methods, such as ISO 14064 and the Greenhouse Gas Protocol, in order to maximise accuracy and efficiency with respect to time, effort and administrative burden for data collection and processing.

The Emissions-Calculating tool has a two-pronged approach. The first component involves calculating the emissions that are generated by the everyday activities of GTZ projects, including the use of project vehicles, employees commuting to work, work-related flights, etc. The

second component – which is the focus of this brochure – quantifies the emissions that are reduced or ‘saved’ as a result of a technical cooperation project in the energy sector.

The GHG benefit from project activities can be classified into two different categories based on the concept of results-based monitoring, which seeks to clearly identify the desired results and steer change processes in the necessary direction. The GHGs that are mitigated by the project may be categorised as a direct contribution by the project to emissions savings. If the project succeeds and is replicated, e.g. by other institutions or in other regions of the country, then the mitigation potential of the original project activities is broadened and the GHGs mitigated may be categorised as an indirect contribution by the project to emissions savings. The Emissions-Calculating tool seeks to quantify separately the direct and indirect emissions savings.

The procedures for calculating the emissions mitigated are different for each project, since only renewable energy projects use a standardised approach. For the purposes of projecting

emissions savings into the future, the Emissions-Calculating tool considers UNFCCC methodologies for the Clean Development Mechanism.

Today’s results from the testing of the Emissions-Calculating tool indicate that the potential for climate change mitigation is significant, and the development benefits are real. That is why GTZ intends to use the Emissions-Calculating tool as a standardised monitoring tool in energy-related projects – with the overall aims of creating awareness and learning about the best ways to contribute to a country’s development and to climate change mitigation at the same time.

**For more details about the methodology of the Emissions-Calculating tool go to <http://www.gtz.de/de/dokumente/gtz2008-en-climate-ghg-emissions-accounting.pdf>**



# Project 1

## blue energy mini hydro power project // indonesia

Since 1999, the Directorate General of Electricity and Energy Utilisation within the Indonesian Ministry of Energy and Mineral Resources, GTZ on behalf of the German Federal Ministry for Economic Cooperation and Development, and the Dutch Ministry of Foreign Affairs have been cooperating in the 'Mini Hydro Power Project'.

### Objectives

- ensure access to energy services in Indonesia's remote areas through the manufacture and operation of mini hydro power plants
- facilitate a regulatory framework and establish financial incentives

### Background

Roughly half of the 130 million people residing outside of Indonesia's cities and towns have no access to a power grid. Reliance on kerosene and diesel generators to supply energy for residential

and productive purposes in rural areas is not only harmful to the environment but also consumes a large proportion of people's income.

To date, less than 10 per cent of the country's potential hydro power has been exploited. Meanwhile, the global rise in oil prices combined with fewer governmental subsidies for fuel is turning hydro power in Indonesia into a competitive enterprise.

The GTZ-implemented Mini Hydro Power Project seeks to leverage the abundant water resources in Indonesia to produce clean and cost-effective energy in the remote areas of Java, Nusa Tenggara Barat, Nusa Tenggara Timur, Sulawesi and Sumatra.

The project operates in the following areas:

- capacity development for the local manufacture of mini hydro equipment
- sustainable project planning & development
- operation & management of mini hydro power systems
- income-generation opportunities from energy production e.g. through local production of electromechanical equipment

**Direct savings** The mini hydro power plants of the project area replace diesel generators in rural villages, which results in a co-benefit of GHG reductions. The project built 20 mini hydro power plants in 2006. They replace diesel generators that had operated for four hours per day. The direct emissions savings are based on the average size of the hydro power plants, which is 26.5 kW, and result in a reduction of GHG emissions by 1,006 tonnes of CO<sub>2</sub>-eq per year. During the remaining years of project implementation, the project had plans to install 40 additional units that would result in savings of 2,000 tonnes of CO<sub>2</sub>-eq per year. If the project utilisation period is 10 years, then direct emissions savings from the project are **30,060** tonnes of CO<sub>2</sub>-eq.

