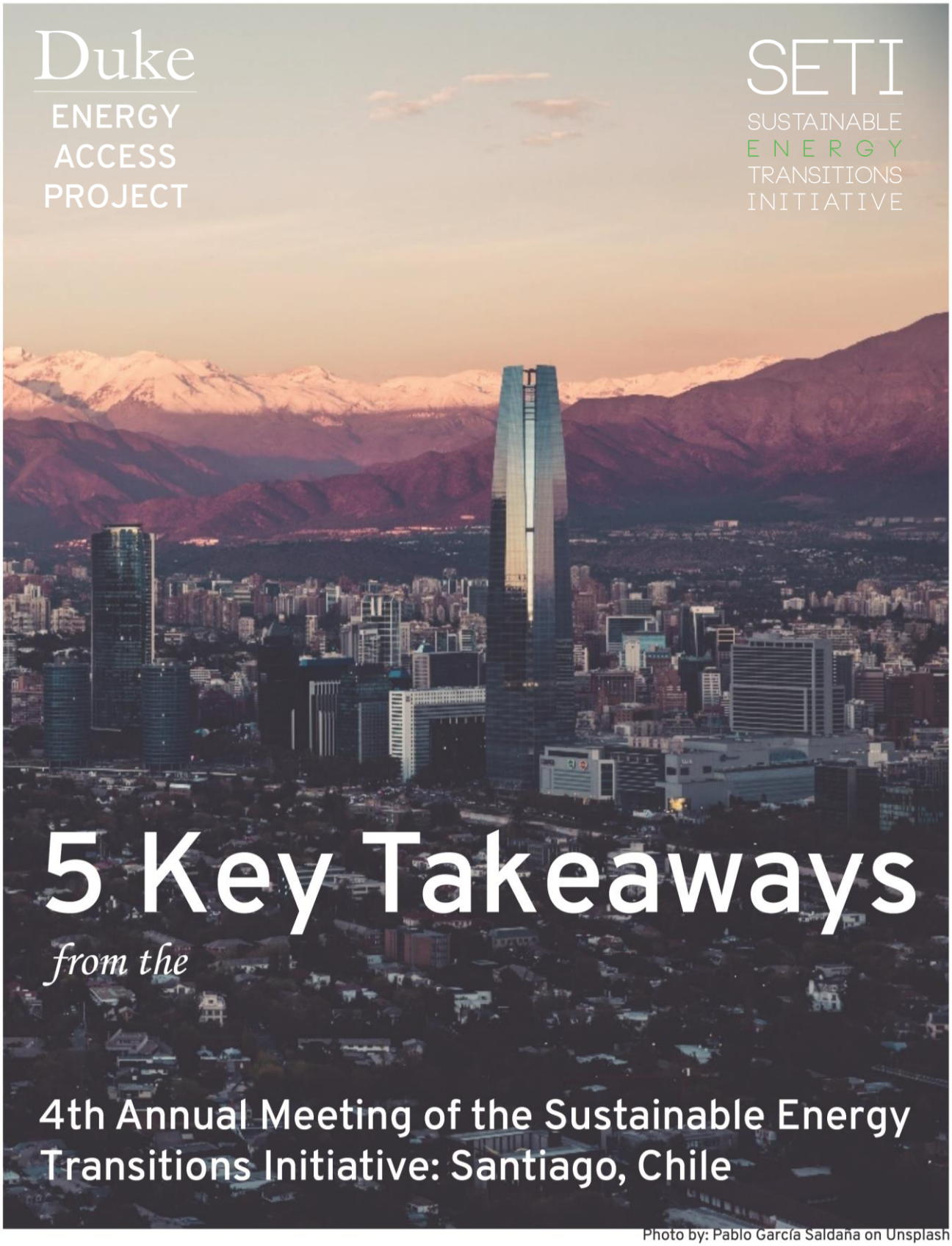
Duke
ENERGY
ACCESS
PROJECT

SETI
SUSTAINABLE
ENERGY
TRANSITIONS
INITIATIVE



5 Key Takeaways

from the

4th Annual Meeting of the Sustainable Energy Transitions Initiative: Santiago, Chile

Photo by: Pablo García Saldaña on Unsplash

Santiago, Chile [Source: Sebastian Miller & Christobal Ruiz-Tagle]

Energy researchers from across the world converged on Santiago, Chile on May 15-17, 2019, for the 4th Annual Sustainable Energy Transitions Initiative Conference. Sponsored in part by the Energy Access Project at Duke University, the event represents an important opportunity for showcasing new and largely unpublished cutting-edge research covering a range of energy topics. The gathering infuses practitioner and policy-making communities to highlight the most pressing energy issues facing countries all over the world. Here are the five major lessons we're taking away from the event.

