A tale of two lettuces: why we need Cooling for ALL

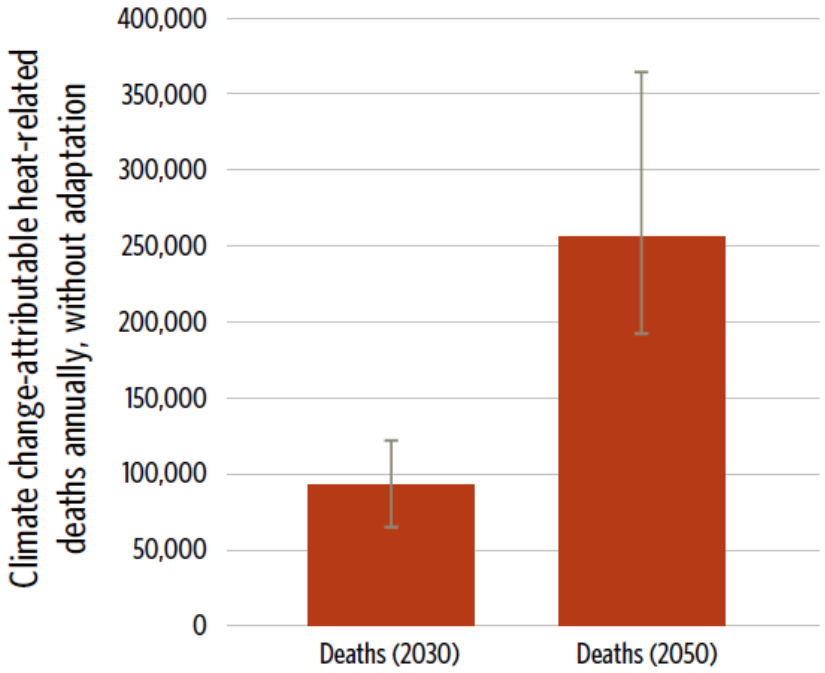
Ian Crosby, Head of Energy Productivity and Cooling
Sustainable Energy for ALL

Imagine …

- You are in Karachi in a slum without a fan …
- We have arranged lunch outside in the courtyard and they set up a seafood buffet already but the ice delivery didn't arrive ..
- To prepare for this trip you took a Dukoral vaccine to prevent against water borne disease … but the delivery came from Karachi and the refrigerated truck broke down ..

Heat extreme impacts are most severe for the elderly, women, and the poor – society's most vulnerable groups

Forecast of climate change's impact on deaths due to excess heat



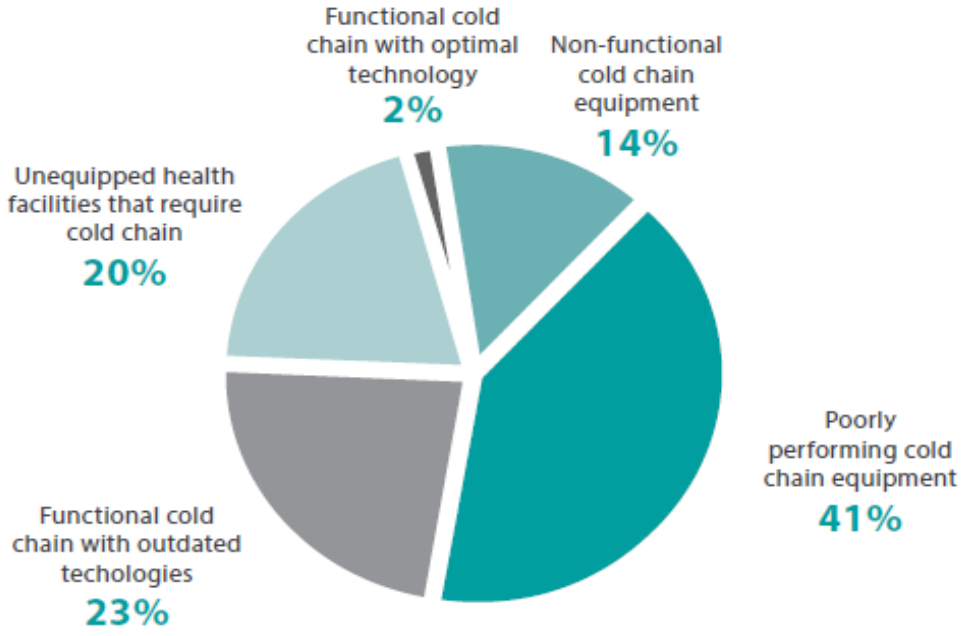
Pakistan's 'shocking' spring heat drives up water use, health risks

