# FUELS, TECHNOLOGIES, AND STANDARDS

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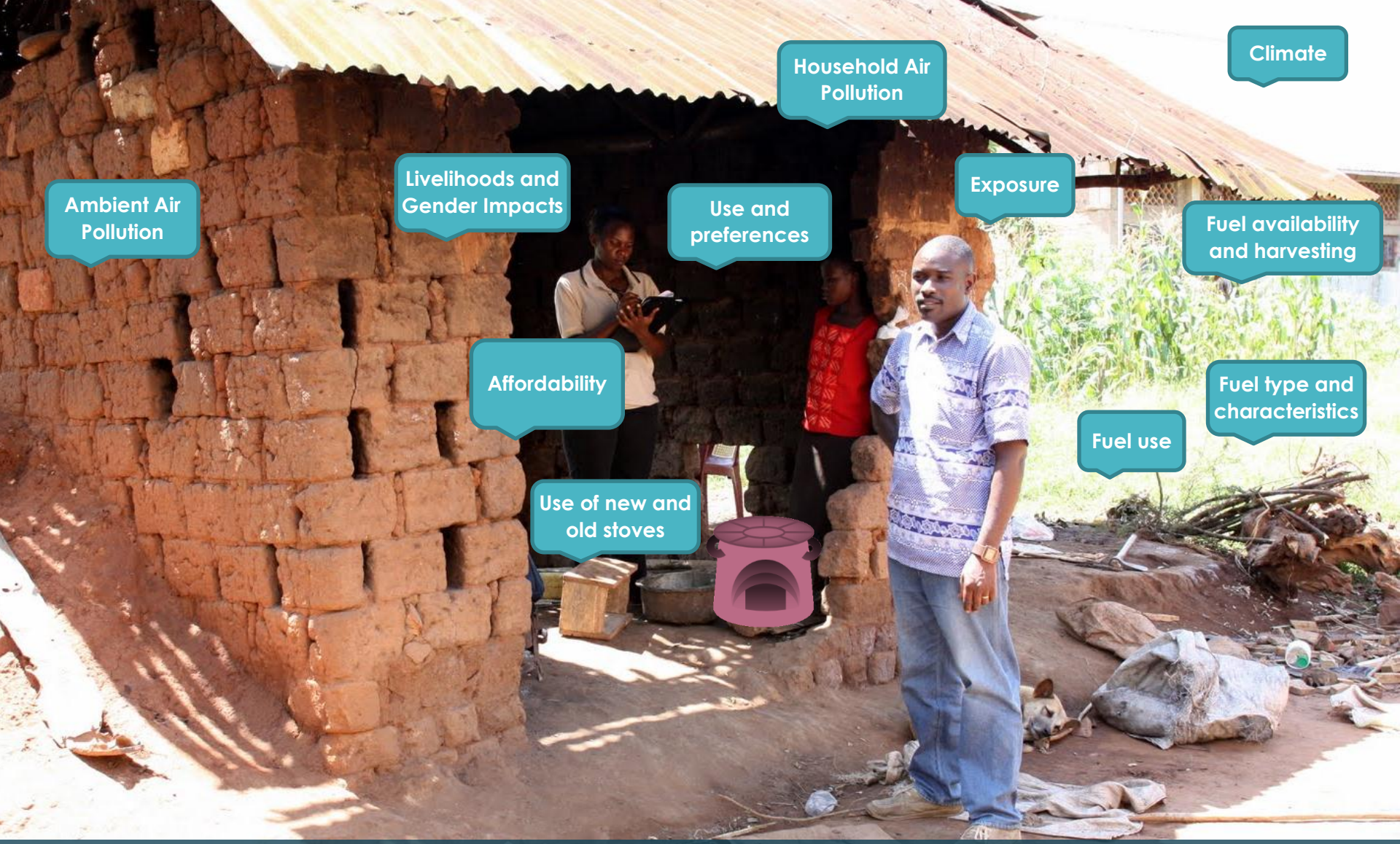


We can evaluate many issues. How do we translate research into decisions and progress?

# Informing decisions and driving progress – STOVE Options

Drive improvement and innovation

Identify options that are most suitable and with most potential for impact?




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# Informing decisions and driving progress – FUEL Options

Transition to better fuels over time by improving availability, affordability, and ease of use









