<table>
<tr><td>Short title</td><td>ICF KPI 6: Net Change in Greenhouse Gas Emissions (tCO2e) – tonnes of GHG emissions reduced or avoided

Please note that this methodology had some minor changes made to it in March 2013. These are to allow for the capture of in-year savings and the remaining expected lifetime savings. Please see the data calculation section below.</td></tr>
<tr><td>Type of indicator</td><td>Cumulative (individual years summed to total): report annual in-year totals <u>only</u> against each milestone. These annual in-year totals should then be summed at the end of the results template to give a cumulative total for the current spending review period (2011/15), the life of the programme and where results will occur outside the life of the programme for total programme benefits.</td></tr>
<tr><td>Key reporting requirements</td><td>Below is a list of key reporting requirements to keep in mind when making your returns. Further details are available in the text below:

<table>
<tr><th>Requirement</th><th>Summary</th></tr>
<tr><td>Is this a DRF indicator?</td><td>No</td></tr>
<tr><td>Available for reporting?</td><td>Yes</td></tr>
<tr><td>Methodology changes?</td><td>Yes – minor changes</td></tr>
<tr><td>Units</td><td>tCO2e</td></tr>
<tr><td>Attribution</td><td>Pro-rata share of public funding</td></tr>
<tr><td>Disaggregation to be reported in results templates</td><td>• None, but please report if carbon credits have been obtained or not and if these have been sold.</td></tr>
</table></td></tr>
<tr><td>Technical definition/ Methodological summary</td><td>The indicator will report on the <u>net change</u> in greenhouse gas (GHG) emissions measured in tonnes of carbon dioxide equivalent (tCO_2e), estimated relative to the assumed business as usual emissions trajectory, and will reflect abatement results directly attributable to ICF mitigation and forestry projects over the lifetime of the projects.

<u>Summary of Methodology for the project level indicator:</u>
The net change in GHG emissions is estimated through a simple calculation – it is not a directly observable result. This calculation varies by project type, the three main types being 1) electricity generation, 2) energy efficiency measures and 3) forestry.
The calculation steps are however similar (detailed in worked examples) and involve:
1) Determination of the baseline counterfactual - this is to be outlined in individual project business cases drawing on the DFID GHG guidance methodology (though may be revised if necessary).
2) Estimating the change in activity or fuel consumption owing to the ICF intervention relative to the baseline counterfactual
3) Estimating the net change in GHG emissions through the application of an emissions intensity factor to the activity level data
4) Applying an attribution rule to ensure results report do not overstate or double count where there is project co-financing,
5) Taking into account carbon market interactions.</td></tr>
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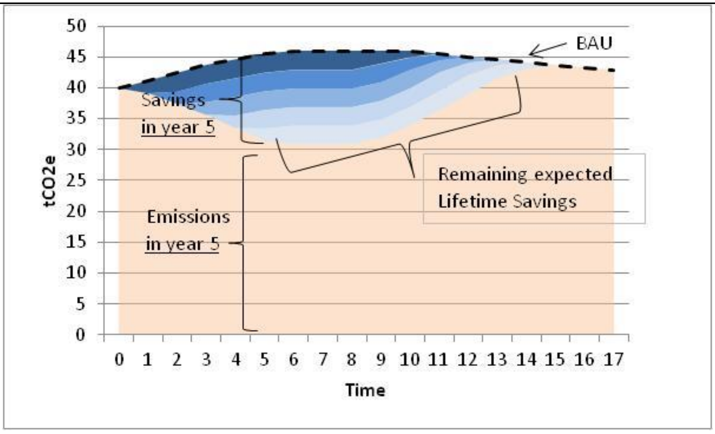
	The indicator will report realised actual net changes in GHG emissions from the intervention, reporting progress by each year of the project and providing a forecast for the remaining expected emission savings over the lifetime. **<u>Target results:</u>** The target results for the indicator will be based on expected results from the business case project appraisal – covering the full lifetime of project. The calculation methodology for this is provided in the DFID GHG appraisal guidance. **<u>Definition, Coverage and Disaggregation:</u>** Greenhouse Gas (GHG) emissions refers to the **'Kyoto basket' of greenhouses gases (GHGs)** which includes all carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), Hydrofluorocarbons (HFCs) , Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF_6) emissions. The indicator will report GHG emission impacts from **all activities within a given territory (production emissions)**. This is consistent with the methodology used by the Intergovernmental Panel on Climate Change (IPCC) for estimating national GHG emissions. This will not capture life-cycle impacts or consumption emissions that fall outside the individual country. In this regard, we recognise that this indicator may not comprehensively capture the full emissions impact. The indicator will cover **all sectors of the economy**, including changes in net emissions from Land-Use, Land-Use Change and Forestry (LULUCF) – and results will be disaggregated by each sector, allocated by source and defined by the UNFCCC Inventory Categories.

