



Renewable & Appropriate Energy Laboratory

RAEL



Strathmore University

Energy Research Centre

Brief Overview of RAEL Energy Research in East Africa

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July 9, 2018 – UC Berkeley – SERC Energy Access Workshop, Nairobi, Kenya

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The challenges of household energy access

Majid Ezzati & Daniel Kammen (2001) "Indoor air pollution from biomass combustion and acute respiratory infections in Kenya: An Exposure-response study", *The Lancet*, 358, 619 – 624.



Improved stove education sessions at Kibera Town Centre

<http://www.humanneedsproject.org>

Data and Off-Grid Energy Access

OFF-GRID POWER AND CONNECTIVITY

PAY-AS-YOU-GO FINANCING AND
DIGITAL SUPPLY CHAINS FOR PICO-SOLAR

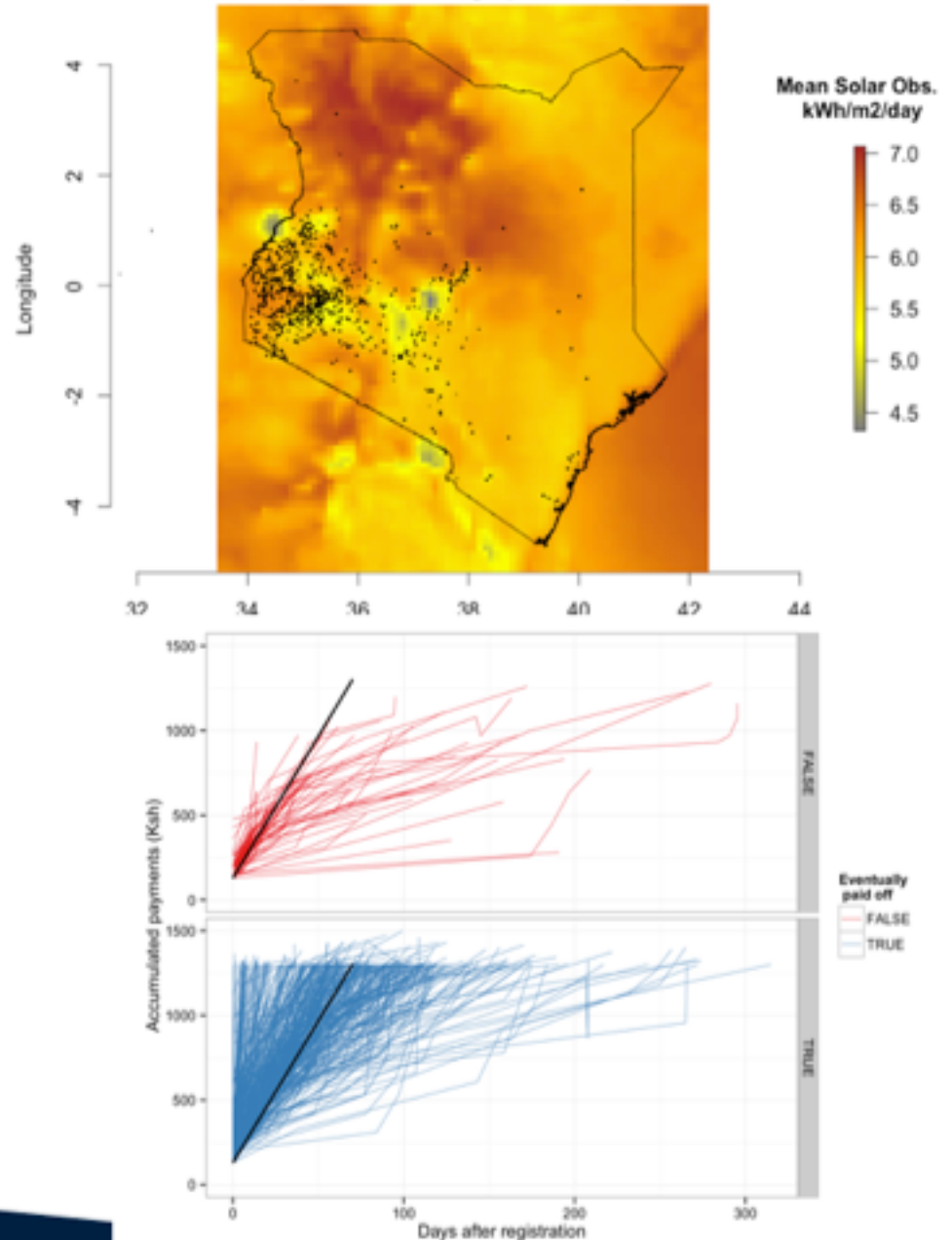


Lighting Global | Market Research Report | May 18, 2015

*Peter Alstone, Dimitry Gershenson, Nick Turman-Bryant,
Daniel M. Kammen, and Arne Jacobson*