Improve efficiency and cleanliness of fuel production and use, or eliminate use



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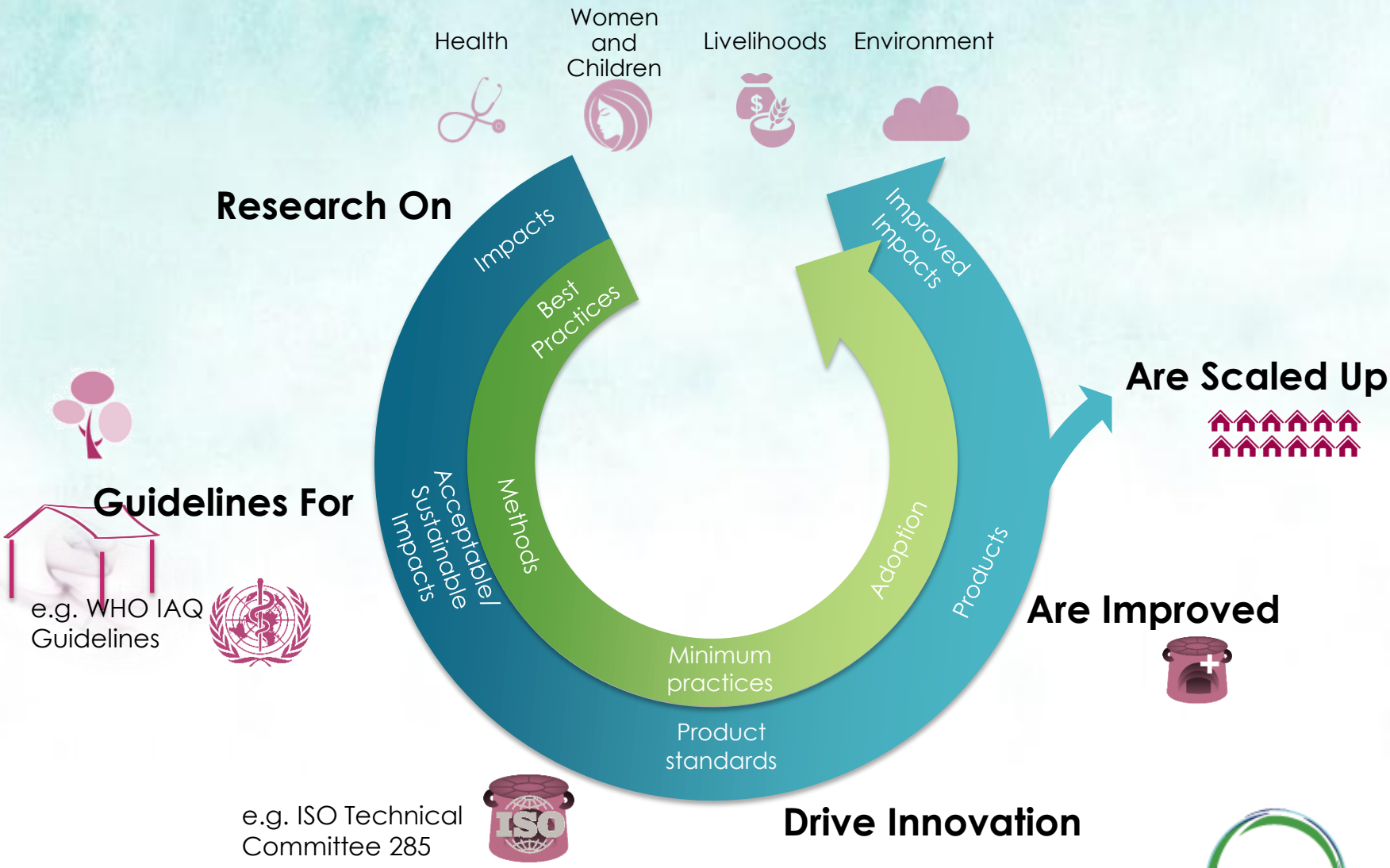
# Understanding impacts → Driving impacts



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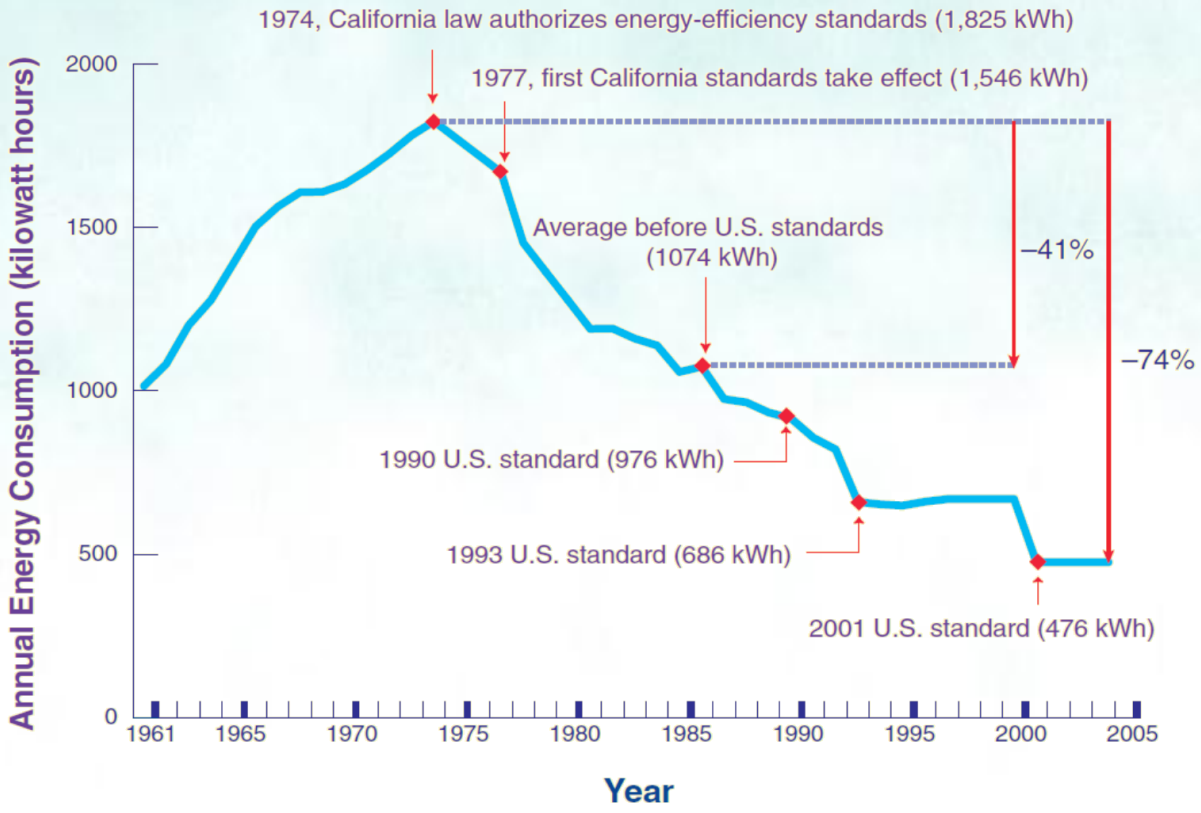
# Example: Refrigerator Standards in the U.S.