UNFCCC Categories
Energy Supply
Industrial processes
Business
Public
Residential
Transport
Agriculture
Waste management
Land Use, Land Use Change and Forestry (LULUCF)

For the Low Carbon Development theme results will predominately be reported under the energy supply sector from changes in power generation and electrical energy efficiency improvements, or emission savings from energy efficiency measures in the industrial, business, residential or transport sectors.

For the Forestry theme results will be reported under the LULUCF and Agriculture sector and will capture changes in emissions from deforestation and forest degradation, forest conservation, sustainable management of forests and enhancement of forest

	carbon stocks (REDD+).
Rationale	A key priority of the ICF is to demonstrate low carbon development is feasible and to achieve emission reductions. Monitoring the level of emissions abated from ICF projects is a key indicator of progress and results of direct action on the ground.
Reporting Organisation	HMG Project Managers
Country office role	**For Bilateral projects** - country offices will be required to report throughout programme implementation. This information ought to be generated in any case as part of their corporate compliance responsibilities. DFID CED will also seek support from EvD in quality assuring the data received. **For projects delivered through MDBs and others** – reporting will draw on their results frameworks and annual reviews.
Data source	Individual project data.
Data included	Estimated lifetime emission savings, derived from activity data including land use data in the case of forest projects, fuel savings data (where applicable) and emission factors.
Formula/Data calculation (including attribution rule)	**Calculation** The indicator will report realised actual net changes in GHG emissions from the intervention, reporting in year progress for each year of the project and providing a forecasts for the remaining expected emission savings over the lifetime. For example: • Project year 1 results = tCO_2e avoided in year 1 from clean capacity or energy efficient technologies installed in first year of project • Project year 2 results = tCO_2e avoided in year 2 from clean capacity or energy efficient technologies installed in first and second year of project. • … … • Project year 5 results = tCO_2e avoided in year 5 from clean capacity or energy efficient technologies installed in first and second year of project (illustrated by in diagram below). • Remaining expected lifetime results = expected tCO_2e avoided from clean capacity or energy efficient technologies installed over lifetime of project, minus results pre-reported (illustrated in diagram below for post year 5).



Similarly, for forestry projects, the indicator will report in year savings and the remaining expected lifetime tCO_2e avoided, including through sequestration. The lifetime for a forestry project is more difficult to establish than for some LCD projects, as there is a greater risk of non-permanence. For example, a forest preserved through an HMG intervention in year 1 may be cut down in year 3. The lifetime of a project should be estimated in the business case appraisal and, if necessary, be re-assessed during project implementation. Any increases in emissions (reversals), should be recorded in the evaluation, whether they are natural (e.g. forest fire) or anthropogenic (e.g. poor forest management).

Net change takes into account emission increases as well as savings owing to an intervention - capturing direct rebound effects (which occur when people use some of the financial savings they have gained from the improved energy efficiency to purchase more energy, or when people increase forest clearance because of an increase in the return to alternative land uses, for example). Indirect rebound effects from an intervention may also arise – however the ability for individual projects to capture this impact will be limited and so this indicator will not aim to capture these impacts.