Reuters, May 31, 2018

- Temperatures reached 45°C
- Approx. 60 fatalities to heat-related illness

WHO: 50% of freeze dried and 25% of liquid vaccines wasted per year – cold chain breakdowns a significant cause

An estimated 1.5 million children under 5 die every year from vaccine-preventable diseases



Cold chain equipment status (2014) for the vaccine supply chain in low- and lower-middle-income countries

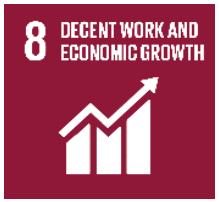
If the lowest levels of wastage achieved in any region at each stage of supply chain were replicated, food wastage would be reduced 50%, enough to feed 1 billion

Losses of perishable food due to the lack and/or inefficiency of cold chain (in % of total production).

	Fruits and Vegetables	Meat / Egg	Fish and Seafood	Milk
Australia, NZ, Japan, United States , Europe, South Korea	9	9	9	9
China	25	12	15	27.5
Sub-Saharan Africa	36	22	22	21
Northern Africa and Western Asia	44	17.6	24	16
Central Asia and Mongolia	23	23	23	23
South-Eastern Asia	25	12	15	27.5
Southern Asia	18	12	25	17.5
Caribbean	23	23	23	23
Central and South America	10	23	23	23

Fruit and vegetable losses >50% in developing countries, mainly due to losses in supply chain - cold chains often scant to non-existent
Food waste is the 3rd largest GHG emitter after USA and China

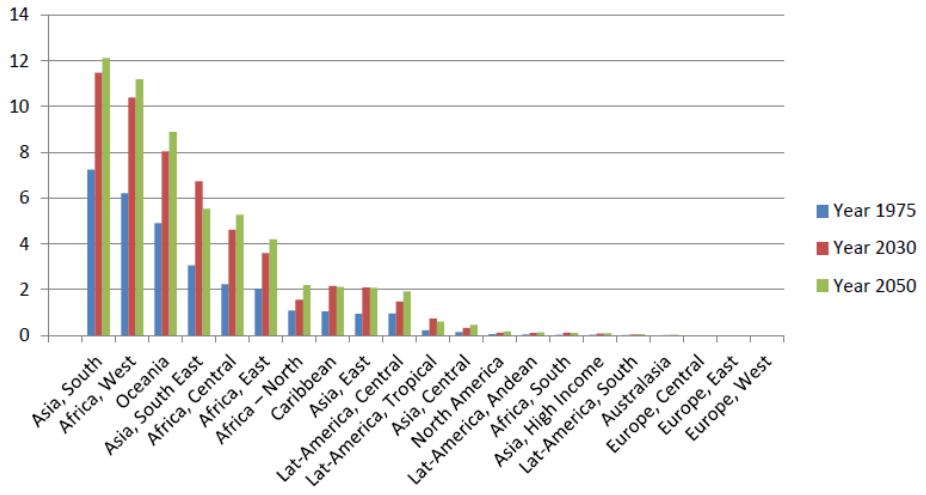
Source: "Assessing the potential of the cold chain sector to reduce GHG emissions through food loss and waste reduction," BIO Intelligence Service for the Global Food Chain Council, October, 2015.



