Health Benefits of Energy efficiencies

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Major health benefits from energy efficiency in:

• Home energy
• Housing,
• Health care,
• Land use
• Transport
Air Pollution is a major risk to health and a sign of energy inefficiency

New evidence showing that particles smaller than 2.5 μm penetrate deep into the lungs and effect the body more systematically leading to diseases like stroke, heart disease, in addition to the cancers, COPD and pneumonia/URLI.

PARTICLE SIZE AND DEPOSITION

PM<10μm – Coarse
PM<2.5μm – Fine
PM<1μm – Ultrafine
Lungs exposed to tobacco and to Indoor air pollution

Pathology slides - Courtesy Prof. Saldiva, São Paulo, Brazil
The links: Household energy fuels and technologies used for cooking, heating and lighting

New Air Quality Guidelines:

1. Use only very efficient cookstoves (following emission rates provided by WHO)
2. Don't use Kerosene
3. Don't use Coal
4. Use clean fuels – LPG, Biogas, ethanol…
Model linking emissions to air quality

Inputs:
- Emission rates:
  - PM2.5
  - CO
- Kitchen volume
- Air exchange rate
- Duration of use (hours per day)

Outputs:
- Predicted average concentrations of:
  - PM2.5
  - CO

• Assumes uniform mixing of pollutants and air in kitchen
Energy-efficient homes reduce air pollution & other housing risks such as...

<table>
<thead>
<tr>
<th>Housing risks</th>
<th>Health impacts</th>
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<tbody>
<tr>
<td>• Indoor/outdoor air pollution</td>
<td>• Chronic/acute respiratory disease</td>
</tr>
<tr>
<td>• Damp, mould &amp; allergens</td>
<td>• Allergies, asthma</td>
</tr>
<tr>
<td>• Poor indoor ventilation</td>
<td>• Other NCDs</td>
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<tr>
<td>• Inefficient insulation/energy system</td>
<td>• Cold exposures – morbidity/mortality</td>
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<tr>
<td>• Planning, transport access</td>
<td>• Water and sanitation-borne disease</td>
</tr>
<tr>
<td>• Urban waste, sanitation &amp; water</td>
<td>• Heat strokes</td>
</tr>
<tr>
<td>• Heat Island</td>
<td>• Injuries</td>
</tr>
<tr>
<td>• Storms/flooding</td>
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</table>
Interventions on housing E-Efficiency improve health

« Improved insulation saved 0.26 months of life per person » (UK Warm Front Programme)

« Reduced wheezing, days-off school, doctors’ visits were reported by occupants of insulated homes » (NZ Insulation study)

Reduction of respiratory illness by 9% to 20% and increase of individual productivity between 0.48% and 11% with natural ventilation strategies
Health co-benefits in housing

Energy-efficient heating, cooling and natural ventilation can reduce strokes and respiratory illness as well as TB and vector-borne diseases;

A focus on slums/sub-standard housing - where needs are greatest/benefits could be multiplied
Access to clean/sustainable energy in Health Care

• Adopt energy efficient medical technologies
• Substitute diesel generators for sustainable sources (solar, hydro…)
• Access to sustainable transport
• Energy efficient buildings …

Solar suitcase powering a health care facility in Nigeria.

Solar powered refrigerator in Vietnam.
Low energy medical devices in resource constrained settings

- **LED lighting** – for better visual management of patients
- **Battery-powered ultrasound** – enables early treatment of multiple births, breach births, and placenta previa
- **1-3 Watt fetal heart monitors** - identify and manage birth complications
- **Digital blood pressure devices** – hypertension management
Response to a Silent "epidemic" of energy poverty – Initial WHO analysis African facilities

<table>
<thead>
<tr>
<th>Survey</th>
<th>No. Countries</th>
<th>No Electricity</th>
<th>Unreliable Electricity</th>
<th>No/unreliable electricity</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHS</td>
<td>5</td>
<td>18-58%</td>
<td>15-49%</td>
<td>-</td>
<td>Nationally representative</td>
</tr>
<tr>
<td>Global Fund</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>23-55%</td>
<td>Geographic Balance/high burden areas</td>
</tr>
<tr>
<td>WHO SAM/SARA</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>42-84%</td>
<td>Mix nationally representative/geographic balance</td>
</tr>
</tbody>
</table>
Help fill the energy gap in health care in developing countries