All SHS with data (n=1025) marked on a map with satellite-derived estimates of solar potential during operations period





Human Needs Project's Town Centre in Kibera is Open!

1 4 4 5 Days Active

Welcome to the HNP Town Centre, a place that empowers against poverty, by bringing essential services to slum residents. Designed by renowned architect and green designer Ken Kao, the first centre opened its doors in Kibera, Nairobi in July of 2014. We are so proud of our team and the collaborative efforts of our local and international partners.



Begun as women's sanitation and self-help centre, work is now underway on solar street-lighting, and community energy and water mini-grids

<http://www.humanneedsproject.org>



Berkeley
UNIVERSITY OF CALIFORNIA

<http://rael.berkeley.edu>



Olympic Primary School

Area: 2000 m²

Capacity: 350 kWp

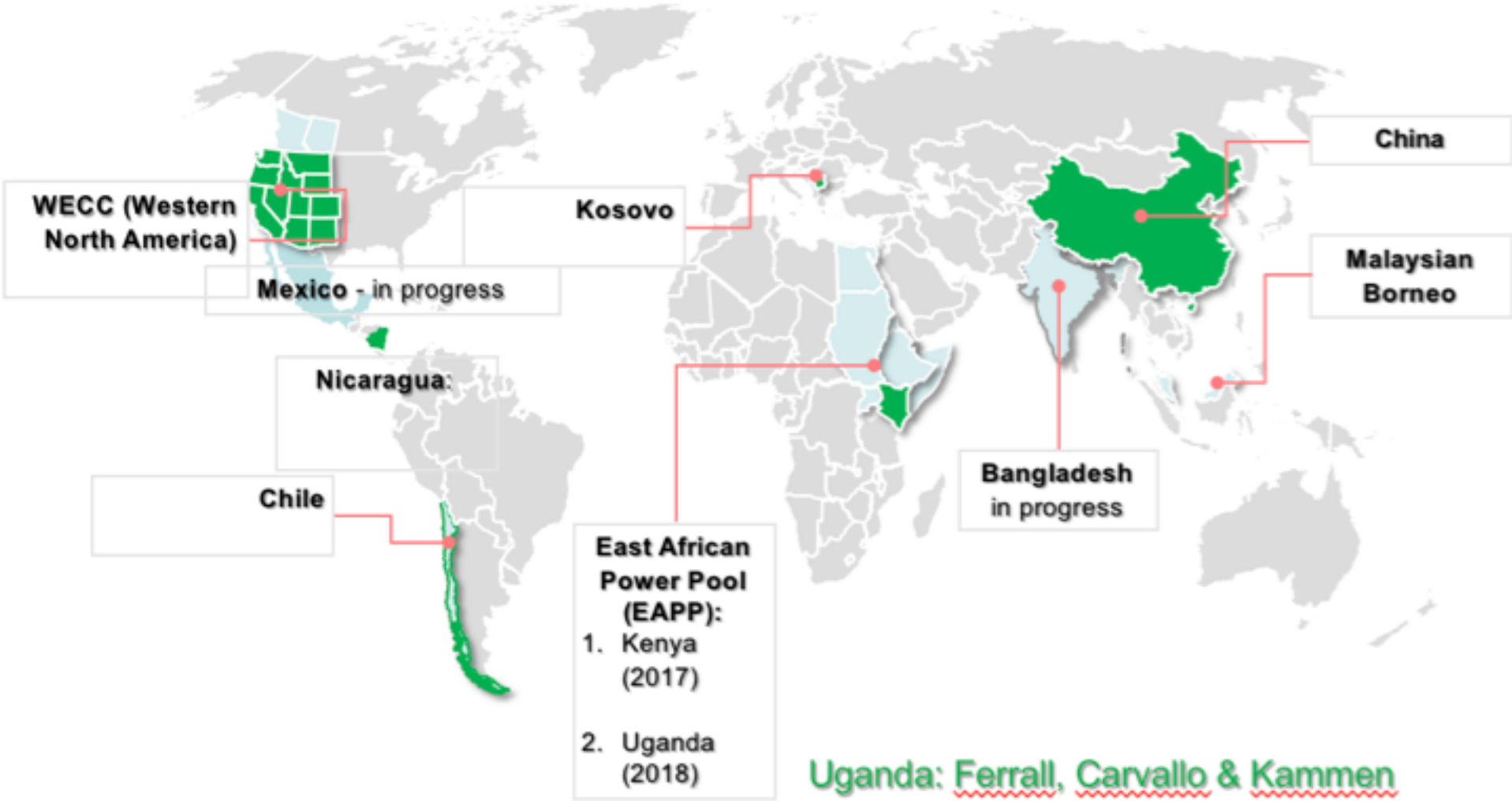
Solar Panel Size: 1.96 m x 0.995 m

Serena Patel

THE IRC KAKUMA RELIEF CAMP PROJECT



RAEL's "SWITCH" Power System Models to Plan the Clean Energy Transition



<http://rael.berkeley.edu/project/SWITCH>

Sustainable Low-Carbon Expansion for the Power Sector of an Emerging Economy: The Case of Kenya

Juan-Pablo Carvalho,^{†,‡} Brittany J. Shaw,^{†,‡} Nkiruka I. Avila,^{†,‡} and Daniel M. Kammen^{*,†,‡,§}

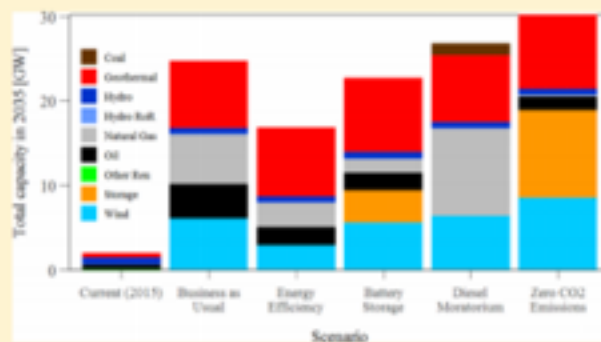
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S Supporting Information

ABSTRACT: Fast growing and emerging economies face the dual challenge of sustainably expanding and improving their energy supply and reliability while at the same time reducing poverty. Critical to such transformation is to provide affordable and sustainable access to electricity. We use the capacity expansion model SWITCH to explore low carbon development pathways for the Kenyan power sector under a set of plausible scenarios for fast growing economies that include uncertainty in load projections, capital costs, operational