## estimated emissions savings



**Indirect savings** As a result of the project's efforts and based on the project model, project partners built an additional 20 plants with even larger capacities (35 kW), which replace diesel generators that had operated an average of six hours per day. The estimated indirect emissions reductions are 1,993 tonnes of CO<sub>2</sub>-eq per year. During the remaining years of project implementation, the project had plans to install 40 units that would result in 4,000 tonnes of CO<sub>2</sub>-eq savings per year. If the project utilisation period is 10 years, then indirect emissions savings by the project are **59,930** tonnes of CO<sub>2</sub>-eq.

# Project 2

## a regional approach to clean energy

renewable energy development programme // caribbean

In 1998, 14 Caribbean countries and two British territories began to work together with UNDP and GTZ, acting on behalf of the German Federal Ministry for Economic Cooperation and Development, on a regional project called 'Caribbean Renewable Energy Development Programme'. Its main partners are the Caribbean Community Secretariat, the Caribbean Electric Utility Service Corporation, the Caribbean Energy Information System and the Organisation of Eastern Caribbean States.

### Objectives

- /// remove existing barriers to the use of renewable energies in the region and create a friendly market environment for the commercialisation of renewables
- /// identify renewable energy technologies that may be replicated across the Caribbean
- /// strengthen the ability of Caribbean countries to mobilise investment in the renewable energy sector
- /// reduce GHG emissions in the region

### Background

The Caribbean region is heavily dependent on fossil fuels for its energy consumption. Despite substantial wind, solar, hydro power and biomass resources, renewable energy provides less than two per cent of the region's commercial energy.

The GTZ-supported component of the programme operates in the following areas:

- /// facilitation of policy frameworks for renewable energy measures
- /// identification and engineering of potential renewable energy projects
- /// capacity development, including training of programme partners
- /// sharing international best practices, networking and public outreach



**Direct savings** The reduction of GHGs in the Caribbean is a key objective in GTZ's work in the programme. Feasibility studies have been conducted for 14 renewable energy project proposals, including hydro power and wind energy. If the projects all reach implementation and operate for 10 years, the GHG emissions savings from direct emissions will be **477,848 tonnes of CO<sub>2</sub>-eq.**

**estimated emissions savings**

Direct

**477,848 t**



# Project 3

## making the most of the sunshine promotion of renewable energies // mexico

The promotion of renewable energies in Mexico is one component of a broader programme called 'Sustainable Energy in Mexico'. Compared to former programmes the current one seeks additionally to increase energy efficiency and to mitigate climate change. German Technical Cooperation has been working together with the Mexican Ministry of Energy since 2005.

