

# **Prioritization of Climate Change Adaptation Options**

## **The Role of Cost-Benefit Analysis**

### **Session 4: Using the Social Cost of Carbon in Cost-Benefit Analysis**

**Accra (or nearby), Ghana  
October 25 to 28, 2016**

## Outline of presentation



*Empowered lives.  
Resilient nations.*

- 1. Definition of Social Cost of Carbon (SCC)**
- 2. Overall approach and steps in estimating the SCC**
- 3. The role of integrated assessment models (IAMs)**
- 4. Value of SCC in selected MDBs**
- 5. Using national or global SCC?**

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## Definition of SCC



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**The SCC is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year.**

**It is generally measure as a \$ value per ton of CO<sub>2</sub> or per ton of CO.**

**Simultaneously, it serves as an estimated of the gain (benefits) resulting from the mitigation of carbon (where the benefit is measured as a \$ value per ton of CO<sub>2</sub> or per ton of CO).**

### **More technically:**

**It is the marginal external cost of a unit of emission of CO<sub>2</sub>, measured in terms of foregone consumption based upon the damages inflicted by that emission upon society through additional climate change.**

## Definition of SCC



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**It is meant to include (but is not limited to):**

- **Impacts on net agricultural productivity**
- **Impacts on human health**
- **Impacts on property damages from increased flood risk**
- **Impacts on ecosystem services**

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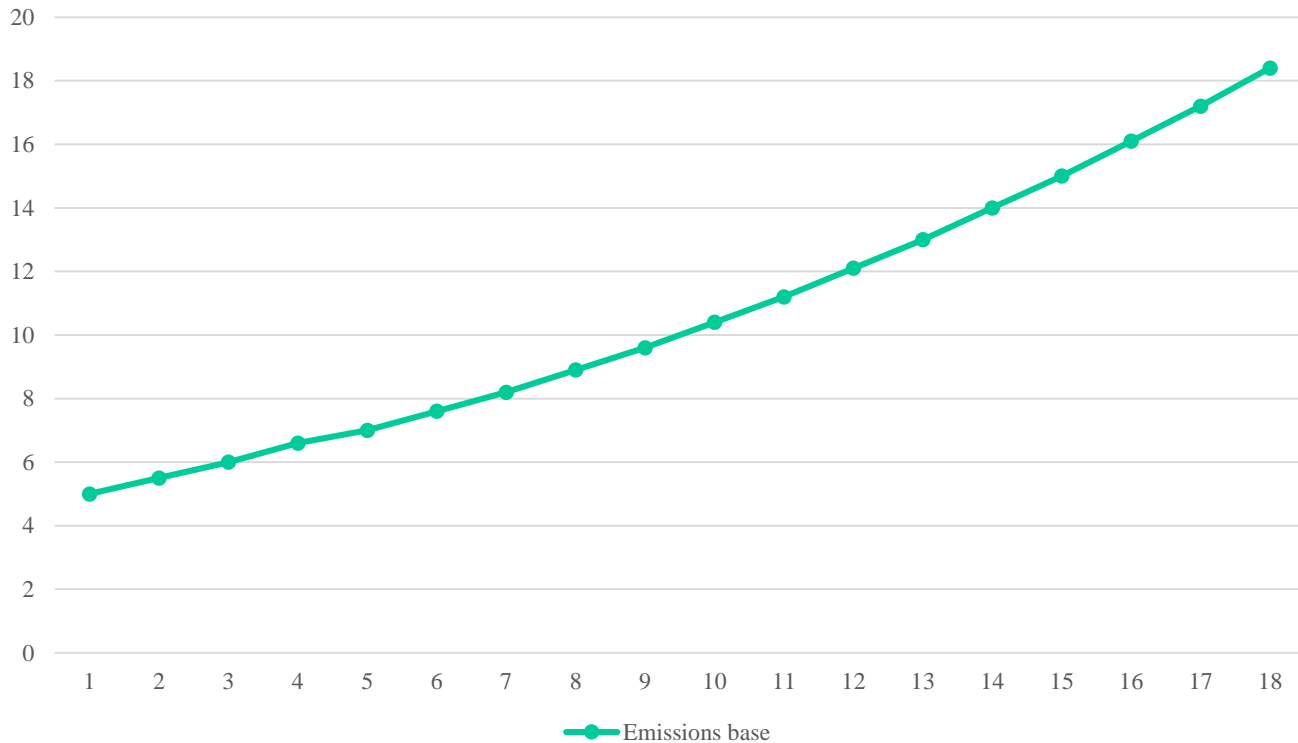
# Approach and steps in estimating the SCC