performance, and technology and environmental policies. In addition to an aggressive and needed expansion of overall supply, the Kenyan power system presents a unique transition from one basal renewable resource—hydropower—to another based on geothermal and wind power for ~90% of total capacity. We find geothermal resource adoption is more sensitive to operational degradation than high capital costs, which suggests an emphasis on ongoing maintenance subsidies rather than upfront capital cost subsidies. We also find that a cost-effective and viable suite of solutions includes availability of storage, diesel engines, and transmission expansion to provide flexibility to enable up to 50% of wind power penetration. In an already low-carbon system, typical externality pricing for CO₂ has little to no effect on technology choice. Consequently, a “zero carbon emissions” by 2030 scenario is possible with only moderate levelized cost increases of between \$3 and \$7/MWh with a number of social and reliability benefits. Our results suggest that fast growing and emerging economies could benefit by incentivizing anticipated strategic transmission expansion. Existing and new diesel and natural gas capacity can play an important role to provide flexibility and meet peak demand in specific hours without a significant increase in carbon emissions, although more research is required for other pollutant’s impacts.



Environ. Sci. Technol., 2017, 51 (17), pp 10232–10242
DOI: 10.1021/acs.est.7b00345

The New York Times

Why Build Kenya's First Coal Plant? Hint: Think China



<https://www.nytimes.com/2018/02/27/climate/coal-kenya-china-power.html>

THE POLITICS OF POVERTY

Ideas and analysis from Oxfam America's policy experts

General Electric's hypocrisy: Does Kenya need coal?

June 14, 2018 | Posted by James Maroney



Author bio



James Maroney

James Maroney is a Researcher on Extractive Industries and Governance at Oxfam America.