### Objectives

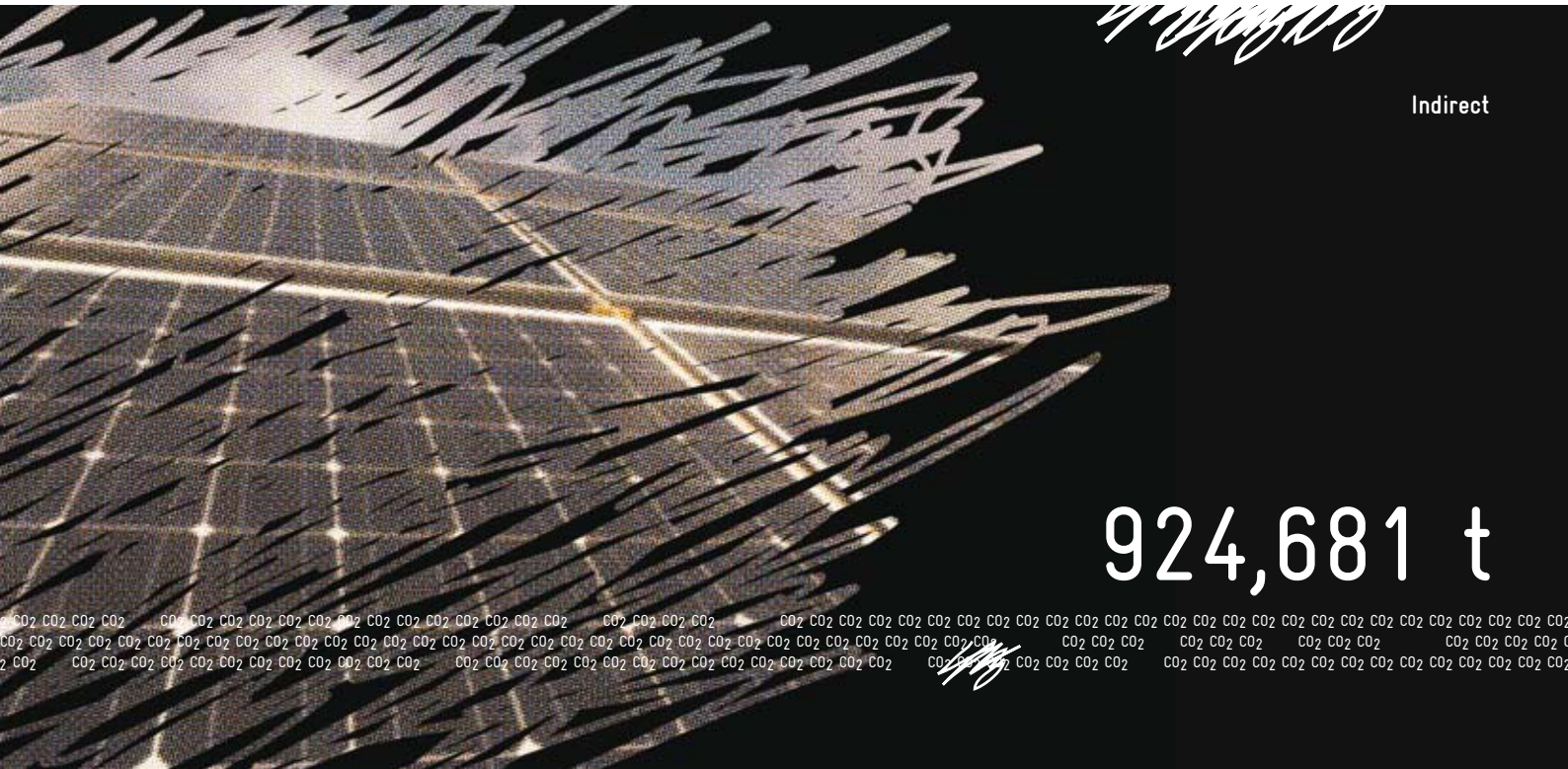
/// design policies and strategies that are conducive to effectively expanding the use of renewable energies in Mexico

### Background

Mexico, with its favourable climate and extensive territory, has an enormous, but largely untapped potential to produce renewable energy. A lack of competition in the energy sector, combined with a lack of supporting legislation from the national government has limited the use of renewables thus far. The Mexican Government has started to explore its options for reducing its dependence on fossil fuel and to exploit the potential of the private sector to spur investment and innovation for alternative energy. An important step in this direction was the approval of the renewable energy and energy efficiency bills at the end of 2008.

A core initiative of the programme is the promotion of solar water heaters to replace conventional gas-based water heaters. GTZ supports the implementation of the National Programme to Promote Solar Water Heaters in Mexico. This programme was officially presented in August 2007 and outlines the goal to install 1,800,000 m<sup>2</sup> of solar water heater systems in the period from 2007 to 2012.