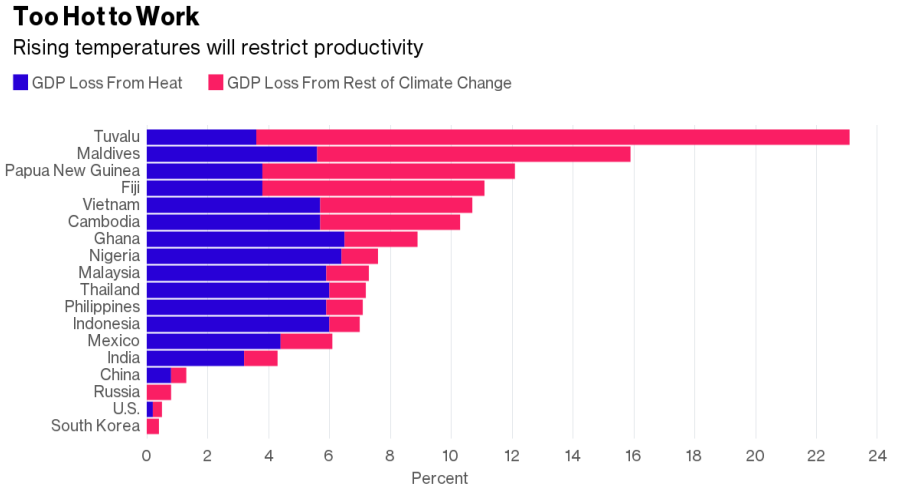
Lack of access to cold chains threaten farmers income.

How much would you pay for fresh vs wilted lettuce?

Heat extremes threaten large economic losses as temperature limits productivity



Estimates of percentage of annual daylight work hours lost due to excessive heat



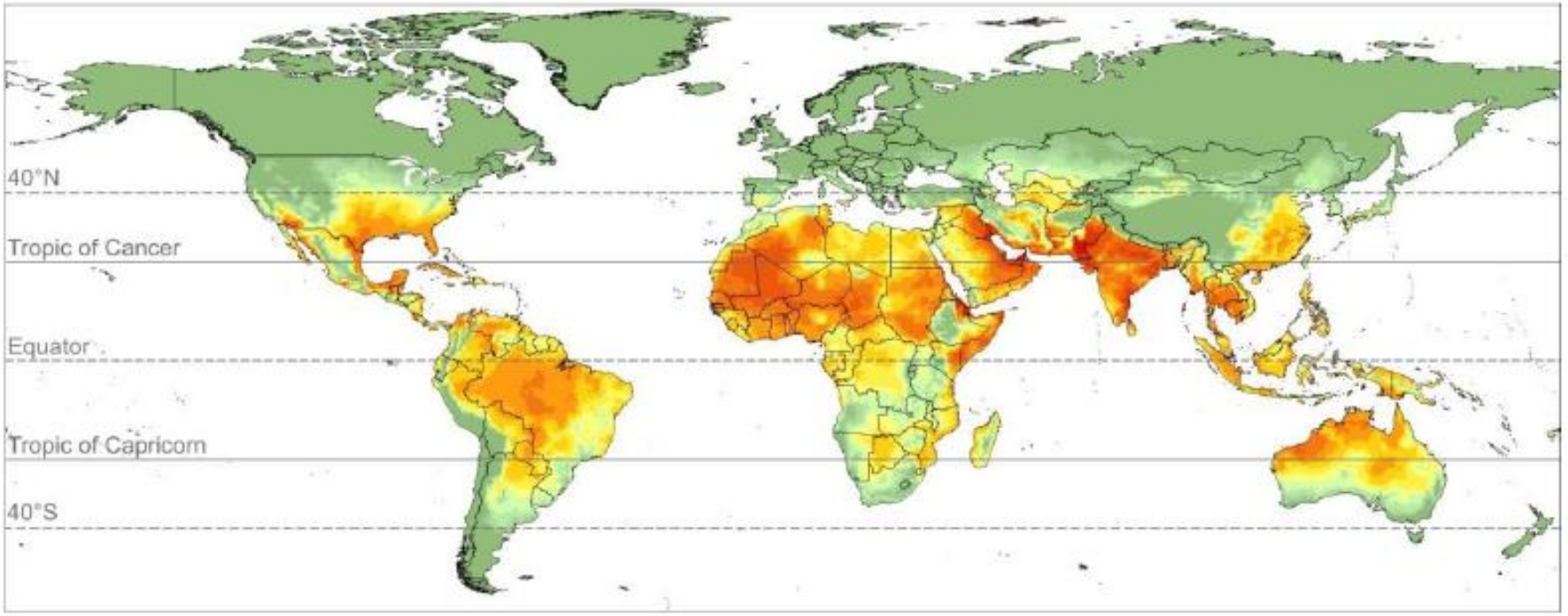
Estimates of GDP loss for selected countries as a result of heat stress by the year 2030