Show posts by James Maroney

<https://politicsofpoverty.oxfamamerica.org/2018/06/general-electrics-hypocrisy-does-kenya-need-coal/>

New Challenges:

- Increasing demand for some, & very low/constrained demand for the poor
- Energy and economic analysis versus political story of new projects (e.g. Lamu coal)
- Mini-grid / macro-grid dynamics and productivity
- Long-term planning, cost, and performance



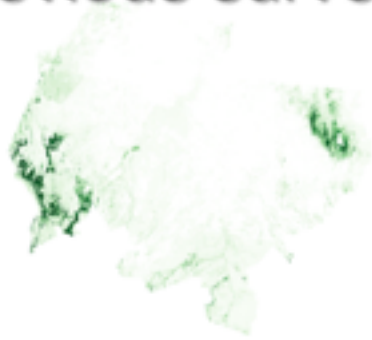
Monthly use	Dec 2003 (per unit)	July 2004 (per unit)	July 2005 to-date
0 - 50 units	\$0.25	\$0.25	\$0.25
51 - 1,500	\$0.02	\$0.02	\$0.02
Above 1,500	\$0.07	\$0.07	\$0.07
Fuel charge	\$0.00	\$0.00	\$0.00



A GHG assessment for rural counties: Drought, livestock, vegetation and conservation for Laikipia, Kenya

Dennis Best & Daniel Kammen

Previous surveys



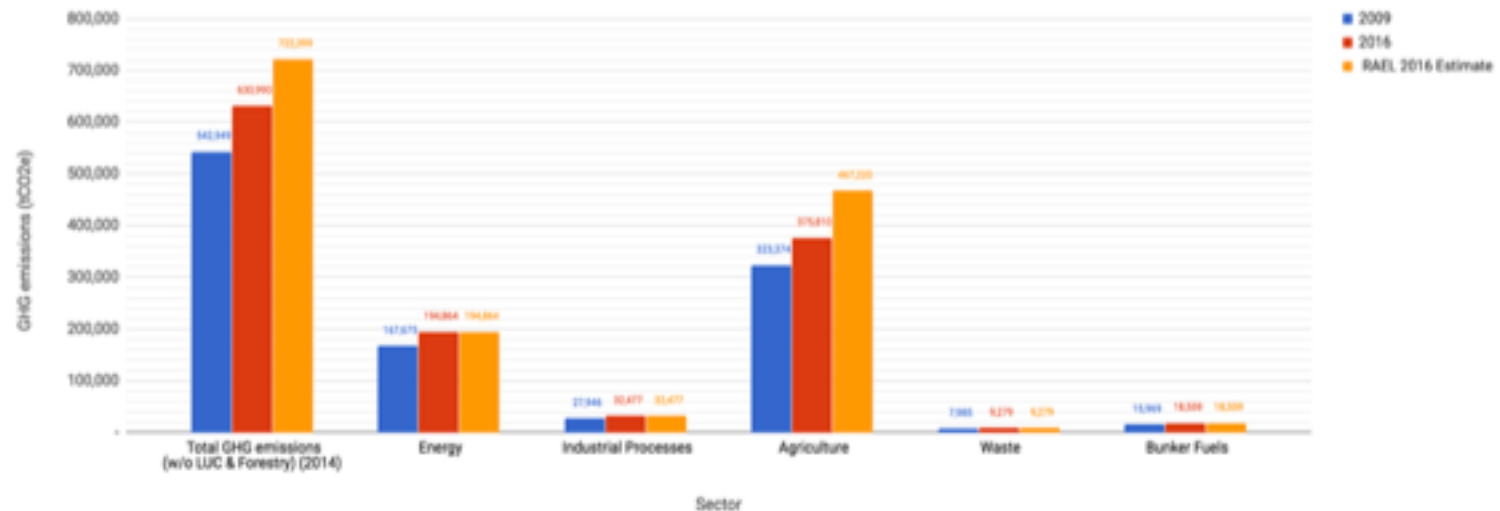
Baccini et. al (2012)



ESA landcover map (2015)

