

Analysis of the CO₂ Reduction Effects of the IAP 2006 update

- final version -

prepared for

**Renewable Energy Policy
Network for the 21st Century (REN21)**

prepared by

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1 Introduction

The International Action Programme (IAP) is one of the central outcomes of the *International Conference for Renewable Energies – renewables2004*.

It contains about 200 actions and commitments from governments, international organizations and stakeholders from civil society, the private sector and other stakeholder groups participating in the conference¹.

After the conference, an analysis of the IAP was prepared with respect to the content and the distribution of the actions and commitments according to certain criteria, and as regards the CO₂ reduction potential which the actions and commitments are expected to have². The report assumed the *full and successful* implementation of *all* quantifiable IAP actions.

Meanwhile, REN21 compiled a monitoring report on the IAP implementation, taking into account available information on the status of all actions³.

Based on the data of the monitoring and implementation status, this report now gives a summary of the updated estimation of the CO₂ reduction potential from the IAP with respect to the implementation of actions until the end of 2005.

¹ see www.renewables2004.de for more information.

² see “Content Analysis of the International Action Programme of the International Conference for Renewable Energies, renewables2004 Bonn, 1-4 June 2004”; report of the Conference conveners, prepared by Öko-Institut, Berlin/Darmstadt (January 17, 2005) http://www.renewables2004.de/pdf/IAP_content_analysis.pdf Besides the CO₂ reduction potential, also effects on poverty alleviation were measured by the additional *access to energy* created by the actions and commitments, and the expected *investment volume* and the *installed capacity* resulting from the actions and commitments were determined.

³ REN21 (Renewable Energy Policy Network for the 21st Century) 2006: Report on the Implementation of the International Action Programme of the International Conference for Renewable Energies, 1-4 June 2004, Bonn, Germany; prepared by REN21 Secretariat, Paris, 30 November 2006 http://www.ren21.net/pdf/IAP_Implementation_Report_061130.pdf

2 Update on the CO₂ Reduction Potential of IAP Actions

As for the previous analysis, it includes only actions for which a *quantification of direct* effects of the implementation was possible.

The remaining actions also do contribute to CO₂ reduction, e.g., through reducing barriers, raising awareness, reducing specific investment costs, or reducing transaction costs. Still, the analysis here does *not* include the potential for these additional reductions.

The estimation of CO₂ is based on several key assumptions for renewable energy electricity generation and for renewable energies delivering heat or transport fuels⁴.

The methodology gives a *conservative* estimate of the overall CO₂ reduction.

To judge the implementing status of the IAP actions, information submitted from the actors was used, as well as available data on the status of RE implementation in the respective countries, mainly based on the REN21 Global RE Status Report (2006 update), and IEA data.

The international financing organizations EBRD and EIB contributed *own estimates* of their CO₂ reduction, which are included here without further analysis.

Other actors (e.g. World Bank Group) did not report the status of the implementation of their commitments under the IAP.

Similarly, IAP Actions from civil society (e.g., WF Powerswitch campaign) and private sector contributions (e.g. EIP) could not be quantified, as no information was provided on the status of implementation.

2.1 Data Sources and Assumptions for the 2006 Update

In the following, a brief description of the data used for the updated CO₂ reduction estimate is given for each action.

2.1.1 Industrialized Countries

The first part of Section 2.1 describes the implementation achievements for commitments of industrialized countries in the order of their 2-letter country code.

AT

Austria reported in details on the status of implementation of its action *klima:aktiv* (www.ren21.net/iap/commitment2.asp?id=23) and gave explicitly data for the CO₂ reduction achieved until end of 2005. As Austria is a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action until 2012 is non-additional.

AU

Australia provided its own data for CO₂ reduction in its information on the status of implementation (www.ren21.net/iap/commitment2.asp?id=20). The action included here is the Mandatory Renewable Energy Target.

⁴ The methodology used is described in the Annex to this report.

BE

Belgium did not report progress on the status of implementing its action *Green Certificates/ Guaranteed Minimum Price* (www.ren21.net/iap/commitment.asp?id=27), so that an estimate was made here, assuming that 50% of the target (+5%-points increase in renewable electricity until 2010) are achieved. As Belgium is a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action is non-additional.