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# Framework for Driving Innovation through Standards

**Regional Testing Knowledge Centers** in 13 countries enhanced through grants, global network of RTKCs strengthened

**Clean Cooking Catalog** launched as online resource for stove specification and performance data, with 116 stoves and over 500 test results

**Technology Pilot Projects** supporting technology innovation
**Fuels Studies** to evaluate fuels landscape and barriers


**WHO and ISO Interim Guidelines** developed through international consensus addressing emissions, efficiency, and safety
**ISO Technical Committee** established to continue international and national standards process addressing durability, field testing, social impacts

**National Committees** established to begin process to develop and adopt national standards to guide regulation



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# Data Transparency - Clean Cooking Catalog

Global database of cookstove and fuel information, including specifications and performance

**PARTNERS** Submit stove and test data


| | |
|---|---|
| **MANU-FACTURERS** | Demonstrate product performance & quality, drive innovation |
| **CONSUMERS** | Evaluate compatibility of specifications with user preferences |
| **DONORS & INVESTORS** | Support informed decisions, maximizing impact |
| **RESEARCHERS** | Data for advanced analysis and study |
| **TESTING CENTERS** | Distribute results and facilitating sector collaboration |

Since Sept 2013, 3500 unique visitors, 10 pages per visit, 1% bounce rate

**http://catalog.cleancookstoves.org**



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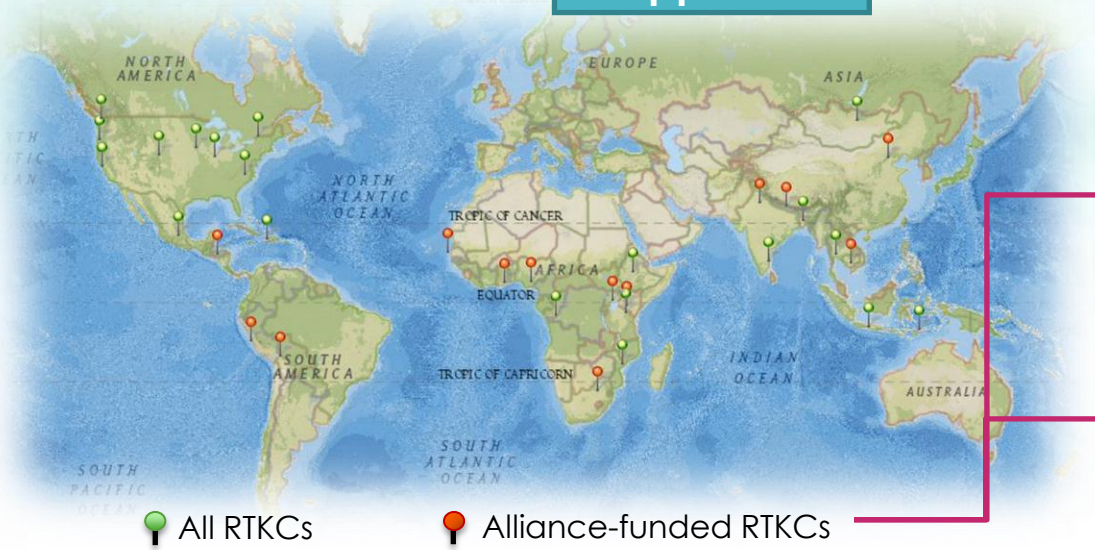
# Building Global Testing Capacity

Researchers | Regulatory Bodies | Consumers

Manufacturers | National Alliances | Government

**Support for**




**Increased testing activity** with almost 300 tests conducted per year

**Expanding impact and network**, supporting many organizations and countries (providing testing services to at least 100 organizations)

**Building global consortium** through training workshops (Jan 2013, Dec 2013) and collaboration



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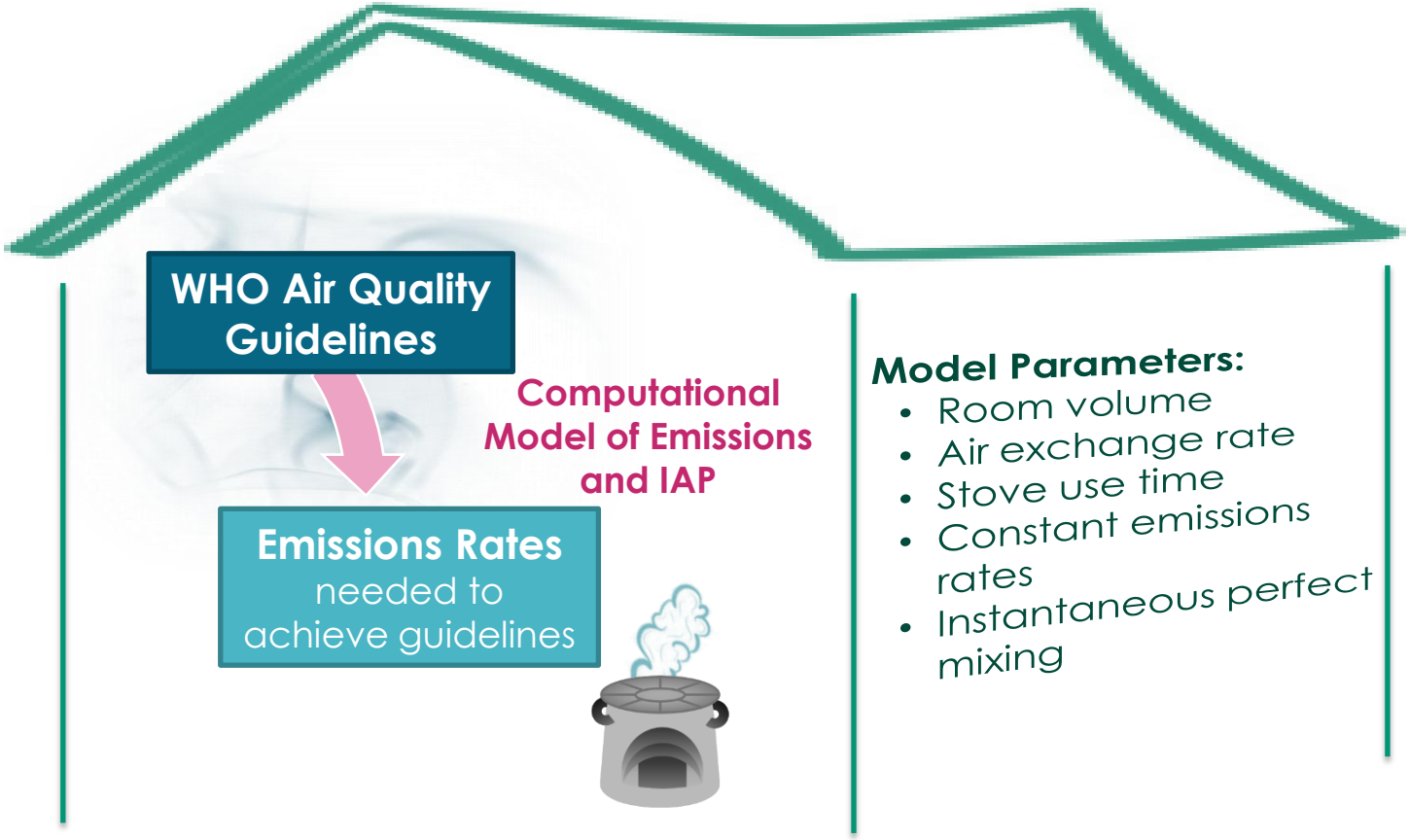
# Linking **indoor air quality (health-based target)** with **performance (intervention-based target)**