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## Overall approach:

Emissions and Consumption

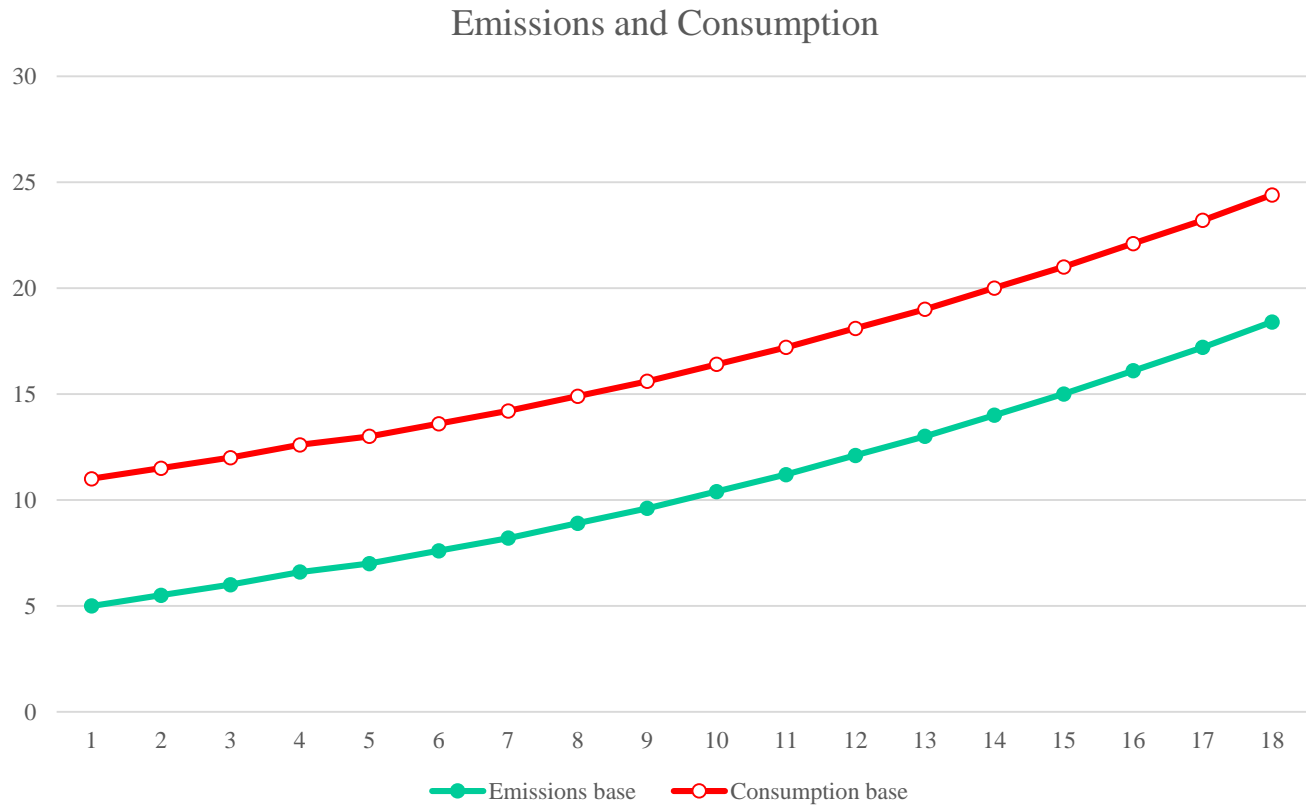


# Approach and steps in estimating the SCC



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## Overall approach:





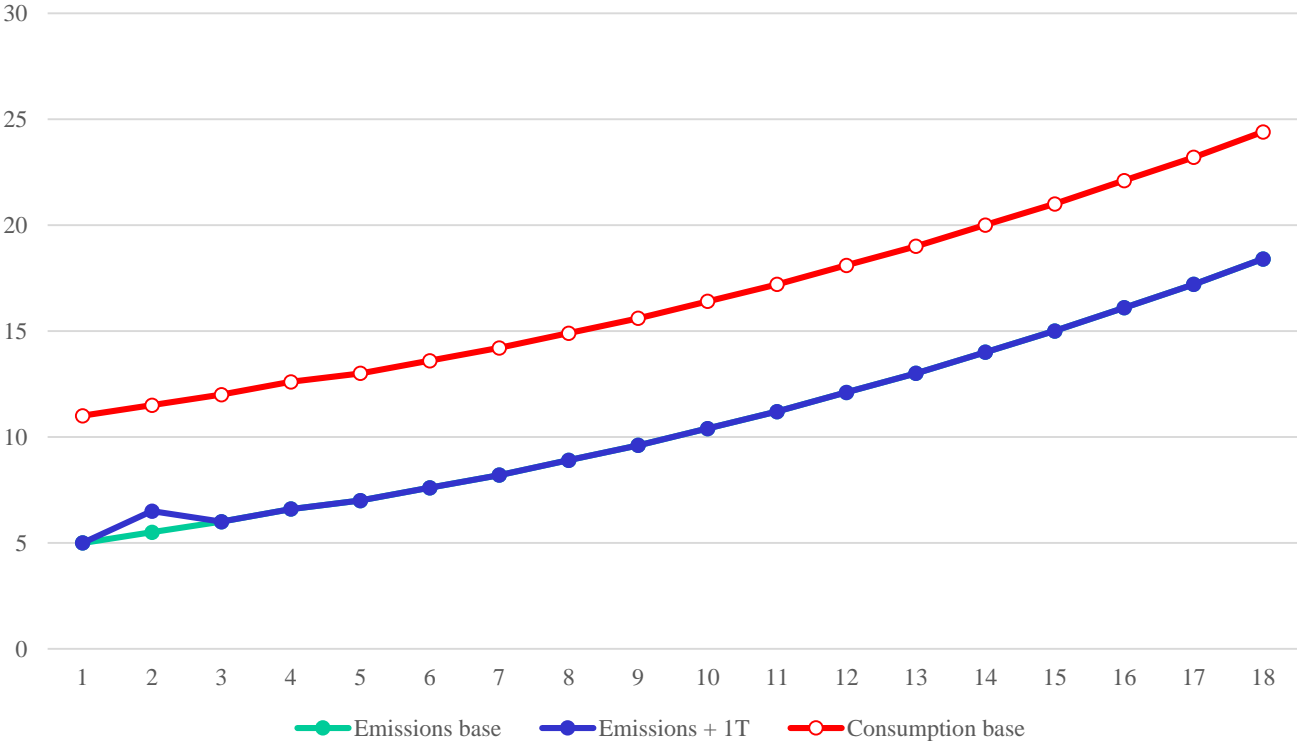
# Approach and steps in estimating the SCC



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## Overall approach:

Emissions and Consumption



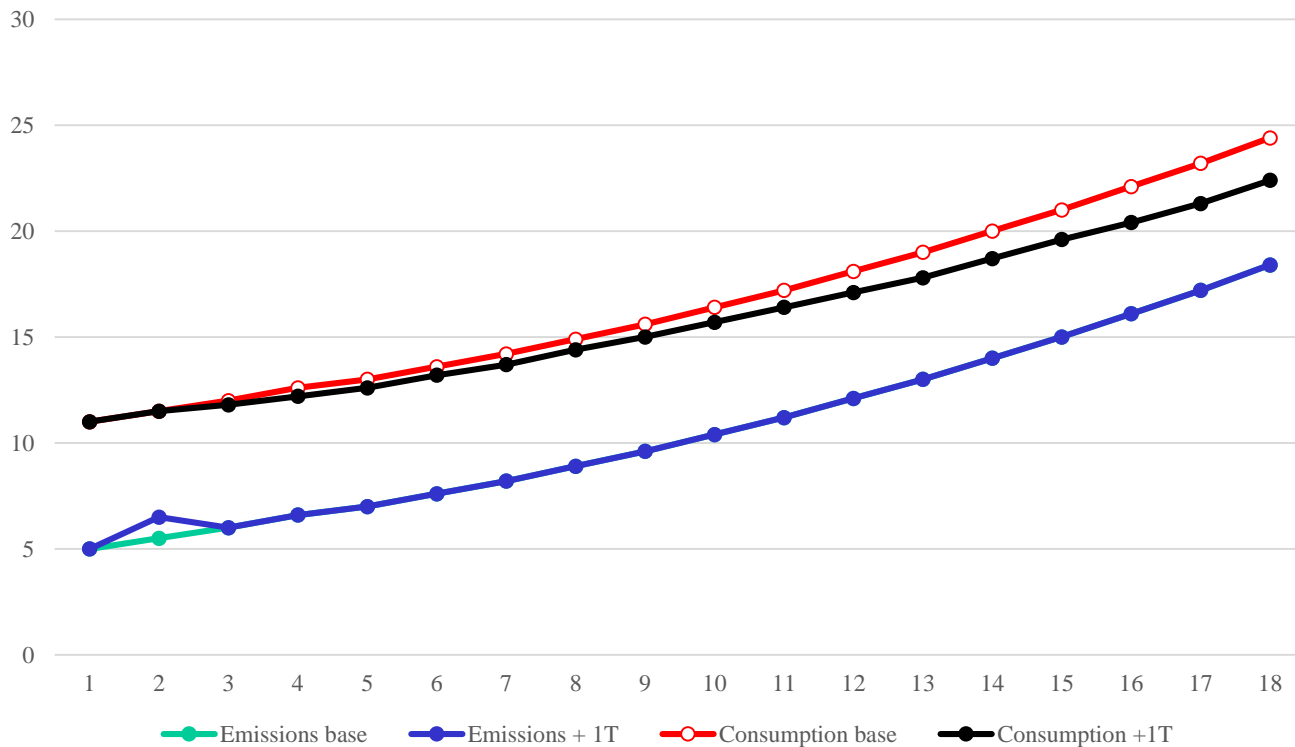
# Approach and steps in estimating the SCC



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## Overall approach:

Emissions and Consumption



**The SCC is the present value (to Year 2) of the difference between “Consumption base” and “Consumption + 1T”.**

# Approach and steps in estimating the SCC



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## Steps:

### Step 1:

**Project a future path of GHG emissions (assumptions about population growth, GDP, technology development and adoption, etc.)**

### Step 2:

**Translate this path of GHG emissions into alternate scenarios of climate change. Do the same for a projected path of GHG emissions which add 1 ton of carbon in any given year.**

### Step 3:

**Estimate physical impacts of climate change on humans and ecosystems.**

### Step 4:

**Monetize these impacts and discount.**

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# Role of IAMs



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**IAMs do all 4 steps.**

## **3 IAMs:**

**DICE (Dynamic Integrated Climate Change and Economy; W. Nordhaus)**

**PAGE (Policy Analysis of the Greenhouse Effect; C. Hope)**

**FUND (Climate Framework for Uncertainty, Negotiation, and Distribution; R. Tol)**

## **These IAMs differ in terms of:**

- **The way they transform changes in temperature into changes in consumption and investment. For example, GDP is endogenous in DICE but not PAGE and FUND.**
- **PAGE and DICE includes the possibility of catastrophes, not FUND.**
- **PAGE and FUND allows for some form of adaptation, not DICE.**

# Role of IAMs



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## Known limitations of IAMs:

- **Incomplete treatment of non-catastrophic impacts**  
For example, the impacts (and costs) of ocean acidification are not included in IAMs.
- **Incomplete treatment of potentially catastrophic impacts**  
For example, the impacts (and costs) of massive loss of ice sheets and re-organization of ocean circulation are not included in IAMs
- **IAMs are calibrated over a relatively narrow range of observed temperatures (around 2.5C). Very crude extrapolation of damages to higher degrees of warming.**
- **Incomplete treatment of adaptation and technological change.**

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## Value of SCC in selected MDBs