2.5 billion expected to join world's urban population by 2050 – mainly in Asia and Africa

AC units in Phoenix, Arizona, heat the night-time air temperature 2°C

324 million Americans consume more energy for AC than 1.1 billion in Africa consume for electricity (IEA, 2018)

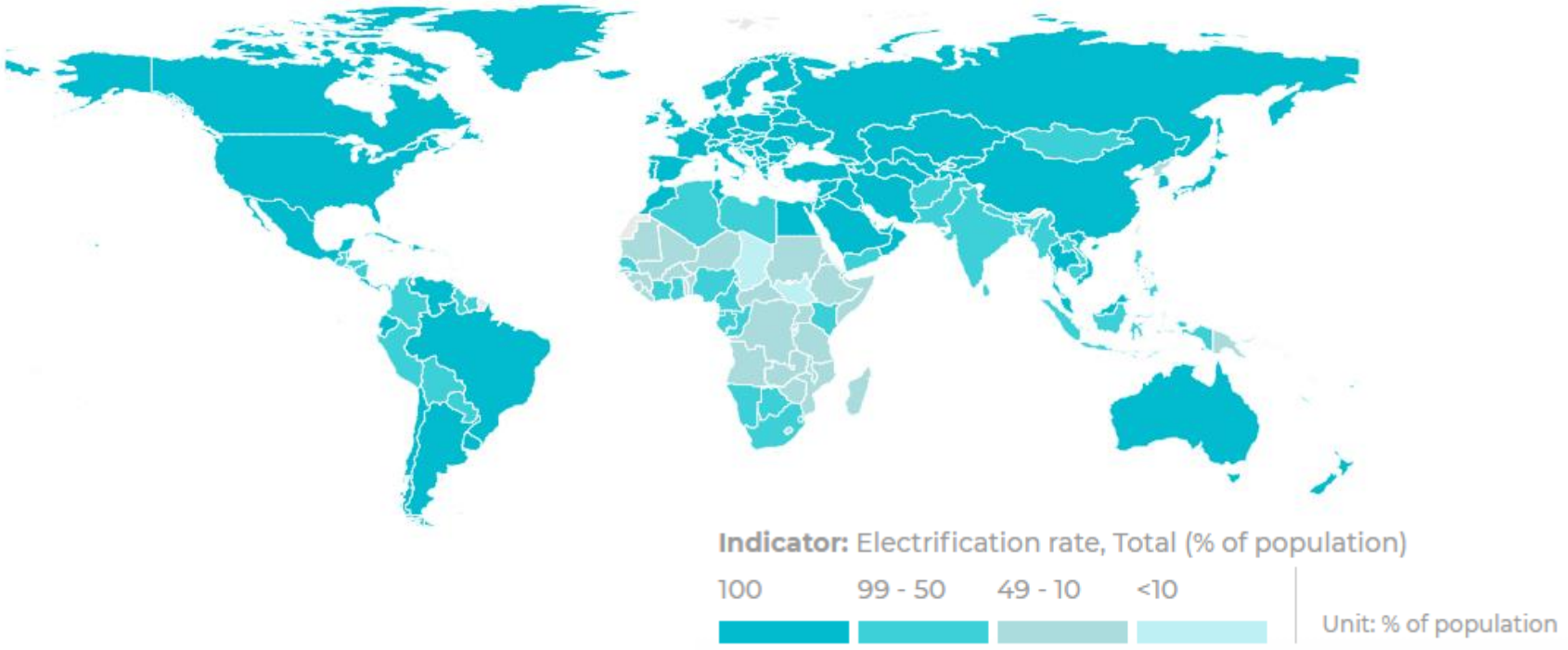
Heat exposure risk



Hottest month average level of occupational heat stress
Afternoon values in shade or indoors, 30-year averages 1980-2009