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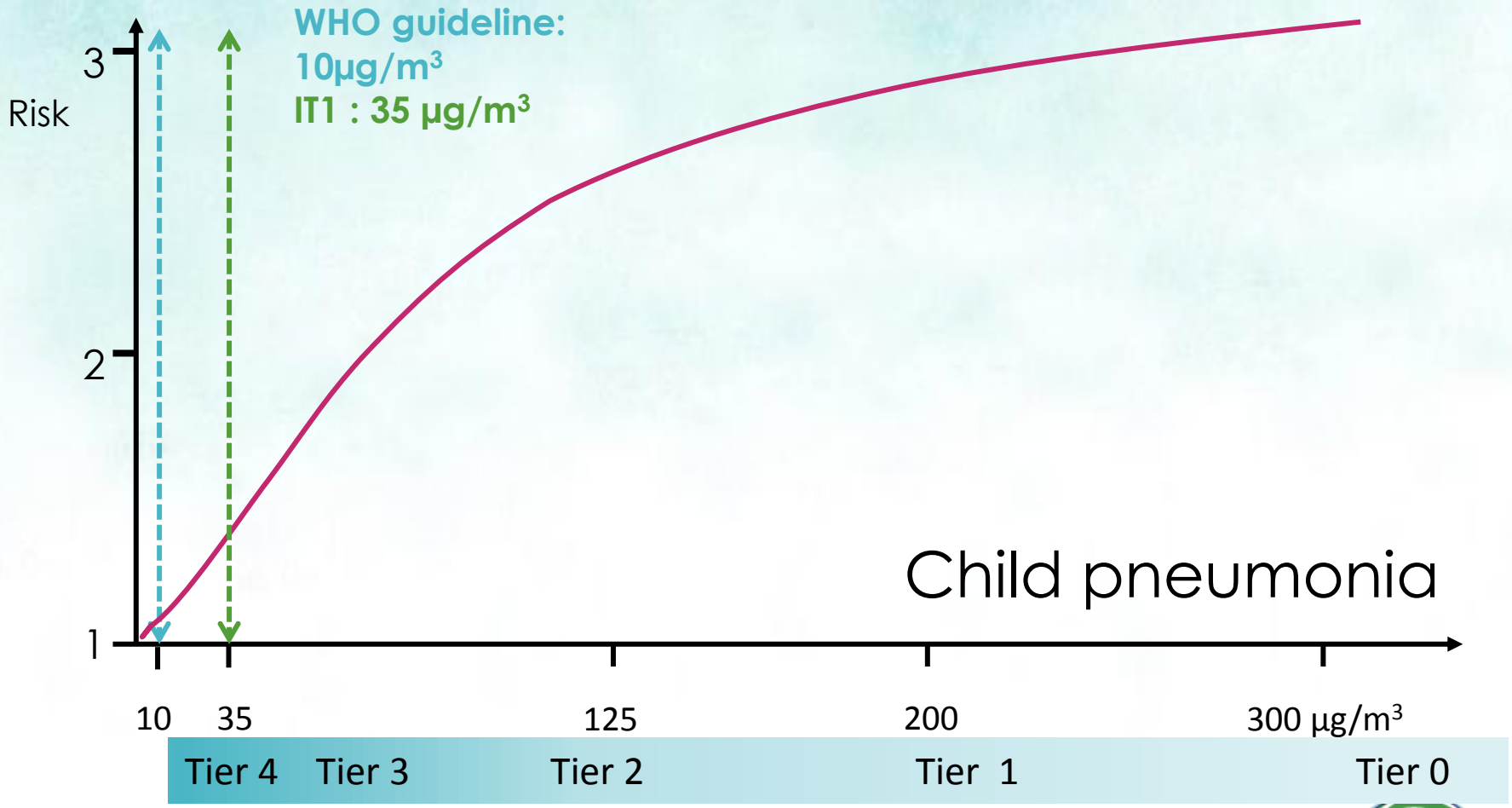
# Linking health-based target with performance target



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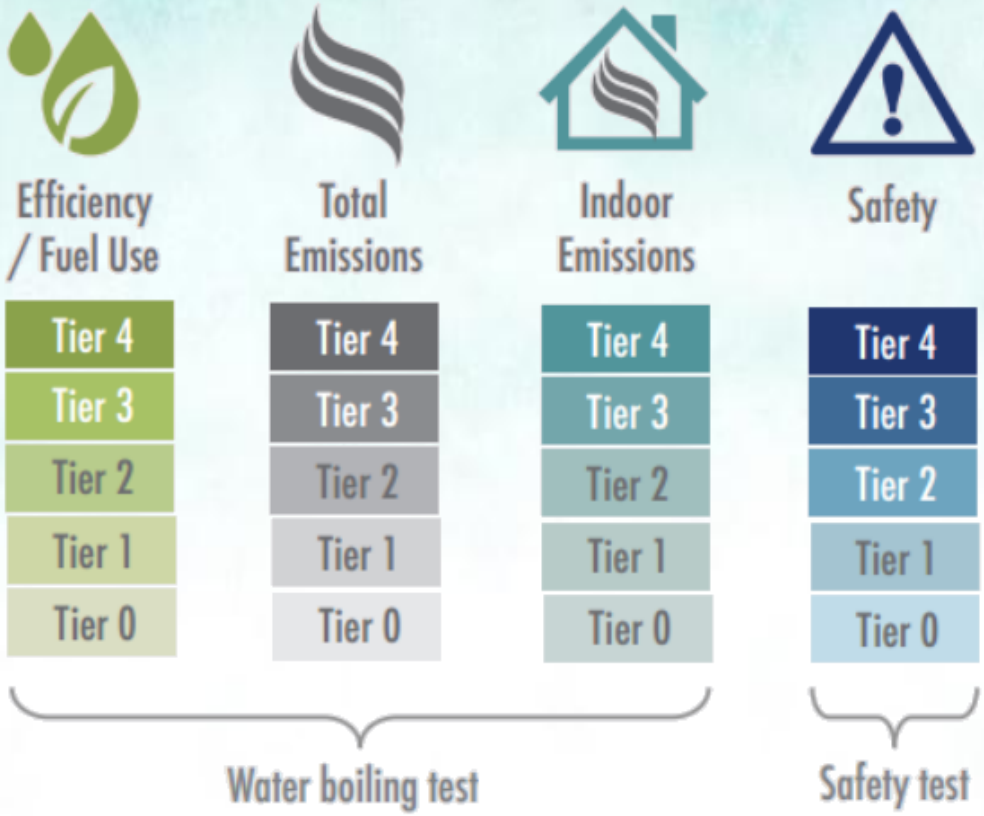
# ISO Progress Builds on WHO Guidelines