Calculation

For energy related emission savings: the net change in GHG emissions is calculated from net changes in fossil fuel consumption relative to the baseline. Energy use is converted into a corresponding amount of CO_2e by multiplying fuel use (in kWh, therm, tonne or litre) by a fuel-specific (and unit specific) marginal emission factor.

GHG emissions factors represent values that attempt to relate the quantity GHG released into the atmosphere with an activity associated with the release of that pollutant. These factors are usually expressed as the weight of GHG divided by a unit weight or volume of fossil fuel.
For directs fuels the emission factors are scientific, related to the carbon content of the fuel, and vary by fuel and country.

Δ Emissions = [Δ fuel x Marginal Emission factor (defined by fuel)]

For most projects estimates of fuel savings will be directly derived from estimates of changes in activity or technology uptake and an average associated change in fuel.

In the case of electricity generation projects a generation emission factors can be applied directly to activity levels, avoiding fuel savings and individual emission factors to be explicitly estimated and applied.
Δ Emissions = [Δ generation by fossil fuel x Marginal Emission factor]

For electricity, the emission factor reflects the carbon intensity of electricity generation and depends on the generation displaced.

- *The Operating Margin Emission Factor (OMEF) should be used to estimate emissions savings where the proposed project is likely to displace electricity generation from existing in-country power plants.*
- *The Build Margin Emission Factor (BMEF) should be used to estimate emissions savings when the proposed project is likely to displace electricity that would otherwise need to come from building new power plants.*

These emission factors and more information can be found in the DFID GHG appraisal guidance.

The target results for the indicator will be based on expected changes in fuel consumption and emissions from the business case project appraisal – covering the full lifetime of project. The calculation methodology for this is provided in the DFID GHG appraisal guidance.

For forest related emission savings: the net change in GHG emissions is calculated from net changes in land use relative to the baseline. Land use is converted into a corresponding amount of CO_2e by multiplying land use (in hectares) by a specific emission factor. *(See paragraph above for definition of emission factor.)*

Land use emission factors vary by vegetation type (e.g. dry forest), climate (e.g. tropical), soil type (e.g. acidic) and forest condition (e.g. no degradation, low degradation). The latter is important for measuring the impact of projects that reduce forest degradation.

The monitoring of emission savings of a forest project is likely to involve three types of calculation:

1. Where the forest type remains the same but its quantity has changed e.g. in an afforestation project:

   Δ Emissions = [Δ forest land area x emission factor]

2. Where the quantity of forest remains the same but its condition has changed e.g. in an anti-degradation project:

   Δ Emissions = [forest land area x emission factor x Δ degradation multiplier]

One driver of forest degradation is illegal logging. To capture the change in emissions from a project that addresses illegal logging, wood-balance and import-source analyses should both be used.

3. In addition, the method of land use *change* should be taken into account. For example, deforestation through fire releases more GHGs than deforestation through felling.

Assumptions underpinning these calculation steps should be determined and outlined in the project appraisal for the business case. The DFID GHG appraisal guidance provides further information and guidance.

The UN maintains a spreadsheet tool that may be used for these calculations. It is freely available online at: http://www.fao.org/tc/exact/ex-act-tool/en/

The tool is set to default IPCC Tier 1 emission factors, but users can enter their own emission factors if they have local information. The spreadsheet covers afforestation, deforestation, and degradation, as well as farming and agriculture. A data preparation sheet is also available to help with the fieldwork, but note that it does not include degradation.

Alternatively, project evaluators can perform their own calculations, as long as they are consistent with IPCC methodologies and the DFID appraisal guidance.

As with LCD projects, the target will be based on the business case project appraisal.