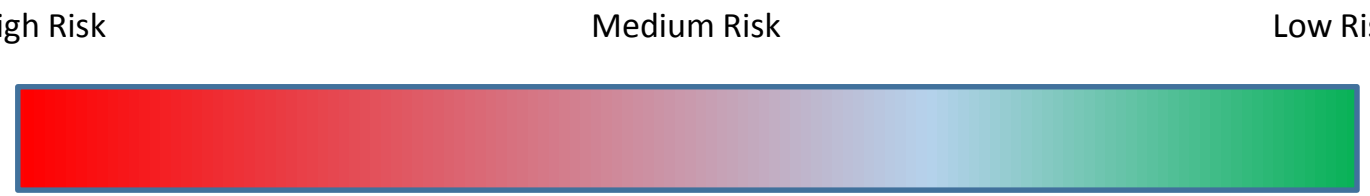
Roughly 1 billion people lack access to energy

In fact, 3 billion people lack access to RELIABLE energy and therefore are likely to lack access to powered cooling as well. But how many really need it and why?



Access to Energy as % of population – 2018: Tracking SDG 7

Spectrum of risks in high temperature environments



High Risk	Medium Risk	Low Risk
Lack of electricity access Poor ventilation Poor construction No refrigerator Farmers have no access to cold storage or precooling Vaccines exposed to high temps Income below poverty line	Electricity access Fans available Buildings constructed according to old standards Food is refrigerated Vaccines stored and transported may have some occasional exposure to high temps Lower incomes	Full and stable electricity access Well built home, insulated with good ventilation and possibly some air conditioning Passive design Food and vaccines have well controlled cold chain Middle incomes

Populations with Different Cooling Needs

Rural Poor

Likely to lack access to electricity and live below the poverty line, likely to include subsistence farmers who do not have access to an intact cold chain. Medical cold chains may also not be intact, putting lives at risk from spoiled vaccines

Slum dwellers

May have access to electricity but housing quality is very poor; income may not be sufficient to purchase or run even a fan. May own or have access to a refrigerator but intermittent electricity supplies may mean that food often spoils and there is a high risk of food poisoning.

Carbon Captives

Increasingly affluent lower-middle class that is on the brink of purchasing the most affordable but least efficient air conditioner on the market. Likely to have access to in-tact cold chains for food and vaccines. Poor purchasing decisions by this group however could cause dramatic increases in energy consumption and associated GHG emissions