**International Workshop Agreement 2012**



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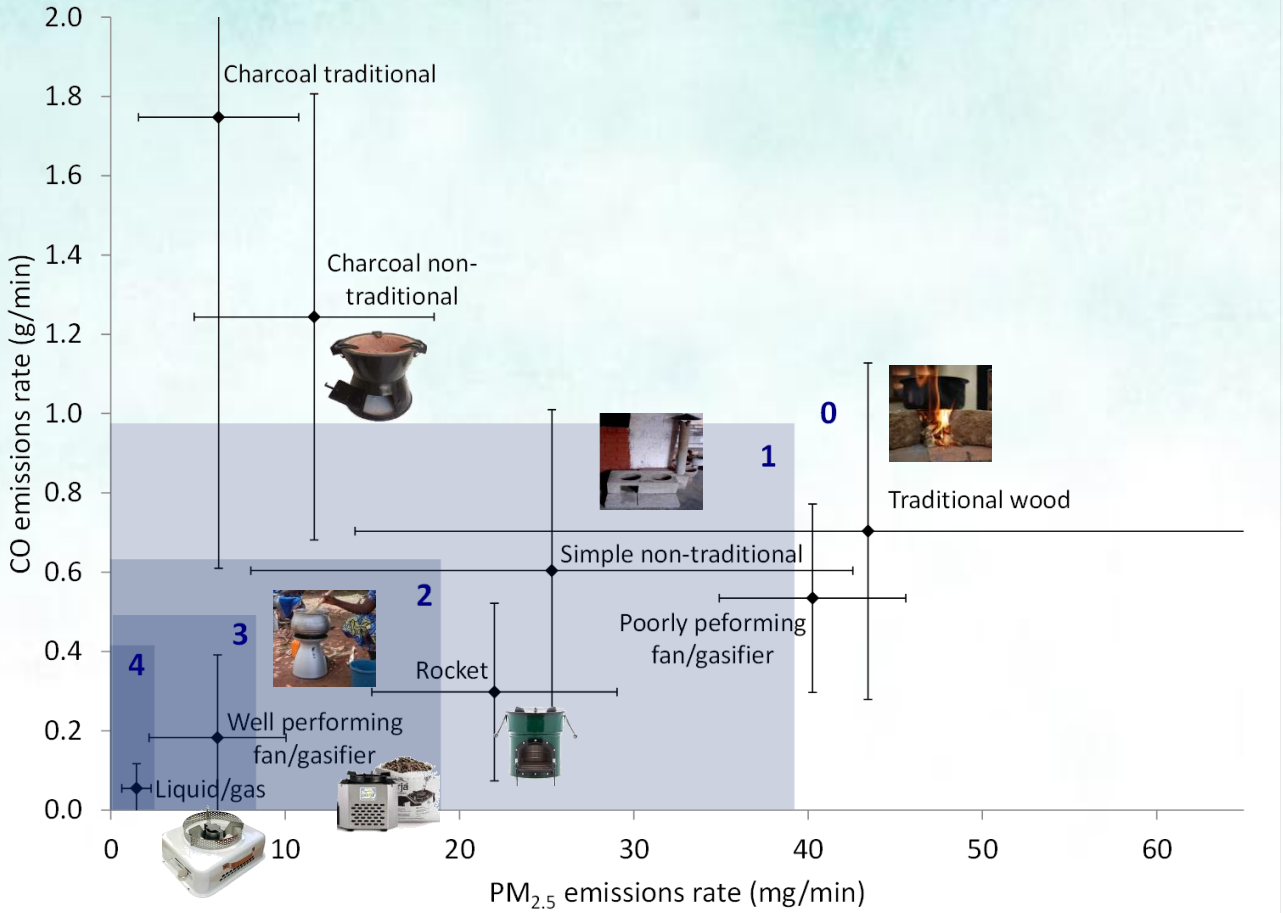
# Performance of existing technologies – Laboratory testing