1. **When it comes to urban air pollution, we can't clean up what we can't see. Civilian science and low-cost monitoring can help clear the smog.**

An alarming and underreported fact is that, worldwide, upwards of 90% of people breathe highly polluted air but we're driving blind when it comes to understanding the severity of urban air pollution in many places because of a lack of credible monitoring.

Air pollution in Chile rocketed into the news last year after people in the coastal town of Quintero suffered respiratory problems, dizziness and vomiting due to poisonous clouds that were attributed to nearby chemical plants, coal-fired power plants and oil processing facilities. Cristobal Ruiz-Tagle and Sebastian Miller highlighted how even a high-income country like Chile can be caught unaware of air pollution problems. Even though Chile has around 200 official monitoring stations, they don't allow for the granularity needed to track the problem. Air quality shifts and changes across time and space, even within a city, and so multiple monitoring stations are required to work out where solutions should be implemented.

This problem is even more stark in poorer countries. Outdoor air pollution kills nearly 4 million people every year, with 90% of those deaths occurring in low- and middle-income

countries that don't have the monitoring equipment in place to determine where air pollution is at its worst.

The good news is that we are seeing more and more governments increasing commitments to monitor and reduce air pollution and, thanks to new technology, it's never been easier to gather the data critical to understanding the breadth and depth of this issue. Victor Caquilpan from the Government of Chile demonstrated how low-cost monitoring systems that upload results to a data portal in real time have improved our understanding of when and where air pollution is at its worst. The low cost of these systems is also unlocking the ability of citizens and civic organizations to participate in monitoring activities and increase data resolution for decision-makers.

Farmer burning crop residue [Source: Prachi Singh]

2. **Subsidizing better technology saves Indian farmers money and reduces air pollution**

Northern India is one such place where outdoor air quality is a major problem. This is in large part due to agricultural activity - in particular, when farmers burn rice stalks and other crop residues at the end of the growing season. Crop residue burning is commonly practiced to clear fields for the next crop (usually wheat, on the Indo-Gangetic Plain) and quickly return nutrients back to the soil – but it turns out other methods are better not just for air quality and climate, but also for farmers' profits. Research by P.P. Krishnapriya, Ridima Gupta and others compared the profits for ten crop residue

management practices. They found the greatest returns accrue to a no-till strategy called the Happy Seeder system – so named for the tractor-mounted device that allows farmers to plant wheat directly into the ground, while leaving chopped-up rice stalks in the fields to serve as a weed-suppressing mulch. The Happy Seeder system is 20 percent more profitable than the most common burning system, and 10 percent more profitable than the highest-profit burning system.

Why, then, are farmers not already using the Happy Seeder? The authors identified barriers including capital constraints, lack of information on the system, uncertainty over whether the right inputs will be available at the right time of the season, and uncertainty over government policies that affect what is allowed or proscribed in cropping systems. To address these barriers, the researchers recommend increased manufacturing and service provision, financial incentives and education, communication and social nudges, and government enforcement of burning bans.

The Government of India has taken up this approach, offering subsidies for machinery, such as the Happy Seeder system, which was then adopted for use on 800,000 acres of farmland. Analysis presented by Prachi Singh suggests that weekly fire-events were reduced by around 12-15%. This month, the Government of India announced that, based on a different measure of fire prevalence, this scheme contributed to a 41% reduction of crop residue burning in four key states in northern India.

[Air Pollution in India, Source: Prachi Singh]

"Most polluted cities in South America are in Chile." [Source: Cristobal Ruiz-Tagle & Alejandra Schueftan]

3. Information interventions can seriously reduce emissions for as little as a cup of coffee

The conventional wisdom is that higher incomes will lead to the adoption of cleaner cooking technologies. The latest evidence suggests that this isn't always the case. In India, Marc Jeuland, Subhrendu Pattanayak and others found that robust supply chains, technologies matching local needs and access to cash were key to the adoption of improved cookstoves. Adoption alone is not enough to solve the problem. Alarmingly, Carlos Gould found that in parts of Ecuador 40% of households still rely partly on polluting firewood, even though 98% use cleaner LPG as their primary cooking fuel, suggesting that regular use of cleaner technologies can mask the ongoing use of dirtier fuels.

But how do we change behavior? Alejandra Schueftan studied an intervention that focused on subtly changing behavior through labeling the pollution emissions of a popular wood-stove in Chile's south-central cities. Here, the government had subsidized a conversion to new (cleaner) wood-stoves for heating. This technology replacement program was implemented successfully, but most households choked the airflow in their new wood-stove, to make the fuel last longer but simultaneously increasing air pollution 5- to 6-fold.