% of Health Care Facilities with No Electricity Access

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>No Electricity Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uganda</td>
<td>2007</td>
<td>58%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>2006</td>
<td>50%</td>
</tr>
<tr>
<td>Guyana</td>
<td>2004</td>
<td>38%</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>2012</td>
<td>35%</td>
</tr>
<tr>
<td>Ghana</td>
<td>2002</td>
<td>31%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>2011</td>
<td>30%</td>
</tr>
<tr>
<td>Kenya</td>
<td>2010</td>
<td>26%</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>1999-00</td>
<td>23%</td>
</tr>
<tr>
<td>Zambia</td>
<td>2005</td>
<td>20%</td>
</tr>
<tr>
<td>Rwanda</td>
<td>2007</td>
<td>18%</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>2008</td>
<td>14%</td>
</tr>
<tr>
<td>Namibia</td>
<td>2009</td>
<td>4%</td>
</tr>
<tr>
<td>Egypt</td>
<td>2004</td>
<td>1%</td>
</tr>
<tr>
<td>Gambia, The</td>
<td>2004</td>
<td>0%</td>
</tr>
</tbody>
</table>
Figure 1: Impact of Energy Access on Public Health. Adapted from EC (2006).
Integration of land use and transport define the “shape” of a urban growth as energy “obese” or “trim”
Medium density (European) cities achieve largest energy efficiency gains in comparison to North America.

Longer vehicle travel distances = more pollution emissions – although tailpipe controls may mitigate some emissions.

Public transport systems are less efficient in low-density/sprawl – destinations are too dispersed. So patronage declines sharply.
Housing Density – also a determinant of home energy efficiencies, e.g.

Multi-unit buildings share walls, utility points and energy systems

Planned, multi-unit development is an also an entry point for scaling up resilient, energy-efficient building technologies

- Cities with higher densities and mixed residential/commercial neighborhoods had significantly lower CO$_2$ emissions than suburban areas with strictly separated zones. (*Glaeser & Kahn, 2008*)

- In Toronto, a low-density suburban development used 2.5 X more energy than a condominium development in the centre city (*Norman J., et al 2006*)

Many developing cities, however, also are growing horizontally - in low-density extremes of slums and suburbs – the latter pictured below.

*New suburb in China*  
*Guragaon, India*
Integration of housing, services/schools and recreation reduces travel & promotes active travel

- Land use planning one of most effective measures to promote physical activity (WHO, 2009)
- & reduce pollution: e.g. schools within walking distance to homes – reduce CO\textsubscript{2} emissions by 12%; shrinking business-home distance by 20% in Santiago, Chile (Barias et al, 2005)

Copenhagen
Zona Rosa, Mexico City
Sustainable transport health benefits

- Reduce air pollution
- Increases physical activity
- Reduces traffic injury
- Frees urban road/parking for green spaces
- Facilitates more equitable access to mobility
- Eases movements of elderly, children, disabled, women
- Promotes social cohesion in local communities
More active travel from home to work = greater health

People who cycled to work had 30% lower premature mortality rates, on average, in long-term large population studies of Copenhagen and Shanghai commuters (Andrews et al, 2000; Matthews et al, 2007)
Urban transit – efficient and healthy

- Integrated urban energy use planning – linking housing-density, services proximity, could reduce urban GHG emissions in Canada by 40-50% (Bataille et al, 2009)
- Packages of walkways, cycleways and BRT could reduce emissions by 25% in developing countries at low cost (Wright, Fulton, 2005)
- Efficient public transit, walking & cycling consistently associated with more physical activity, less obesity, and lower risk of road traffic injuries in WHO Health in Green Economy review (WHO, 2011)
Need to account and track the health benefits of E-efficiency measures and costs for inaction

Currently working on a model for strengthening capacity of urban stakeholders and the health sector to support decision making in other sectors with relevant information

‘Green’ clustered housing developments, Beijing