Berkeley Air Monitoring Group, 2012

**http://catalog.cleancookstoves.org**



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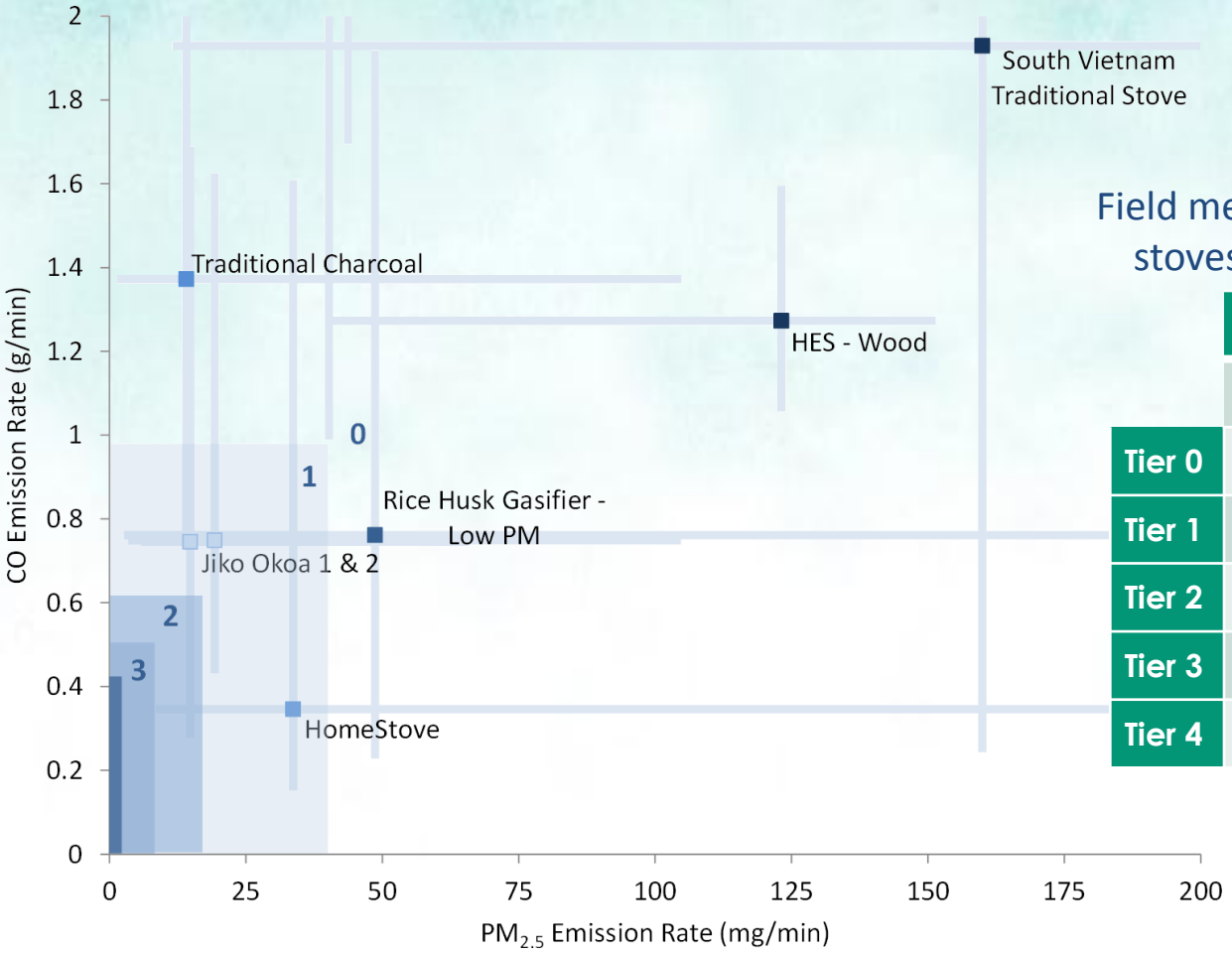
# Performance of existing technologies – Field Testing




Field measurement "equivalencies" for stoves with laboratory IWA testing

| | PM (mg/min) | | CO (g/min) | |
|---|---|---|---|---|
| | WBT 4.2 | Field | WBT 4.2 | Field |
| Tier 0 | >40 | >150 | >0.97 | >1.5 |
| Tier 1 | ≤40 | ≤150 | ≤0.97 | ≤1.5 |
| Tier 2 | ≤17 | ≤65 | ≤0.62 | ≤1 |
| Tier 3 | ≤8 | ≤30 | ≤0.49 | ≤0.75 |
| Tier 4 | ≤2 | ≤2 | ≤0.42 | ≤0.42 |



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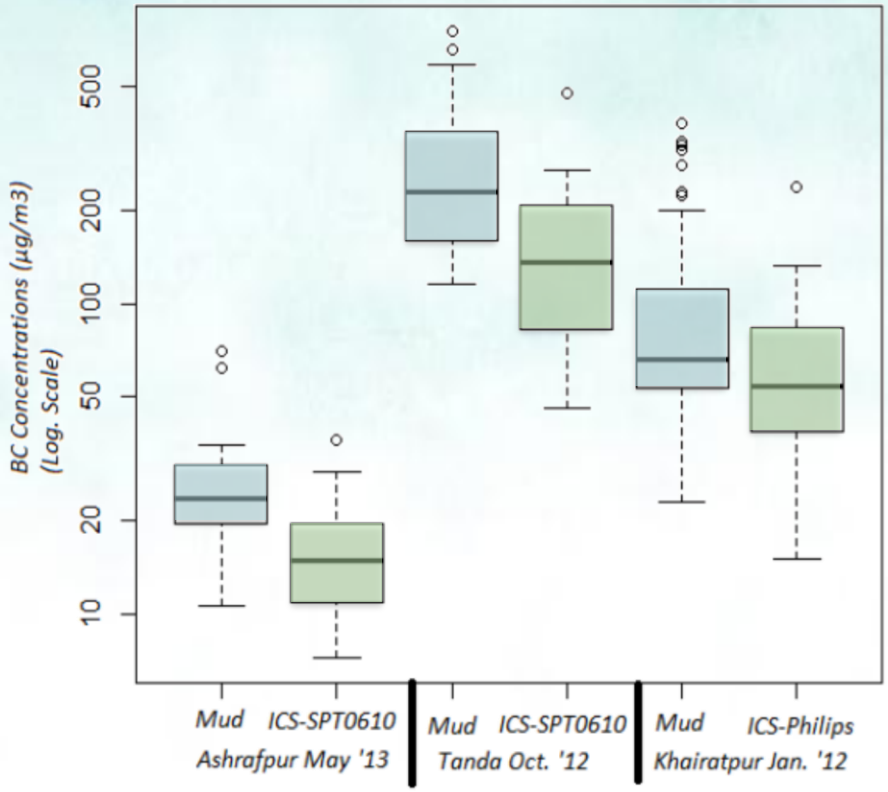
# Black Carbon Concentrations, Emissions




Ramanathan et al, preliminary results (2013)



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# Technologies need to be used to achieve impact

Product Performance /Quality **x** Adoption/ Use **x** Scale **=>** Level of Impact



