

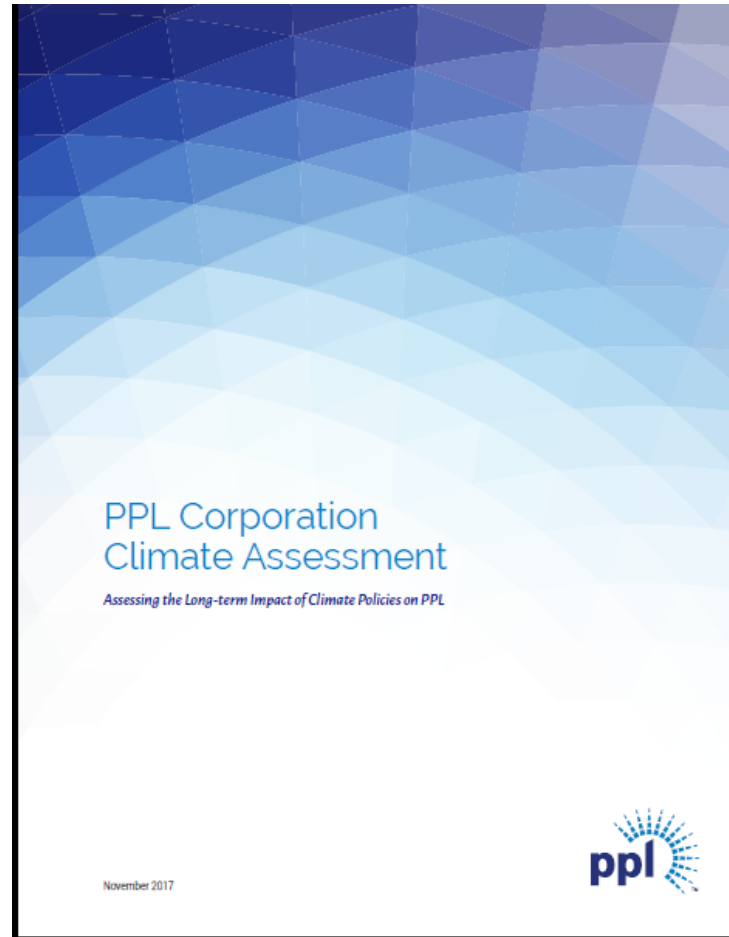
Proposed Clean Energy resolution: a balanced approach to cost -effectively reducing CO<sub>2</sub> emissions over time or renewable energy at all costs?



Louisville Metro Council  
David S. Sinclair, VP Energy Supply and Analysis  
November 29, 2018