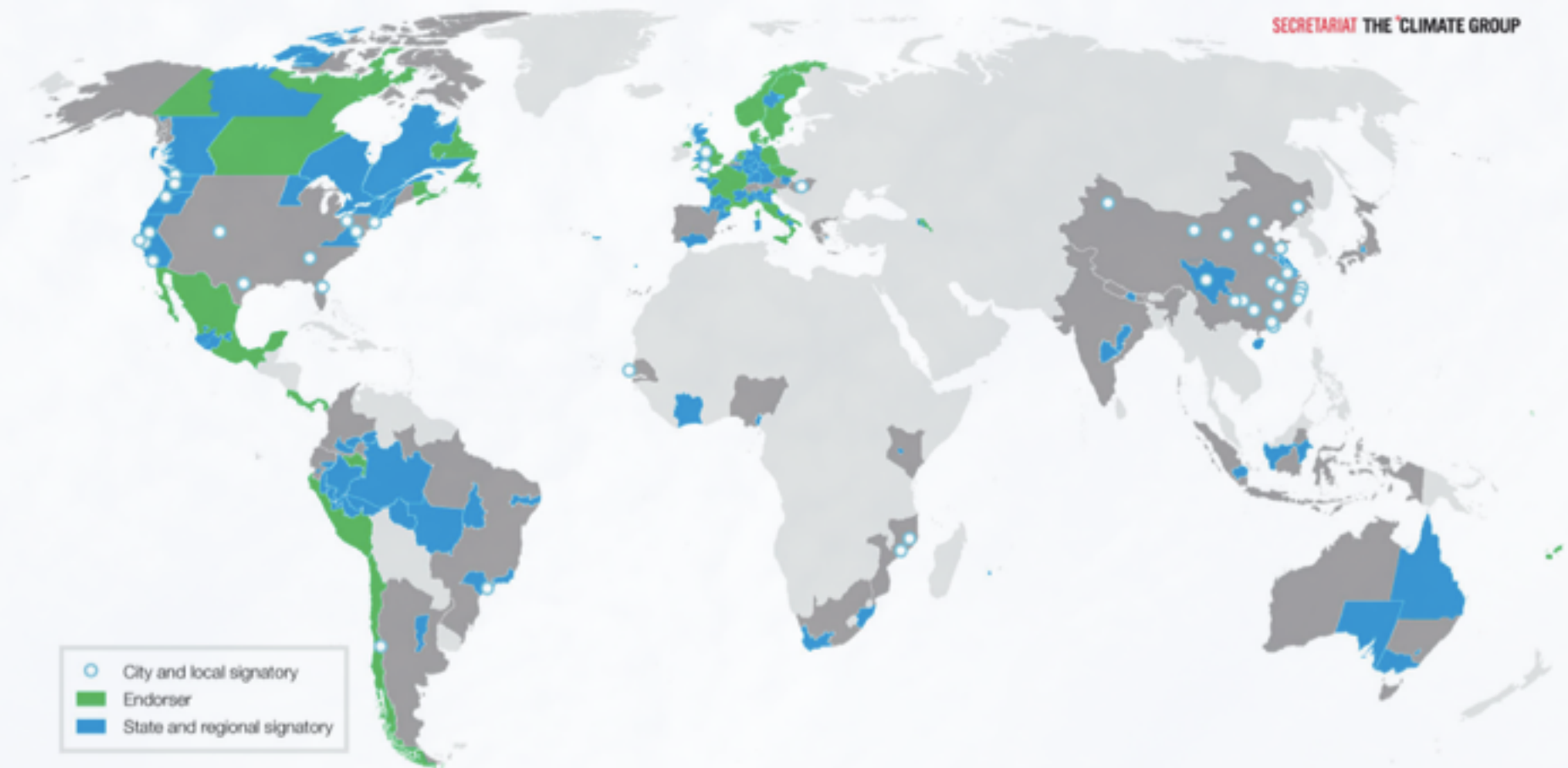


Laikipia County council (2013)



The Under2MOU Coalition

THE UNDER2 COALITION



Co-chairs 2017: Edmund G. Brown Jr., Governor of California Philippe Couillard, Premier of Québec Winfried Kretschmann, Minister-President of Baden-Württemberg Willies Mchunu, Premier of KwaZulu-Natal Aristóteles Sandoval, Governor of Jalisco Jay Weatherill, Premier of South Australia

UNDER **2**

REGIONS REPRESENT

1.2 BILLION
PEOPLE



AND



\$28.8 TRILLION
IN GDP

That's 39% of the global economy