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### Comparison

**SCC used by different agencies (\$/t CO<sub>2</sub>)  
(all measured in \$2015 – using GDP deflator)**

	<b>EIB</b>	<b>EBRD</b>	<b>US IWG</b>	<b>World Bank</b>
<b>2015</b>	<b>27.0</b>	<b>35.3</b>	<b>46.4</b>	<b>30.2</b>
<b>2020</b>	<b>29.2</b>	<b>39.7</b>	<b>52.5</b>	<b>35.3</b>
<b>2030</b>	<b>33.7</b>	<b>48.5</b>	<b>63.5</b>	<b>50.4</b>
<b>2040</b>	<b>42.7</b>	<b>59.1</b>	<b>75.7</b>	<b>65.6</b>
<b>2050</b>	<b>60.7</b>	<b>72.0</b>	<b>86.7</b>	<b>80.7</b>

**Given the limitations of IAMs and the extent of the uncertainty, one does not find these values to be fundamentally inconsistent.**



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## Using national or global SCC?



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**In most instances, the population which has standing in a cost-benefit analysis corresponds to the political jurisdiction that is bearing the cost of the policy or investment.**

**In circumstances where a national government bears the cost of a policy or investment, the CBA will include *national* costs and benefits of the policy or investment.**

## Using national or global SCC?



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**In the US: US government guidance (OMB 2003, Circular A-4):**

**“Your analysis should focus on benefits and costs **that accrue to citizens and residents of the United States**. Where you choose to evaluate a regulation that is likely to have effects beyond the borders of the United States, these effects should be reported separately.”**

**In the US: US Executive Order 13563 (of 2011):**

**“Federal agencies should promulgate only such regulations as are required by law, are necessary to interpret the law, or are made necessary by compelling public need, such as material failures of private markets to protect or improve the health and safety of the public, the environment, or the well-being of the **American people**”**

**What to do with greenhouse gases?**

## Using national or global SCC?



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### Recommendations of the Interagency Working Group on SCC:

**“(...) the interagency working group concluded that a global measure of the benefits from reducing U.S. emissions is preferable.”**

**(Interagency Working Group 2013)**

### Rationale:

**“(...) climate change presents a problem that the US alone cannot solve. Other countries also need to take action. The US has been actively involved in seeking international agreements to reduce emissions and in encouraging other nations to take significant steps to reduce emissions.”**

**“(...) to address the global nature of the problem, the SCC must incorporate global damages caused by GHG emissions.”**

## Using national or global SCC?



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### Recommendations of the Interagency Working Group on SCC:

The issue of GHG is the only case in the US where a global benefit of a proposed regulation (as opposed to a domestic benefit) is used in the cost-benefit analysis of regulatory interventions.

The legality of the approach may be challenged.

See Gayer, T. and W.K. Viscusi. 2014. *Determining the Proper Scope of Climate Change Benefits*. The Brookings Institution, Washington, D.C.

## Using national or global SCC?



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**On July 14, 2014, the World Bank issued the following document:**

**Social Value of Carbon in project appraisal  
Guidance note to the World Bank Group staff**

**Let's examine a few excerpts.**

## Using national or global SCC?



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### Social Value of Carbon in project appraisal Guidance note to the World Bank Group staff

**GHG emissions are *global* externalities. As such, we recommend that the economic analysis be done both with and without a social value of carbon.**

**The analysis with the SVC is the most relevant for the WBG, given its role as a global institution; borrowing countries may however want an estimate of the domestic economic costs and benefits only.**

## Using national or global SCC?



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### **Social Value of Carbon in project appraisal Guidance note to the World Bank Group staff**

**Cases may arise where a project is economically viable with the global (positive) externality, but not without – i.e. the project domestic costs are higher than domestic benefits.**

**In such a case, efforts may be made to find additional financing to cover incremental cost of delivering global benefits. The country may also decide to pursue the project for strategic or other reasons.**



## Using national or global SCC?



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### **Social Value of Carbon in project appraisal Guidance note to the World Bank Group staff**

**In particular, carbon market prices appear to bear little relation with the value of climate damages or the carbon price needed to achieve a 2°C target. For this reason, we recommend against the use of carbon market prices for project evaluation at this time.**

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