## estimated emissions savings



**Indirect savings** Since the project is focused on transforming framework conditions for the use of solar water heaters, the contribution to GHG emissions reductions made by project activities is considered to be indirect. Through the project's work to promote the use of solar water heaters between 2005 and 2009 and assuming an utilisation time of 10 years for the solar systems, an estimated 924,681 tonnes of CO<sub>2</sub>-eq indirect emissions can be saved.

# Project 4

## maximising outputs, cutting consumption environmental protection in the energy industry // china

'Environmental Protection in the Energy Industry' is the name of a project that contributes to the protection of natural coal and water deposits, as well as to the efficient and environmentally friendly use of both coal and water in Chinese power plants. GTZ's main partner in this project is China's National Development and Reform Commission. Other partners are the China Electricity Council, the State Administration of Coal Mine Safety as well as 12 implementing agencies at the micro level.

### Objectives

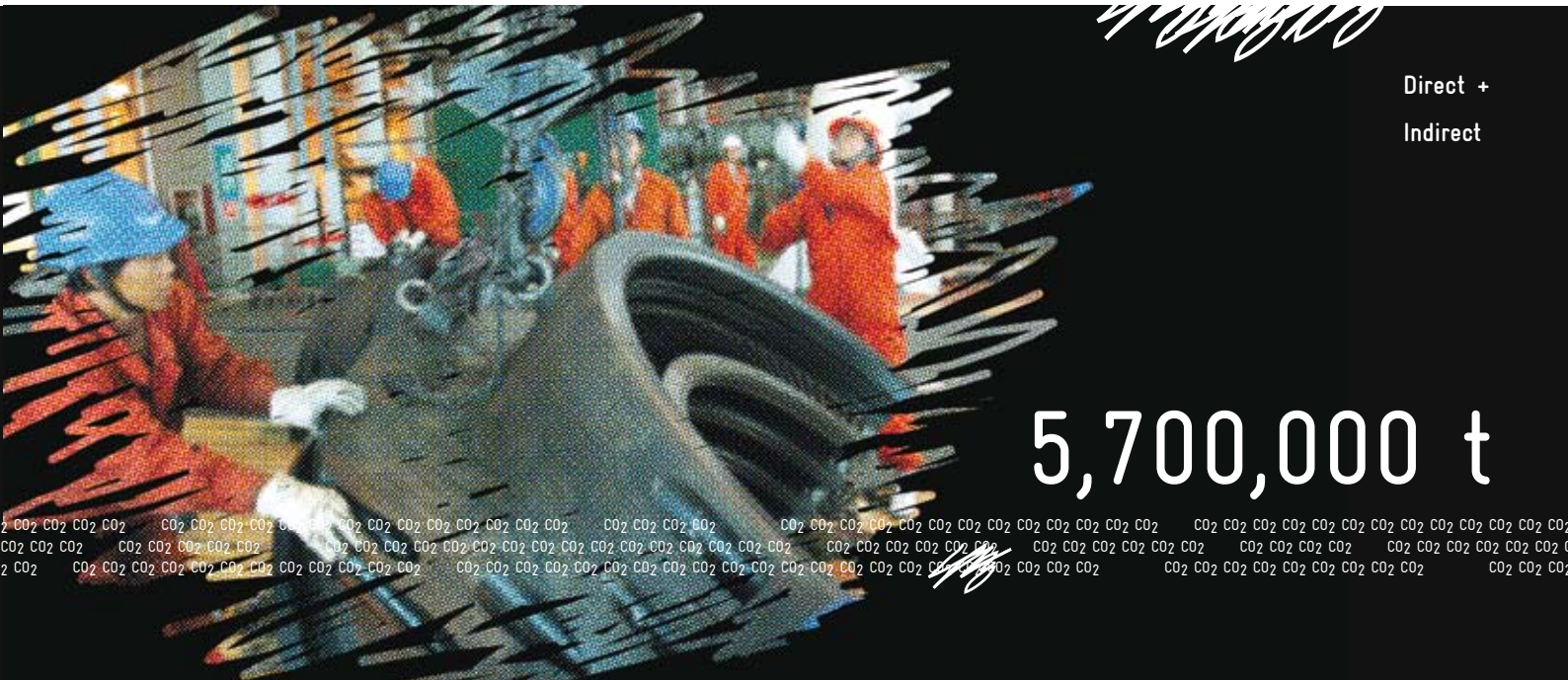
- /// improve China's energy policy
- /// optimise the efficiency of coal-fired power plants
- /// reduce the consumption of coal and water within coal-fired power plants
- /// protect coal in its natural deposits by extinguishing coal-seam fires