CA

Canada did not report progress on the status of implementing its actions *Wind Power Production Incentive (WPPI)* and *Renewable Energy Deployment Initiative (REDI)* (www.ren21.net/iap/commitment.asp?id=37). As the actions' targets were to deploy RE investments in a 5-year timeframe and some of the investments have been made already, it is estimated here that 10% of the actions are already implemented. As Canada is a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action is non-additional.

CH

Switzerland reported progress in the action *Promoting Market Penetration of Renewables and Renewable Transport Fuels* (www.ren21.net/iap/commitment2.asp?id=122), but did not report quantitative results. From statistical data and other information, it was estimated here that 5% of the action's CO₂ reduction potential is already implemented. As Switzerland is a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action until 2012 is non-additional.

CY

Cyprus did not report on the implementation status of its action *Promotion of Renewable Energy Sources, 2002-2010* (www.ren21.net/iap/commitment.asp?id=47). It was estimated here that 20% of the action's CO₂ reduction potential is already implemented. As Cyprus is a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action until 2012 is non-additional.

CZ

The Czech Republic reported in detail on the progress in implementing its *Renewable Energy Plan* (www.ren21.net/iap/commitment2.asp?id=48), and also gave data for the CO₂ reduction achieved from that in 2005. As the Czech Republic is a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action until 2012 is non-additional.

DE

Germany reported on the status of implementing its action *offshore wind energy* (www.ren21.net/iap/commitment2.asp?id=78) which is delayed due to technical and administrative reasons, so that nearly no CO₂ reduction is achieved yet. On its further action on implementing its *Renewable Energy Sources Act (EEG)* (www.ren21.net/iap/commitment.asp?id=81), Germany did not reported progress, but from statistical data provided by the German government on electricity generation from renewable energies, the results of the action was estimated here. As Germany is

a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action is non-additional.

ES

Spain did report in detail on the progress in implementing its action *Support of Renewable Energy Sources* (www.ren21.net/iap/commitment2.asp?id=117), but did not specify quantitatively the results until the end of 2005. From statistical data and other information, it was estimated here that 30% of the action's CO₂ reduction potential are already implemented. As Spain is a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action is non-additional.

EBRD

The European Bank for Reconstruction and Development reported on progress on its *Action Plan for Renewable Energy* (www.ren21.net/iap/commitment2.asp?id=144), indicating 80 GWh of additional RE electricity generation until the end of 2005. From that, the CO₂ reduction was calculated here.

EIB

The European Investment Bank reported on progress on its *Climate Change Initiatives* (www.ren21.net/iap/commitment2.asp?id=148), but did not quantify the results so far. The EIB also reported on its action *Renewable Energy Lending Objectives* (www.ren21.net/iap/commitment2.asp?id=146) and indicated the CO₂ reduction achieved until end of 2005.

FR

France did report on progress on its *New French Energy Law* (www.ren21.net/iap/commitment2.asp?id=65), but without indicating quantitative results. From statistical data, it was estimated here that 10% of the action's CO₂ reduction potential are already implemented. As France is a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action is non-additional.

IT

Italy did report on progress on its *National Programmes on Renewables* (www.ren21.net/iap/commitment2.asp?id=87) but without indicating quantitative results achieved so far. It was estimated here that 10% of the action's CO₂ reduction potential are already implemented. As Italy is a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action is non-additional.

JP

Japan reported on its action *Renewable Portfolio Standard (RPS) Law* (www.ren21.net/iap/commitment2.asp?id=92), indicating that 4.5 TWh of renewable electricity was generated already in 2004, and more investments are underway until 2006. From that it was estimated here that 50% of the action's CO₂ reduction potential was achieved until the end of 2005. As Japan is a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action is non-additional.

NO

Norway reported progress on implementing its action on *hydropower* (www.ren21.net/iap/commitment2.asp?id=104), and explicitly indicated additional electricity production and resulting CO₂ reductions until the end of 2005. As Norway is a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action until 2012 is non-additional.

NZ

New Zealand reported on its action *Projects to Reduce Emissions* (www.ren21.net/iap/commitment2.asp?id=100) and directly specified the CO₂ reduction achieved until the end of 2005. As New Zealand is a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action is non-additional.