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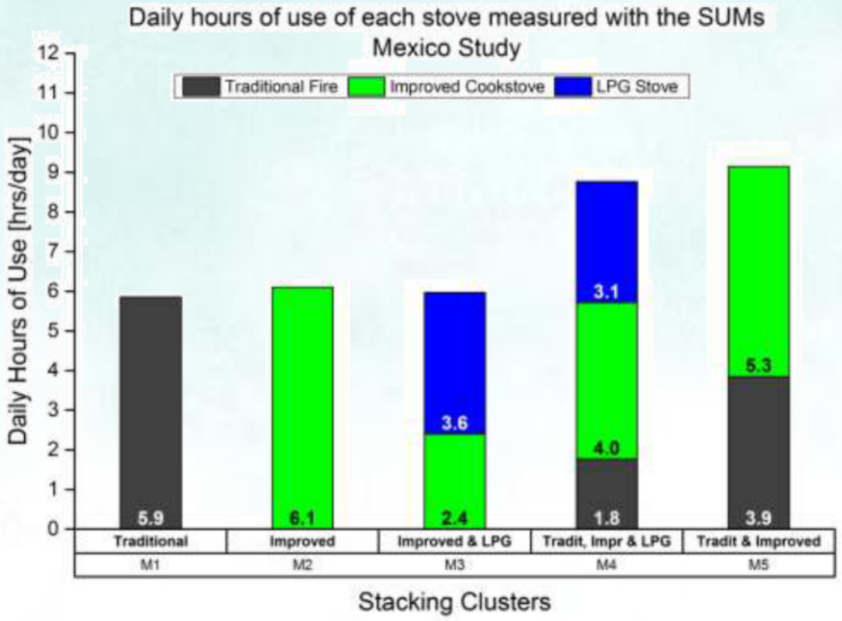
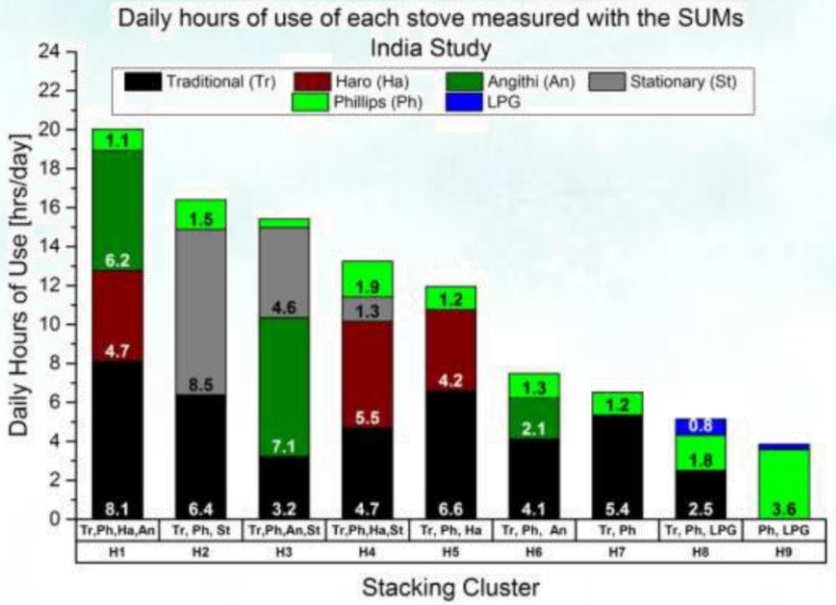
# Measurements of stove use and stacking




Ruiz-Mercado et al, preliminary results (2014)



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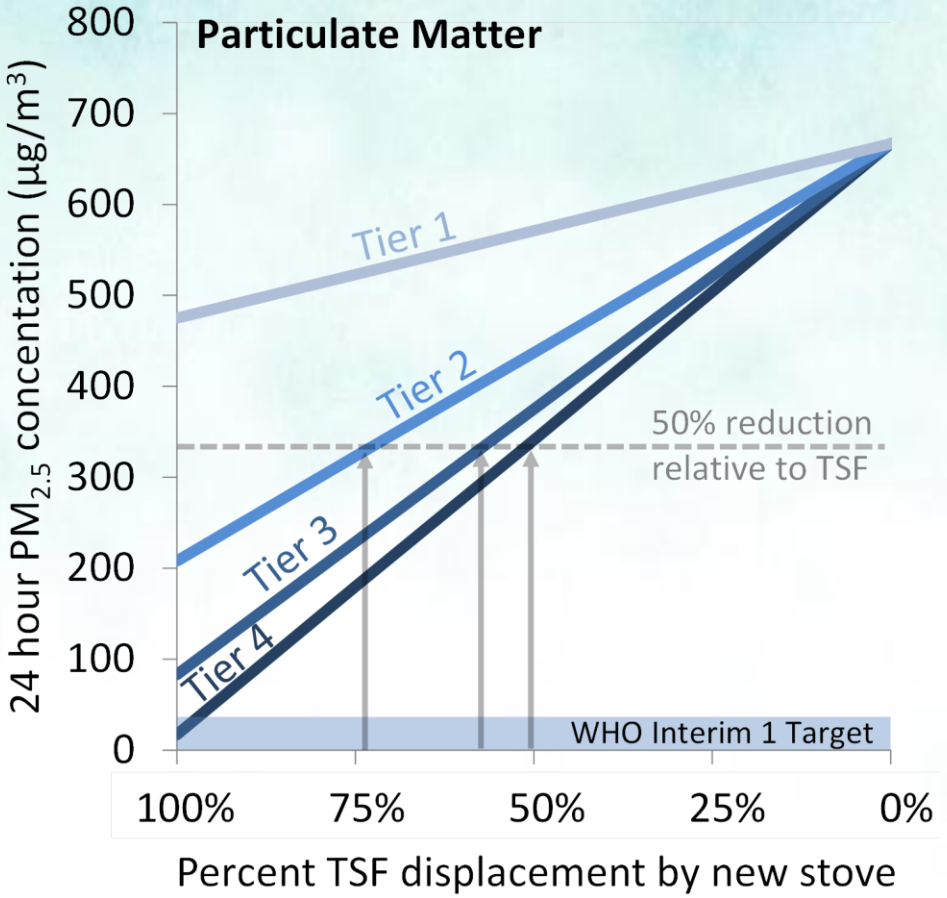
# Guidelines for use