### Background

Rapid growth in China's power sector has resulted in additional installed capacity of 50-90 gigawatts per year. Since 2007, 80 per cent of China's electricity has been generated by coal-fired power plants. With an annual production of more than 2.5 billion tonnes of coal, China is the largest coal producer in the world. The over-reliance on coal has several negative effects on the environment. A spike in SO<sub>2</sub> emissions has resulted in one-third of the country's land area being impacted by acid rain. Plus, spontaneous coal-seam fires are resulting annually in 10 million tonnes of wasted coal and in the release of GHG emissions.

**Direct savings** Through the development and implementation of environmental policies for coal-fired power plants, the measures undertaken to reduce emissions in coal-fired power plants in three provinces have been reviewed. Based on real data from coal use and operating conditions, the project estimates that 700,000 tonnes of CO<sub>2</sub>-eq savings per year can be attributed directly to project interventions.

# estimated emissions savings



**Indirect savings** The measures to reduce emissions in coal-fired power plants have since been replicated in approximately 200 power plants, saving annually 800,000 tonnes of coal and resulting in a reduction of 1,500,000 tonnes of CO<sub>2</sub>-eq per year. Efforts to extinguish fires in coal seams during the past four years of project operation have also been successful in reducing high-quality coal losses by 1,900,000 tonnes. The result has been an estimated 3,500,000 tonnes of CO<sub>2</sub>-eq emissions that have been avoided, which are also considered as an indirect emissions reduction by the project.

# Project 5

## anything but 'business as usual'

energy and eco-efficiency in agro-industry // thailand

On behalf of the German Federal Ministry for Economic Cooperation and Development, GTZ has been cooperating with the Thai Department of Alternative Energy Development and Efficiency in the 'Energy and Eco-Efficiency in Agro-Industry' project since 2004.

### Objectives

- /// strengthen the competitiveness of the Thai agro-industry
- /// implement cost-effective production technologies and professional management techniques
- /// promote the efficient use of energy and the improved use of biomass for energy production

### Background

In Thailand, 60 per cent of the population derives its income from the agro-industry. Within the Thai manufacturing sector, agro-industry accounts for the largest share of energy consumption, while at the same time offering the largest potential for renewable energy use. If a favourable energy policy were to be put in place, power plants based on biomass residues could reach a total installed capacity of approximately 3,000 megawatts, which represents about 15 per cent of Thailand's present peak energy load. The Thai agro-industry stands to increase its income by US\$1 billion per year through energy-efficiency and waste-to-energy initiatives.

The project helps the Thai agro-industry to realise its economic and efficiency potential through the use of waste-to-energy technologies in the three following sectors:

- /// palm oil industry
- /// starch processing industries
- /// shrimp farms

**Direct savings** The Thai-German project supported palm oil companies to reduce electricity and steam consumption, production losses, as well as to avoid methane emissions caused by open-pond wastewater treatment. The new technologies for wastewater treatment capture biogas and generate thermal electricity to be used by the companies to process palm fruit bunches. The Clean Development Mechanism is being used to support cofinancing of the biogas plants. In total, the direct emissions to be reduced in the palm oil industry over a 10-year period amount to **4,440,450** tonnes of CO<sub>2</sub>-eq. The starch industry also improved its yields while reducing its methane emissions and electricity consumption by 5 per cent due to project activities. Estimated annual emissions reductions are 19,442 tonnes of CO<sub>2</sub>-eq. The total direct emissions savings in the starch industry over a 10-year period are calculated to be **164,226** tonnes of CO<sub>2</sub>-eq.