UK

The United Kingdom reported on progress in implementing its actions on *energy efficiency* (www.ren21.net/iap/commitment2.asp?id=128) and on the *Renewables Obligation* (www.ren21.net/iap/commitment2.asp?id=129). As no quantification of the CO₂ reduction achieved until the end of 2005 was given, it was estimated here that 20% of the full potential has been implemented already. As the UK is a Party to the Kyoto Protocol, the CO₂ reduction resulting from the action is non-additional.

USA

The United States of America have reported on progress on implementing several of the actions submitted (see www.ren21.net/iap/iap.asp?ActorRegion=191&TargetRegion=0&ActorType=0&ActionType=0&Technology=0), but did not quantify the resulting CO₂ reduction potential⁵. From the information given, it was estimated here that the actions achieved an additional RE electricity generation of 7,500 GWh and a resulting CO₂ reduction of 7,1 million t at the end of 2005.

2.1.2 Developing and Newly Industrializing Countries

Argentina

Argentina made several commitments, with the 8% share of renewables in power consumption being quantifiable. National reporting on this action (www.ren21.net/iap/commitment2.asp?id=18) indicates progress regarding the legal requirements for implementation, and quantitative targets were developed regarding newly installed RE capacities until 2010. From that, it was estimated here that 10% of the target has been achieved already.

Brazil

Brazil reported on the status of implementing its actions *PROFINA Biodiesel* (www.ren21.net/iap/commitment2.asp?id=33),

⁵ Information on the status of the action on geothermal electricity given by the USA (www.ren21.net/iap/commitment2.asp?id=134) noted a CO₂ reduction of 160 Mt/a, based on a 20 MW plant, and several plants under construction. The CO₂ figure must be erroneous and is not included here.

(www.ren21.net/iap/commitment2.asp?id=36) and *Wind in North East Brazil* (www.ren21.net/iap/commitment2.asp?id=205), but did not provide data on the CO₂ reduction achieved so far, and no information on the action *Light for all* (www.ren21.net/iap/commitment.asp?id=34). From the information given it was estimated here that 50% of the overall PROFINA and biofuels reduction potential has been achieved already until the end of 2005, while for the wind action, no reduction was assumed for that timeframe.

China

The People's Republic of China reported in detail on the status of implementing its *National Renewable Energy Development Strategy and Plan* (www.ren21.net/iap/commitment2.asp?id=43), and gave data on the additional electricity generation from renewables, and CO₂ reduction from the action achieved until the end of 2005. The actions concerning biofuels, and the use of renewables for heat have not been part of the monitoring so far, so that no estimate is given here.

Egypt

The status of implementing Egypt's action to meet 14% of Egypt's electricity demand in 2020 by renewables (www.ren21.net/iap/commitment.asp?id=17) has not been reported, but from statistical data and other information it seems to be well underway with the massive investments in wind energy systems, and the growing interest in concentrating solar power systems. As Egypt did not formally report any progress, it was estimated here that 13% of the overall CO₂ reduction potential has been achieved until the end of 2005.

Iran

Iran provided information on the status of implementing its action *National Renewable Energy Masterplan* (www.ren21.net/iap/commitment2.asp?id=86), indicating that 5% of the overall target has been achieved until end of 2005. From that, the resulting CO₂ emission reduction was calculated here.

Jordan

Jordan reported on the status of implementing its action *Accelerating the Development of Renewable Energy* (www.ren21.net/iap/commitment2.asp?id=93), but did not indicate the resulting CO₂ reduction. From the information provided, it was estimated that 5% of the overall CO₂ reduction potential was achieved until the end of 2005.

Mexico

Mexico provided detailed information on the status of implementing its action *Renewable Energy Initiative* (www.ren21.net/iap/commitment2.asp?id=95), and also indicated the additional capacity in renewable electricity generation, and the resulting CO₂ emission reduction achieved until the end of 2005.

Morocco

The status of implementing Morocco's action *Renewable Energies Action Plan* (www.ren21.net/iap/commitment.asp?id=96) has not been reported, but from other information it seems to be well underway with the massive investments in wind energy

systems, and interest in concentrating solar power systems. It was estimated here that 10% of the overall CO₂ reduction potential has been achieved until the end of 2005.