Attribution:

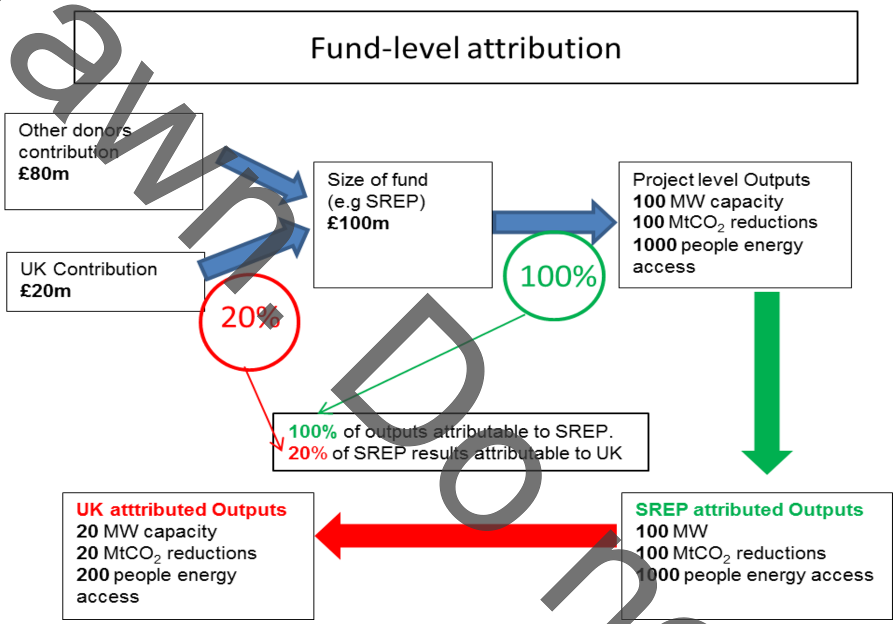
Where HMG are only funding part of the project, benefits (tCO2e) should be calculated as a pro-rata share of public funding. For example, if we are funding 10% of a project that reduces GHG by 100 tCO2e, we should claim that 10 tCO2e of these reductions as attributable to DFID.

For an individual project there may be a rational to deviate from this rule – for example if UK funds have with certainty leveraged in more financing. Any attribution methodologies that diverge from the simple pro-rata rule above need to be approved in the business case for an individual project and flagged in the ICF results template when reporting.

Fund-level attribution (i.e. at point of UK investment) should be applied for reporting expected and actual results and headline results/figures used in Business Cases (to ensure all projects can report on a consistent basis). This method involves sharing results across all donors that contribute to a fund. All results are attributable to the relevant fund (e.g. CIFs, CP3, GAP) regardless of whether these funds blend with other sources of finance in implementing projects at levels below the point of UK investment. For example, if the UK invests £25m into a fund that totals £100m of public money, the UK would claim 25% of the results from that investment. This applies to all results.

The long term ambition is to develop the data availability to enable all projects to use the lowest/most direct level of attribution possible in the future (i.e. project level). Therefore, advisers should be working to develop sufficient data to calculate project level results reports, and where possible, provide this information now alongside headline Fund level results.

To note, the distinction between attribution at the project level and at the Fund level (or at point of UK investment) is only an issue where the UK is investing in funds where there are multiple investment levels.The long term ambition is to use project level and not fund level attribution, therefore advisers should be working to have all the necessary data to calculate this information and calculate it, however it will not be reported in this results collection.



Carbon Market Interactions:

The sale of project CDM credits diminishes the attributable direct GHG mitigation benefits. A project should separately report the sale (or purchase) of international carbon units – for example volume of credits (tCO_2e) issued and sold under the Clean Development Mechanism.