## estimated emissions savings



**Indirect savings** In the shrimp industry, a pilot initiative showed that electricity consumption could be reduced by 38 per cent, and if the measures were replicated across the industry, 280,000 tonnes of CO<sub>2</sub>-eq emissions per year could be saved. This translates into **2,800,000** tonnes of CO<sub>2</sub>-eq emissions reductions over 10 years.

# Project 6

## warmer in winter, cooler in summer energy efficiency in existing buildings // china

'Energy Efficiency in Existing Buildings' is the name of the project. Chinese partners, such as the Chinese Ministry of Construction, Tangshan Municipal Government, the China Academy of Building Research as well as the China Building Materials Academy and GTZ on behalf of the German Federal Ministry for Economic Cooperation and Development, have turned their attention to retrofitting buildings in Northern China.

### Objectives

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- /// save energy resources, reduce GHG emissions and improve living conditions for the people of China
- /// integrate retrofitting concepts, efficiency technologies and financing
- /// improve the capacity of personnel working in the field of building energy efficiency
- /// promote domestic heating-system reform

### Background

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An enormous potential exists to reduce the energy demand in China's building sector. The country currently has 40 billion m<sup>2</sup> of land that is covered with buildings, 16 billion m<sup>2</sup> of which is dedicated to residential buildings in urban settings. Of these residential buildings, less than 10 per cent comply with a national standard that was initiated in 1996 to achieve 50 per cent energy savings for buildings. The energy demands for the building sector currently equate to 30 per cent of the total energy demand in China.

Statistics regarding the energy usage in Northern Chinese residences show that a considerable

amount of heat is being wasted, while residents report indoor temperatures as being too cold during the winter. The buildings not only pose disease risks for the inhabitants, but also offer poor air quality and disproportionately high rates of GHG emissions.

The project has created a demonstration building-efficiency concept in Tangshan, Northern China, that now serves as a model for Beijing and other cities. It consists of three residential buildings covering 6,000 m<sup>2</sup> of heating space. The first year of the project was mainly spent on integrating retrofitting measures, including use of thermal insulation and replacement of old windows with double-glazed windows. Further tasks were: modernising the heating systems with thermal-state valves and installing heat cost allocators, modern kitchens and bathrooms. In addition to a 50 per cent saving in energy, the residents now enjoy average temperatures of 22 degrees Celsius in their apartments, as opposed to 15 degrees Celsius before, and the amount of dust and street noise is also reduced. The demonstration project has resulted in plans for broader adoption of building efficiency measures in Tangshan that would cover 60 million m<sup>2</sup> of heating space.



**Direct savings** The demonstration project that covered 6,000 m<sup>2</sup> of heating space is responsible for 7,605 tonnes of direct CO<sub>2</sub>-eq emissions reductions, given a utilisation period of 20 years.

## estimated emissions savings



**Indirect savings** The indirect emissions reductions associated with the project, should the Tangshan municipal government apply the efficiency measures to the 60 million m<sup>2</sup> of heating space, would be 74,378,298 tonnes of CO<sub>2</sub>-eq over a time period of 20 years.



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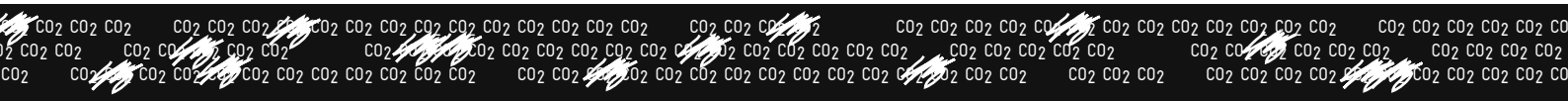
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