Pakistan

Pakistan reported in detail on the status of implementing its action *Renewable Energy Initiatives* (www.ren21.net/iap/commitment2.asp?id=106), but did not provide a figure for the achieved CO₂ reduction. From the information given it was estimated here that 5% of the overall CO₂ reduction potential has been achieved until the end of 2005.

Philippines

The Philippines did not report on the status of implementing its action *Doubling the Generating Capacity from Renewable Energy Sources by 2013* (www.ren21.net/iap/commitment.asp?id=108), so that it was estimated here that 10% of the overall CO₂ reduction potential has been achieved until the end of 2005.

Senegal

The status of implementing Senegal's action *National Strategy for Renewable Energy Development for Poverty Alleviation* (www.ren21.net/iap/commitment.asp?id=111) has not been reported, so that it was estimated here that 10% of the overall CO₂ reduction potential has been achieved until the end of 2005.

South Africa

South Africa reported on its various actions (www.ren21.net/iap/iap.asp?ActorRegion=165&TargetRegion=0&ActorType=0&ActionType=0&Technology=0), but did not specify any resulting renewable energy production, or respective CO₂ reduction. From the available data, no estimate could be made here.

Tunesia

The status of implementing Tunesia's action on *Wind Energy* (www.ren21.net/iap/commitment.asp?id=123) was not reported. From the information on the action it was concluded that no CO₂ reduction was achieved until the end of 2005.

Turkey

Turkey reported in detail on the status of implementing its actions on *RE for electricity and Geothermal* (www.ren21.net/iap/commitment2.asp?id=124), but did not provide data on the CO₂ reduction. From the information given it was estimated here that 2% of the overall CO₂ reduction potential has been achieved until the end of 2005.

2.2 Results of the 2006 Update

The following table summarizes the results of the CO₂ reduction achieved through actions under the IAP until the end of 2005.

Table CO₂ Reduction Potential from IAP Implementation (end of 2005)

Country/Initiative	CO ₂ Red. [mio t/a]	electric [GWh _{el}]	non-electric [PJ _{th}]
AT klima:aktiv 2004-2012	1.0		
AU RE target 2010-2020	13.4	15,000	
BE 6% RE el in 2010	0.5	2,364	
CA 1000 MW Wind + 15 mio \$ for RE	0.3	294	
CH RE 1% el. + 3 % th additional 2010	0.1	25	0.5
CY RE-el 10% + RE-all 9% in 2010	0.2	40	1.1
CZ target 8% RE el. in 2010	0.1	-	
DE offshore wind 2010	0.0	0	
DE 20% RE el in 2020	8.2	12,044	
EBRD	0.1	80	
EIB	2.5		
ES +10% RE el. by 2010	16.2	16,973	
FR 21% RE el in 2010 + th	2.0	4,995	
IT	2.8	2,500	
JP RPS for RE	4.2	6,100	
NO wind/EE + RE-th targets 2010	0.6	792	
NZ projects	1.3		
UK Climate Programme	2.0		
USA RE actions	7.1	3,500	
Argentina 8% of power from RE	0.3	650	
Brazil PROFINA 2010	5.3	7,051	
Brazil Light for All 2008	0.7	938	
China RE Plan 2010	13.5	15,000	
Egypt 14% RE in el until 2020	1.4	1,495	-
Iran 500 MW of RE by 2010	0.1	100	
Jordan 5% RE el in 2015	0.0	21	
Mexico RE 8% el. target 2012	0.8	840	
Morocco PV + solar-th + wind 2015	0.2	151	
Pakistan RE el. target 10% until 2015	0.3	412	
Philippines 2x RE by 2013	1.0	1,065	
Senegal 15% RE share by 2025	0.0	37	
South Africa RE-el target 2013	-	-	
Tunesia 300 MW wind by 2011	-	-	
Turkey RE Law	0.8	834	
total EU	34.5	38,997	1.1
total other OECD	26.9	25,711	0.5
total developing countries	24.4	28,594	0.0
quantified total	85.8	93,301	1.6
overall total (estimated for all IAP actions)	100		

Source: calculation by Oeko-Institut (see Appendix)

3 Summary and Conclusions

The total CO₂ reduction achieved from the actions implemented until the end of 2005 is in the order of **86 million tons per year**. If additional CO₂ reductions from actions not quantified here explicitly are considered also, an overall total of **about 100 million tons of reduced CO₂** can be estimated for end of 2005.