Johnson et al, in preparation



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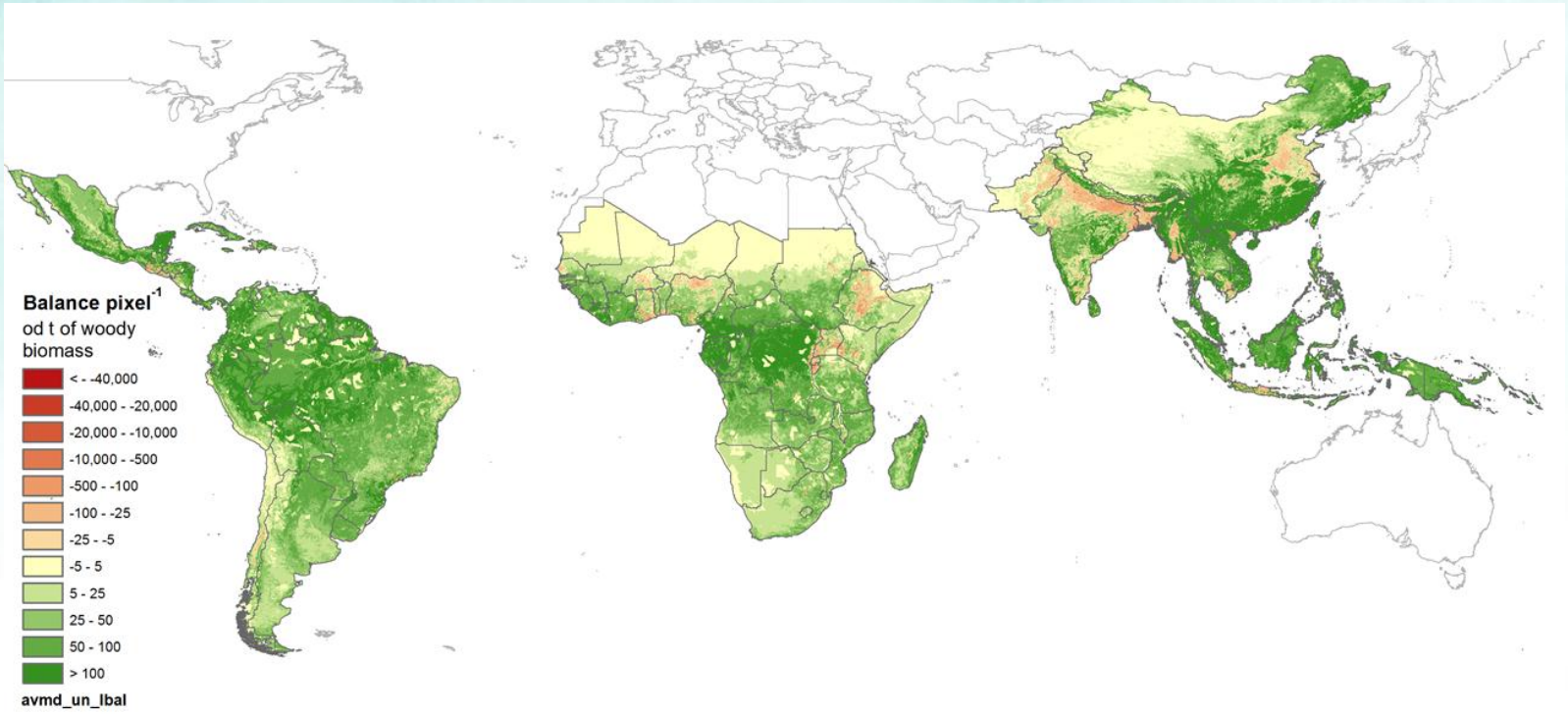
# Are fuels produced and used sustainably?




Biomass supply – harvest levels

stock – accessibility

growth – consumption

Ghilardi et al, preliminary results (2014)



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# Tradeoffs Across the Value Chain

| Wood Production | Fuel Processing | Transport | Wholesale / Retail | Use |
|---|---|---|---|---|
| **Charcoal** | | | | |
| High Consumption | Low Efficiency<br>Low Capital | High Energy Density | Well Established | Variable Efficiency<br>Low Particulate<br>High CO |
| **Sized and dried biomass** | | | | |
| Low Consumption | High Efficiency<br>Moderate Capital | Moderate Energy Density | Not Established | High Efficiency<br>Low Emissions |
| **Pelletized biomass** | | | | |
| Low Consumption | Moderate Efficiency<br>High Capital | High Energy Density | Not Established | High Efficiency<br>Low Emissions |

Adapted from Means and Lanning, Clean Cooking Forum 2013



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# Sustainable Fuel Production, Distribution & Use

Request for Applications, application review in progress

- Matrix for feedstocks, availability, production, distribution and use
- Study to identify successful initiatives
- Matrix on environmental, efficiency, cost, access, health and other social impacts in fuel production, distribution and distribution pathways
- Analysis of knowledge and research gaps related to fuels for cooking
- Knowledge sharing guide and tool for partners to optimize fuel production, distribution and use



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# Areas for standards development

**ISO Technical Committee 285 (est. 2013)**

and 14 Observing countries

Field measurements for stoves with IWA testing in the laboratory

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**Improve and Expand**

- Reflect research updates
- Field testing guidelines
- Durability
- Climate-relevant emissions
- Social impacts
- Fuels

# Applying Standards for Technology and Fuels Innovation

Improve usability, robustness, durability, commercial-viability, fuel processing, and integration into many stove types

| | | |
|---|---|---|
| Alliance-funded | Applied Sunshine | User-centered iterative design on solar cooker in Guatemala |
| | CleanStar Ventures | New ethanol stove design based on user preferences |
| | CQuest Capital | Fuel production for coupling sale of processed firewood with stoves |
| | Prakti | Two-burner, multi-fuel stove targeting Bangladesh, India, and Nepal |
| U.S. DOE-funded | BioLite | Develop a "combustion core" incorporated into many stove types |
| | Colorado State University | Semi-gasifier stove with increased robustness to usage conditions |
| | RTI International | Add-on fan device that can be added to many stove types |
| | Oak Ridge National Laboratory | Materials corrosiveness and durability |
| | | Novel design for natural draft stove |
| | Aprovecho Research Center | Optimization of designs for performance and manufacturability |

Successful innovations ready for further scale and investment, including eligibility for Spark Fund, Working Capital Fund



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# Thank you

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