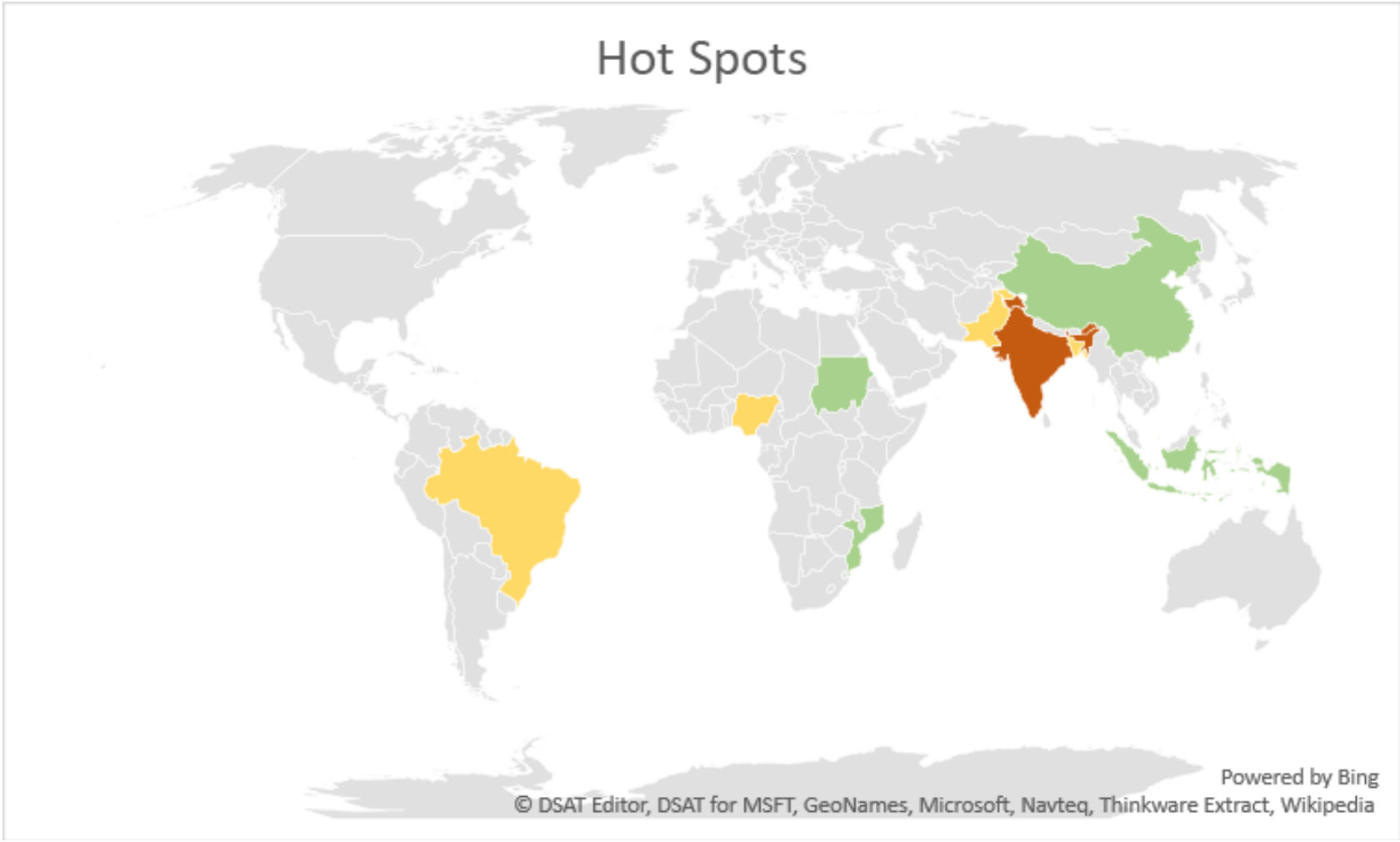
Cool Customers

People that have owned an air conditioner and may be in the market to replace it. The represent the established middle class that might be looking to move to more affluent housing developments that could be designed in a more affordable and sustainable way incorporating thermal cooling systems

Constructing a Model: Nigeria

Rural Poor	Approximately 60% of rural Nigerians, 58.2 million, lack access to electricity. Based on national rural poverty headcount, 50.6 million rural dwellers are poor. Lesser number gives indicative assessment of 50.6 million rural dwellers. 51.4 million rural dwellers unvaccinated, 36.7% of ag production requiring cold chain lost due to lack of access.
Slum dwellers	16.8 million urban Nigerians lack access to electricity. The urban slum population includes these individuals, as well as those without purchasing power for cooling. Including those with and without electricity access, Nigeria is home to approximately 44 million slum dwellers.
Carbon Captives	Includes those with low incomes, but not considered poor, and with access to some electricity. 51.5 million Nigerians
Cool Customers	Those defined as middle income, earning between $ USD 10.01 - 20.00 per day. Approximately 3.5 million

Populations most at risk



Risk? Opportunity? Or Both?

Category	Number	Unit
Rural Poor	470 million	people at risk
Slum Dwellers	630 million	people at risk
Carbon Captives	2.3 billion	People at risk

- There is a dividend to solving the cooling conundrum for these people – more incomes, safer food, healthier and more productive lives, increased learning;
- There are solutions available to serve this very large MARKET – better designed homes, intact cold chains, efficient fans and refrigerators;

BUT

- Solutions must be AFFORDABLE, which may require new business models and financial vehicles;
- Solutions must be SUSTAINABLE and not add to the carbon burden

Cooling for all is not a question of luxury, it is a question of equity … it is also a huge business opportunity!