Worked Example

Increase in uptake of energy efficient appliances Example;

Energy Efficient light bulbs replacing inefficient light bulbs

Δ Emissions = [Δ fuel x Marginal Emission factor (defined by fuel)]

Step 1: Estimate Change in Fuel Consumption

Δ fuel ~ Δ Energy Efficient Bulbs installed from project x average fuel saving per bulb

	Project installs 10,000 energy efficient bulbs in a single year which require 33% less electricity than inefficient bulbs - the energy efficient bulbs are 80 Watts, the inefficient bulbs 120 Watts (the counterfactual, which is assumed to remain static overtime). An average household lights their home for 5 hours a day, 365 days per year and the bulbs last 5 years. To estimate year 1 results: Δ fuel ~ Δ bulbs installed in year 1 x (fuel saving per Watt/Hour) x av. lighting hours/day x No. lighting days Δ fuel ~ 10,000 x (120Wh – 80Wh) x 5 hours/day x 365 x 5 Δ fuel ~ 10,000 x 40Wh x 5 hours = 10,000 x 200Wh = 2,000,000Wh = 2MWh/day x 365 x5 This assumes that all light bulbs distributed are installed and used, and that there is no rebound effect – i.e. no increase in lighting hours, or no increase in other fuels (i.e. increase in heating demand or reductions in cooling demand due to the heat replacement effect[1]). Consideration of these factors and refining the calculation as more is learnt about the effectiveness of the intervention will be required to reflect the best estimate of the impact. <u>Step 2: Select Emission Factor and Estimate Change in Emissions</u> GHG emissions factors for electricity depend on the electricity generation assumed to be displaced. In this example we assume the electricity displaces new build. For Asia the average new build emissions factor is 0.68tCO2 per MWh. (Source: DFID Appraisal Guidance) Δ Emissions Year 1 = 2MWh/day x 0.68tCO2 per MWh x days x years = 1.36 tCO2/day x 365 x5 = 496 tCO2e p.a. x5 = <u>2482 tCO2e</u>
	<u>New Power Generation Example</u>; **Solar power displacing baseline generation** Δ Emissions = [Δ generation x Marginal Emission factor] <u>Step 1: Estimate Change in Generation</u> Δ generation/day ~ Δ MWh/day generated by New Capacity - Δ MWh/day Baseline generation displaced In this example, 10,000 MW of new solar capacity in a single year is installed and has no emissions footprint (for simplicity we assume 100% load factor so capacity=generation). There is no emission impact from increased solar per se as there is no increase in fossil

[1] Electrical appliances and lighting in the home give out heat when they are switched on or on standby. In heated living spaces, some of the heat they give out contributes to the warmth of the building. If you install more efficient appliances, or use the appliances less often, then the amount of waste heat is reduced. The temperature inside the building can only be maintained by adding heat from another source, or reducing cooling. This is known as the Heat Replacement Effect.

fuel generation, Δ fossil fuel = 0, therefore:
Δ fossil fuel generation ~ - Δ MWh baseline generation displaced

Emission savings however arise if the new capacity displaces fossil fuel generation. To estimate - an assumption is required on the degree to which new generation displaces the baseline generation, and to what extent the generation is additional and increases electricity generation per se.

In this example it is assumed that of the new generation - 80% displaces the baseline, 20% is additional.
Δ fossil fuel generation/day ~ - Δ 8,000 MWh/day baseline generation displaced

<u>Step 2: Select Emissions Intensity of Generation (emission factor) and Estimate Change in Emissions</u>
Δ emissions/day ~ - Δ 8,000 MWh/day baseline generation displaced x Marginal Emission factor

GHG emissions factors for electricity depend on the electricity generation assumed to be displaced. In this example we assume the electricity displaces new build coal generation.
For Africa the average new build coal emissions factor is 0.81tCO_2 per MWh. (Source: DFID Appraisal Guidance)

Δ Emissions/year = 8,000MWh/day x 0.81tCO_2 per MWh x 365 = 6480 tCO_2/day x 365

<u>Forestry Example</u>; reducing forest degradation in the Congo Basin

The project reduces degradation on 100 hectares of forest land. It is assumed that the project has a permanent effect.