This figure corresponds to about 6% of the total CO₂ reduction potential estimated for the full implementation of the IAP until 2015. With just 1.5 years of implementation time (13% of the period until 2015), the end of 2005 results are about 50% of the results one would expect from a linear implementation rate.

This finding should not discourage readers: given the short period of time to implement the IAP actions, the results reflect the slow progress typically for early policy implementation. The next years will show if the rate of implementation can be accelerated so that the majority of the actions will be implemented as planned.

It should be noted that a number of actions imply a CO₂ reduction, but are **non-additional**, as their CO₂ reduction is accounted for under the 1st commitment period of the Kyoto Protocol.

These actions and commitments (especially made by European actors) can be seen rather as a *reconfirmation* of previous commitments, and – though positive by nature - do not contribute as *additional* CO₂ reductions in the timeframe of 2008 to 2012.

Annex: Explanatory Notes

The estimation of the CO₂ reduction resulting from the IAP includes only those actions for which a quantification of direct implementation was possible.

The actions not included here also contribute to CO₂ reduction, e.g., through reducing barriers, raising awareness, reducing specific investment costs, or reducing transaction costs.

The estimation of CO₂ reductions from actions for renewable energy (RE) are based on several key assumptions:

Key assumptions for RE electricity generation

If actions concern the extension of existing or creation of new funds to finance investments in renewable energies, a common leverage factor was assumed for all undedicated funds. Furthermore, a "generic" investment cost factor was used which does not differentiate between RE technologies, countries, or operating conditions.

From the total induced investment and the specific investment cost factor, the total additional RE capacity was derived and then multiplied with a generic utilization rate to determine overall additional RE generation.

If actions concern quantified targets and timetables for countries, e.g. a 10% share of RE in the national electricity generation mix, this was translated into the amount of electricity using the year 2000 baseline generation, and the year 2000 baseline RE generation (if any).

Then the future (e.g. 2010) amount of electricity was computed assuming country-specific growth rates taken from averaged IEA data 2000-2010, and own estimates. Multiplying the 2010 generation figures with the year 2010 target for RE, the 2010 RE generation figure was derived. The net additional RE generation was then computed in subtracting the base year RE generation from the year 2010 RE generation.

If actions concern specified capacity extensions/new capacities, or increases in RE generation for specified RE technologies, these figures were used.

No correction was made for gross or net generation, avoided transmission/distribution losses, increased system services for backup or power firming, etc.

The net additional RE generation was multiplied with a CO₂ emission factor of the avoided future generation for which a marginal plant (or a mix of several) was assumed.

The marginal plant technology and fuel-base (or mix of those) was chosen on country-specific terms. All marginal plants were assumed to be state-of-the-art new plants.

Key Assumptions for RE delivering heat or transport fuels

If actions concern quantified targets for the provision of heat or transport fuels from RE sources, or specified extensions of RE shares, the computation followed the logic for electricity, but used oil heating as the marginal option avoided by RE.

CO₂ emissions for heating oil are quite similar to those of gasoline and diesel, so that this is a good proxy.

Limitations of the Quantification Approach

Some of the actions for RE also cover energy efficiency (EE) investments, and do not give a share. As EE investments reduce the need for additional (marginal) powerplants similar to RE investments, but usually have lower investment costs, the approach to assume all investments to be made in RE is conservative.

As the nature of the RE investments (i.e. which source, technology etc.) usually is not given for fund actions, an estimate on the average specific investment costs was used which may be higher or lower in reality, thus leading to more or less additional RE electricity generation.

The marginal powerplant approach is a good proxy to identify CO₂ reductions - for most developing countries, a new coal-fired steam-turbine powerplant for electricity, and an oil-fired boiler for heat generation were used. In reality, the marginal powerplants might differ in fuel use, and efficiency.

As existing plants usually have lower efficiencies than the new powerplant assumed here, the approach is conservative.