In order to encourage less choking, the researchers affixed a strip of plastic above the damper setting for wood stoves, signaling that the more choked the woodstove, the higher the pollution emissions. The plastic strip cost only $5 and reduced the frequency of the choked damper setting by 12.7%, which translated to a 17.3% reduction in pollution emissions! Although there is a tradeoff between fuel consumption and emissions, labelling the emissions implications allowed households to make this tradeoff in a more environmentally friendly way, and prevent a significant amount of indoor air pollution.

Side by side use of traditional wood-burning stove and LPG stove [Source: Carlos Gould]

4. Hidden electricity access challenges mask painful economic realities

The magnitude of the electricity access challenge in South Asia and sub-Saharan Africa is clear just by looking at the sheer number of people lacking basic access. But studying national electrification rates alone can mask the scale of the access challenge and the steep costs of energy poverty in places like Latin America, where countries have relatively high official rates of access.

Case in point: Honduras has an electrification rate topping 80 percent. Yet, according to work presented by Emily Pakhtigian, nearly two thirds of the population lacks reliable, high-quality electricity access. Those households hidden behind the official electrification rate suffer lower productivity and lower asset ownership. (Who wants to buy a refrigerator when the power is only on half the time?) Adding in other factors like reduced kerosene expenditures for lighting, reduced expenditures on cell phone charging, and changes in study time finds that more than $250 million in benefits would accrue to Honduran households through universal, reliable access.

Distribution infrastructure in India [Source: Richard Martin (2015), India's Energy Crisis", MIT Technology Review]

5. Theft & politics undermine good policy in unexpected ways

Not all grid reliability issues are the fault of bad wiring. In a pair of papers, Meera Mahadevan and Robyn Meeks addressed "non-technical losses," which include electricity theft, non-payment, and errors in accounting and record-keeping. Prior research has found that politicians in India provide better power to villages – as measured by brighter lights at night – just before elections to try to sway their votes. But new evidence suggests there are longer-running manipulations going on. Research by Meera Mahadevan finds that electricity consumption data was manipulated in electoral areas in which the incumbent political party at the state level also had local control. Specifically, consumption data was artificially lowered, making electricity bills cheaper for customers who supported the incumbent. While this reward saves money for certain customers in the short term, it translates to significant financial loses for the utility. This in turn harms service quality, potentially leading to increased blackouts as the utility struggles to supply its underpaying customers.

Elsewhere, in a randomized trial of smart meters in Kyrgyzstan, initial results from Robyn Meeks found that smart metering increased monthly electricity bills in the winter. Results suggest decreased outages and fewer voltage fluctuations played a key contributing factor. With better services, billed consumption increased and people purchase new electrical appliances. However, there is no evidence of reduced losses. It's very possible that even with smart meters, theft is still happening. Why? Without investment in monitoring the smart meter data, there's no enforcement. Whether non-technical losses are happening at a household level or through systematic manipulation, they undermine efforts to improve grid reliability.

Concluding Remarks

The most prominent theme of the 3-day conference was the commonality of these challenges, the world over. Air pollution was choking both poor and rich cities. Chile was struggling to reach its last mile customers with solar home systems just as India was. Being a high-income country didn't mean that energy systems had successfully become cleaner or more sustainable. Well-intentioned policies and technologies can also fall short of promised impacts. These shortcomings are reflected in persistent biomass fuel use in Ecuador, and lack of metering enforcement in Kyrgyzstan. While public policy and technological advancement are critical to the advancement of energy transition, we cannot ignore the importance of strong institutions and rigorous monitoring and evaluation. The convening highlighted how we still have a long way to go, and much to learn from one another.

Author: Victoria Plutshack, Policy Associate, Duke University Energy Access Project

Duke ENERGY ACCESS PROJECT

The Energy Access Project at Duke University is a new research and policy effort that aims to address the challenges around increasing access to modern energy solutions to underserved populations around the world. It takes an interdisciplinary approach to developing sustainable, modern energy for all. The Energy Access Project is working to provide policy makers, project developers, investors, civil society and impacted communities with the tools and analysis to help drive this transformation. Key Duke collaborators in this effort include the Nicholas Institute for

SETI SUSTAINABLE ENERGY TRANSITIONS INITIATIVE

The Sustainable Energy Transitions Initiative (SETI) is an interdisciplinary global collaborative that aims to foster research on energy access and energy transitions in low- and middle-income countries and to better understand their impacts on health, social outcomes, economic growth, climate change, and natural resources. This "center without walls" is coordinated by Duke University faculty Subhrendu Pattanayak and Marc Jeuland and is sponsored by the Swedish International Development Cooperation Agency through the Environment for Development Network.

Other Partners:

Universidad de Concepción

NENRE - EfD - CHILE Economía Ambiental y de Recursos Naturales

EfD

TALCA UNIVERSIDAD CHILE