Fossil Fuels, and Human and Environmental Well-Being

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International Climate Change Conference - 12
Washington, DC, March 23-24, 2017
Human Progress & CO2 Emissions, AD 1–2015

Update based on World Bank (2017); Le Quéré et al. (2016), via CDIAC

Updated from Goklany (2012)
Human Progress & CO2 Emissions, AD 1750–2015

GDP/cap (1990 International $)
Population (millions)
CO2 (MMT-Carbon)
Life expectancy (yrs, RH)

Updated from Goklany (2012)

Update based on World Bank (2017); Le Quéré et al. (2016), via CDIAC
## Living longer and healthier, but CO2 is going up!

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>China</td>
<td>41</td>
<td>64.6</td>
<td>68.5</td>
</tr>
<tr>
<td>India</td>
<td>32</td>
<td>54.2</td>
<td>59.6</td>
</tr>
<tr>
<td>USA</td>
<td>68</td>
<td>67.2</td>
<td>69.1</td>
</tr>
<tr>
<td>World</td>
<td>49</td>
<td></td>
<td>63.1</td>
</tr>
<tr>
<td>Atmospheric CO2 level</td>
<td>311</td>
<td>370</td>
<td>401</td>
</tr>
</tbody>
</table>

Global Poverty, 1820–2013

Sources: Morrison & Bourginon (2002), World Bank (2017)

Sources: FAO (2016); Le Quéré et al. (2016), via CDIAC

Sources: World Bank (2017); Le Quéré et al. (2016), via CDIAC
Global deaths & deaths rates from extreme weather events, 1900–2015

Global malaria death rates, 1900–2015

Planet is greener, mainly from FF related factors (70% CO2, 9% N-deposition, 8% climate change)

Figure 1. Spatial pattern of relative change of LAI due to CO2 fertilization during 1982 to 2009. The relative change of LAI in each pixel is derived from the ratio of the increment of LAI driven by elevated atmospheric CO2 to the 28-year average value of LAI simulated by model ensemble mean under scenario S1. Source: Figure S12, supplementary information from Zhu et al. (2016)
Earth is more productive
[14% increase in gross productivity, 1982–2011]

Conclusion: CO2 must be reduced

- Global population is becoming wealthier. Poverty is falling
- Fewer people go hungry. Malnutrition is dropping
- People are healthier and, what’s worse, living longer
- Deaths from extreme weather events are down
- More people have safer water & better sanitation
- Population continues to increase
- The world is greener and more productive
- Creates space for Rest of Nature to coexist with humans

</sarcasm>
Back-up slides
Contributions of FF to economic growth and human well-being

• Increases land productivity:
  – Increases available food
  – Reduces hunger
  – Improves health
  – Enhances human capital

• Substitutes for human and animal labor
  – Frees up human time and energy to pursue other activities
  – Enhances human capital
Contributions of FF to economic growth and human well-being

• Human capital
  – Electricity (67% worldwide from FF) “creates” more time at humanity’s disposal which allows individuals to accumulate human capital

• Bulk of new technology powered directly or indirectly by energy [81% of global energy from FF]