Climate & Emissions
Impacts of Household Solid Fuel Cooking

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01 May, 2014
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GHG Emissions Growth Accelerates Over Last Decade

Last decade 2000-2010 highest growth rate of last 40 years

Total Annual Anthropogenic GHG Emissions by Groups of Gases 1970-2010

Source: IPCC, WG III contribution to AR5, 2014 doi
Environmental Consequences of Solid Fuels Dependence

- Local forest, land and soil degradation
- CO2 emissions if biomass is non-renewably harvested
- Emissions of non-CO2 GHG and PIC with higher GWP
- Growing evidence of strong climate impacts of black carbon (soot) for arctic and glacial ice melting

Source: Pachauri et al. 2012, Chapter 19 GEA doi
Household Reliance on Solid Fuels

Total Population using solid fuels (%), 2010

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Public Health Information and Geographic Information Systems (GIS)
World Health Organization
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Unequal Distribution of Populations without Access to Modern Energy

>40% of the globe lacks access to clean cooking

>20% of the globe lacks access to any electricity

Source: Pachauri et al. 2013 doi
GEA Scenarios – SFU to Rise by 2030 Without New Policies & Actions

![Population in Billions Chart](chart.png)

- 2005:
  - Rural: 98 billion
  - Urban: 53 billion

- 2030 No new policies:
  - Rural: 82 billion
  - Urban: 13 billion

- Sub-Saharan Africa: 98, 65
- Pacific Asia: 31, 10
- South Asia: 88, 85

Source: Pachauri et al. 2013
SE4ALL Goals for 2030

- **Universal Modern Energy Access**
- **Double rate of Energy Efficiency Improvements**
- **Double Share of Renewables in the Energy Mix**

### 100% Electrification
- **Current Status:**
  - ~20% lack access
  - 30% rural unelectrified
- **Trend 2000-2010:**
  - Global 79% to 83%
  - Rural 57% to 70%

### 100% Clean Cooking
- **Current Status:**
  - ~40% lack access
  - 65% rural without access
- **Trend 2000-2010:**
  - Global 54% to 59%
  - Rural almost unchanged
Latest Findings on Fraction of Non-Renewable Biomass Used for Cooking

- Global fNRB is 27--34%
- Several regional “hotspots” where fNRB > 50%
- fNRB > 80% in only 7 subnational units worldwide

Source: Rob Bailis, Rudi Drigo, Adrián Ghilardia, Omar Masera, 2014
Changes in GHG Emissions Due to Universal Access to Modern Energy (even if access is provided through fossils)

Net Impacts on emissions are negligible if all Kyoto GHGs are accounted for

Source: Pachauri et al. 2013
Eliminating Black Carbon from Cookstoves in India

Black Carbon (BC) from cooking with biomass fuels contributes to > 50% of South Asian BC emissions. These emissions contribute to regional climate change, both in terms of regional temperature increases and Himalayan ice melting.

Source: Ramanathan & Carmichael, 2008
Reductions in Black Carbon Emissions Potential of Cookstove Switching

Source: UNEP 2011 doi

Single most important source of BC emissions reductions

- Replace traditional brick kilns with vertical shaft kilns
- Replace traditional coke ovens with modern recovery ovens
- Switch from traditional biomass cookstoves to stoves fueled by LPG or biogas or to fan-assisted biomass stoves (in developing countries)
- Replace current residential wood burning technologies with pellet stoves and boilers (in industrialized countries)
- Replace lump coal with coal briquettes in cooking and heating stoves
- Elimination of high-emitting vehicles
- Additional reduction from Euro-6/VI vehicle standards (including DPF) after elimination of high-emitters
- Ban of open burning of agricultural residues

Note: for biomass cookstoves, only the effect of substitution with LPG and biogas stoves is shown for clarity; with 100 per cent substitution with fan-assisted biomass cookstoves, the emissions reduction would be about 6 per cent less
Reducing Air Pollution to meet WHO Guidelines Consistent PM Levels

- WHO standards set to minimize health impacts (10 mg/m3 for long-term PM2.5 concentration)
- Recent health estimates for 2012 –
  - >3.5 million premature deaths from outdoor air pollution
  - >4 million premature deaths from household air pollution
- Traditional approaches have been insular i.e.
  - Ambient air quality legislation
  - Climate mitigation
  - Energy access policies
Global PM 2.5 concentrations in 2005

GEA approach:
Emissions inventories (GAINS)
Present and planned legislation (GAINS-MESSAGE)
Energy system changes and climate-pollution policies (MESSAGE)
Atmospheric concentrations and dispersion (TM5/JRC)

Source: Rao, Pachauri et al, 2013 doi
Global PM 2.5 concentrations in 2030
Alternate Scenarios - Baseline

GEA: Baseline and CLE
PM2.5 concentrations (2030)

Source: Rao, Pachauri et al, 2013
Global PM 2.5 concentrations in 2030
CLE + Stringent Climate Policy

GEA:
Stringent climate policy + CLE
PM2.5 concentrations (2030)

Source: Rao, Pachauri et al, 2013
Global PM 2.5 concentrations in 2030
Stringent Air Pollution Policy

GEA: Baseline and stringent air pollution legislation
PM2.5 concentrations (2030)

Source: Rao, Pachauri et al, 2013
Global PM 2.5 concentrations in 2030

Coordinated Policies

GEA: Stringent climate policy + stringent pollution policy + universal access
PM2.5 concentrations (2030)

Source: Rao, Pachauri et al, 2013
Estimated Health Impacts & Costs of Alternate Scenarios

Source: Rao, Pachauri et al, 2013
Takeaway Messages

• Emissions from solid household fuels have considerable impact on both human health and climate.

• Universal access to modern cooking and basic electricity services is achievable by 2030. This will require ~ 5% of global annual energy sector investments & dedicated policies. Significant health gains and negligible climate impacts are likely.

• Climate finance can potentially play a larger role in financing clean cooking projects, but the suite of GHGs needs to be expanded and systems streamlined.

• Coordination across multiple policy arenas can make for more effective policies and will be required to achieve WHO AQG consistent PM concentrations.
Thank you!

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