Step1: Estimate the change in the level of degradation:

In this example, a qualitative assessment is made that there would have been 'extreme' degradation without the project. The associated degradation multiplier is 0.2. After the project, there is 'very low' degradation. The associated degradation multiplier is 0.9.

Step 2: identify relevant emission factors:

In this example, the project is working with type 1 forest, in a tropical moist climate in Africa, with HAC acidity soils. The emission factors are:
biomass (below and above ground): - 745tCO_2/hectare
soils: - 240tCO_2e/hectare
total: -985tCO_2e/hectare

Note - the emission factors in this example are negative because forests are generally a sink of GHGs.

	Step 3: calculate emission saving: Δ Emissions = [forest land area x emission factor x Δ degradation multiplier] x years Δ Emissions = 100ha x (- 985tCO2/ha) x (0.9-0.2) x years Δ Emissions = -68,950tCO2e x years The treatment of time is not straightforward for forest projects, as the rate of forest growth and decay is non-linear, and varies by forest type. This has an impact on emissions. Hence it is best to use the UN spreadsheet tool described above, as the tool is programmed to take account of varying rates of growth and decay.
Most recent baseline	The baseline should reflect the situation prior to ICF funding being provided and anticipated projections of what would happen without the ICF. For long running programmes the baseline should be taken as 2010 unless otherwise stated. The baseline should align with the economic appraisal in the project design.
Good performance	Achievement of target / expected results with no concerns of leakage, non-permanence (for forest projects) or significant rebound effect.
Return format	Absolute volume of greenhouse gas emissions reduced or avoided (tCO2e). Further disaggregation required as listed below.
Data dis-aggregation	<u>Data to be disaggregated as part of workings and Quest number provided:</u> Disaggregation of the following variables will not be collected as part of the ICF results template. Please include disaggregated data in your working documents and record the Quest number for these documents in the ICF results template. 1. Absolute volume of additional tonnes of GHG avoided/saved (tCO_2e) by sector, including: Energy Supply, Industrial processes, Business, Public, Residential, Transport, Agriculture, Waste management, Land Use, Land Use Change and Forestry (LULUCF). 2. Absolute volume of CDM credits (CERs) accreditation received (tCO_2e). 3. Absolute volume of CDM credits (CERs) cancelled (tCO_2e). 4. Absolute volume of CDM credits (CERs) sold (tCO_2e). **<u>Please note</u>**: it is a <u>mandatory</u> requirement to list whether any carbon credits have been obtained or not. If they have, please also record whether these have been sold or not. There is a pull down box below the KPI title in the ICF results template where you can record these answers.
Data availability	It should be possible for country offices and multilateral partners to report at least annually (to inform Annual Output to Purpose Reviews). CED will collate this information annually.
Time period/ lag	This will have to be worked through with country offices and multilateral partners. A time lag may be necessary to receive realise results, but in the interim expected results should be used.
Quality assurance	Methodologies will be scrutinised in the economic appraisal of projects at the Business case stage.

measures	We anticipate that there will be 3 layers of QA: country offices, CED, and EvD. If reporting officers have any concerns about the quality of data or any points that they think CED should be made aware of, then please note this in the ICF results template. Any comments can usually be added into the free text columns on the far right of each ICF results template. Further guidance should be available in the commissioning note.
Data issues	There may be varying degrees of quality of data, from data generated by large DFID projects with good quality, to that produced by multilateral partners with their origin in government partners' data systems, which is likely to be lower quality. For forest projects, the high cost of monitoring can pose a constraint on data collection. Satellites and remote sensing technologies are not always available, and forest surveying is highly labour intensive. As a result, detailed data may be unavailable for projects covering large or hard-to-access areas. It may also be difficult to assess and capture the full extent of spillover effects and leakage of emissions outside the scope of a project or country boundaries.
Additional comments	n/a
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