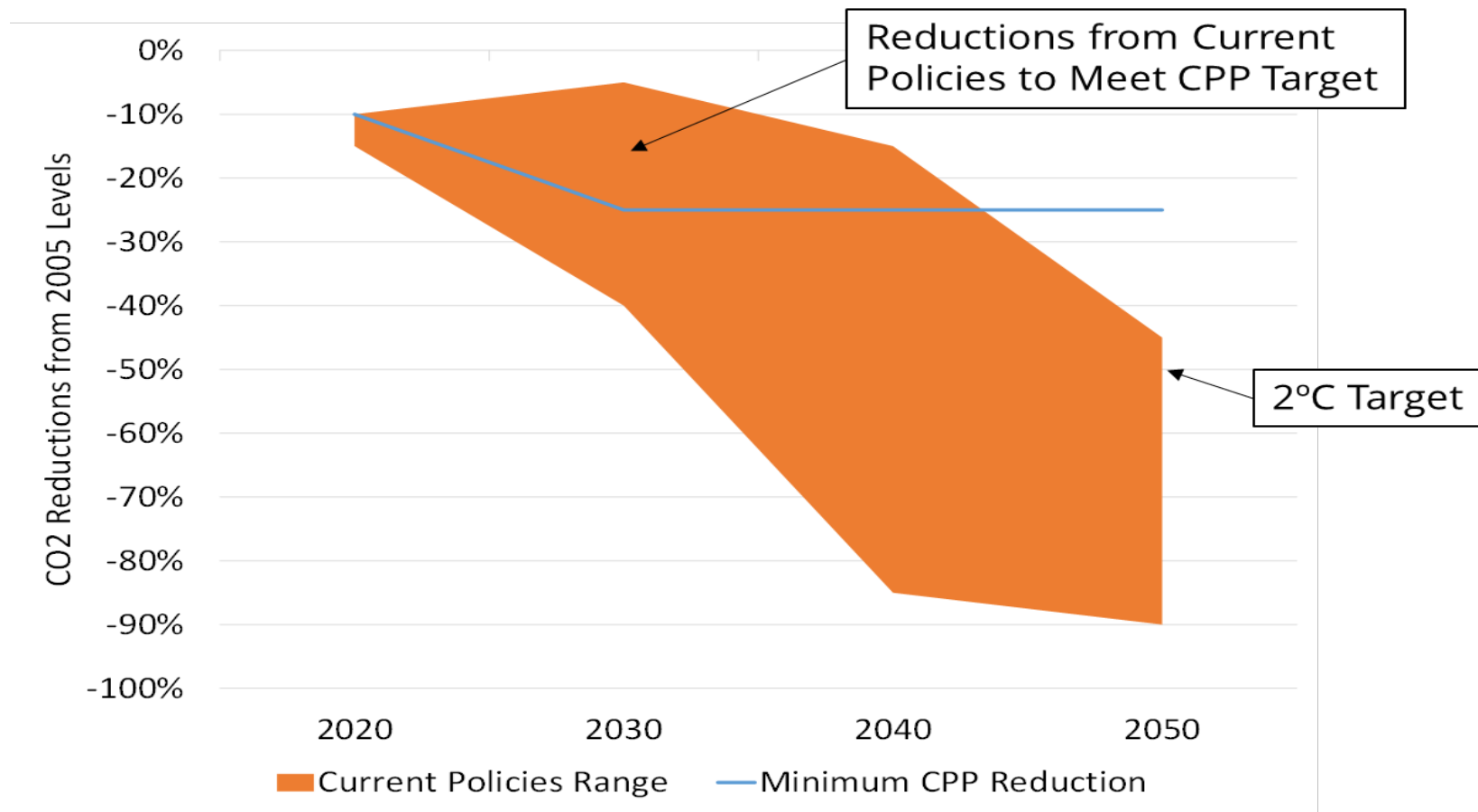


# LG&E parent prepared detailed analysis of its future CO<sub>2</sub> emissions and set a goal of 70% reduction from 2010 levels by 2050



<https://www.pplweb.com/wp-content/uploads/2017/12/Climate-Assessment-Report.pdf>

# LG&E and KU's CO<sub>2</sub> emissions will decline over time as coal plants retire and are replaced with gas and renewables



Source: PPL Corporation Climate Assessment



# Corporate claims of 100% renewable energy use are based on annual utilization, not actually powering their facilities



Google

September 17, 2013 | Revision 3 (initially published April 21, 2011)

## Google's Green PPAs: What, How, and Why

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Introduction  
Google has pledged to reduce its carbon footprint to zero. Zero is an aggressive goal, not easily achieved by any one measure, so we pursue a multi-pronged approach to get there. Efficiency is one prong of the approach and carbon offsets is another. But a very important third prong of the approach is the purchase and use of carbon-free renewable electricity to power our data centers.

When we started out on this path, we realized that we had a lot of learning to do. We had basic questions, such as:

- What types of resources are most appropriate, and from where?
- How do we get the electricity to our facility to use?
- How can we make such a purchase economical, and how can it be leveraged to protect us from higher prices in the future?
- How can we maximize the impact of our green power purchases on our carbon emissions and global emissions?

We also knew we wanted to enforce some fundamental principles that we value: First, our activities must meet the basic criterion of "rationality." We'll describe this more a bit further down, but fundamentally, a renewable energy purchase is additional if it has an effect in the real world, be it direct or indirect. A direct effect would be causing a new renewable project to be built. An indirect effect would be increasing demand for renewable energy such that market pressures are able to encourage new investment.

Second, where possible, our projects should go beyond basic additivity and directly address problems that limit the growth of the renewable industry. For example, if we know that we are going to need renewable energy for a long time, it may be better for renewable project developers if we commit to a long-term contract rather than purchasing as we go, because it makes it easier for them to raise capital.

This paper attempts to show how we have answered these questions and met our principles in a way that makes business sense for us. We hope also that this will serve as a useful starting point for other companies that want to buy renewable power.

### Electrons, markets, and the art of the possible

#### Electrons

First, a little background: We know from Kirchhoff's circuit laws that electricity generated in one spot cannot be directed to a specific user over the electricity grid. Once you put electricity on the grid there is no actual way to know "the energy from wind farm X is going to my data center Y."

*“While we’ll still be drawing power from the grid, some of which will be from fossil fuel resources, we’ll purchase enough wind and solar energy to account for every MWh of electricity our data centers and office operations consume annually.”*

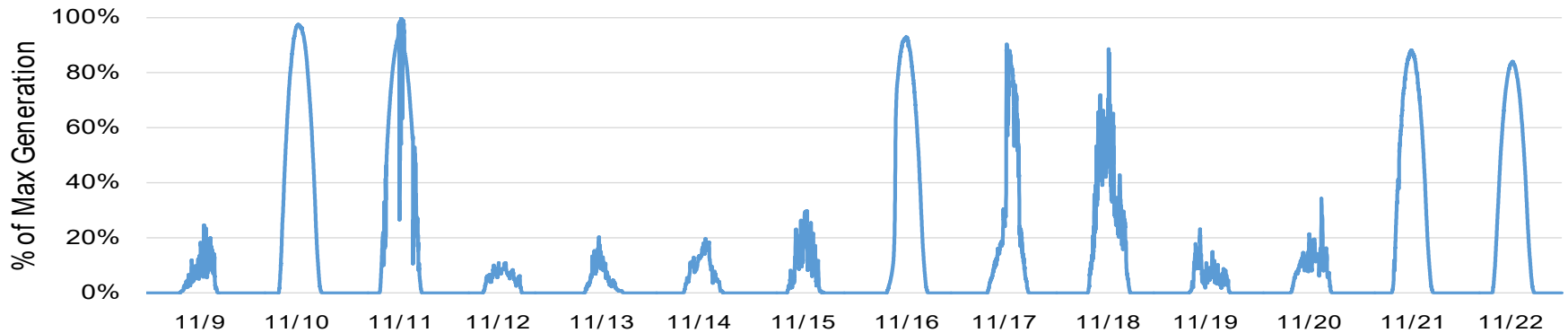
Environmental Report – 2017 Progress Update

*“Fundamentally, data centers and wind farms should each be sited where they can be the most effective—and this is often in different locations.”*

Google’s Green PPA: What, How, and Why, September 2013

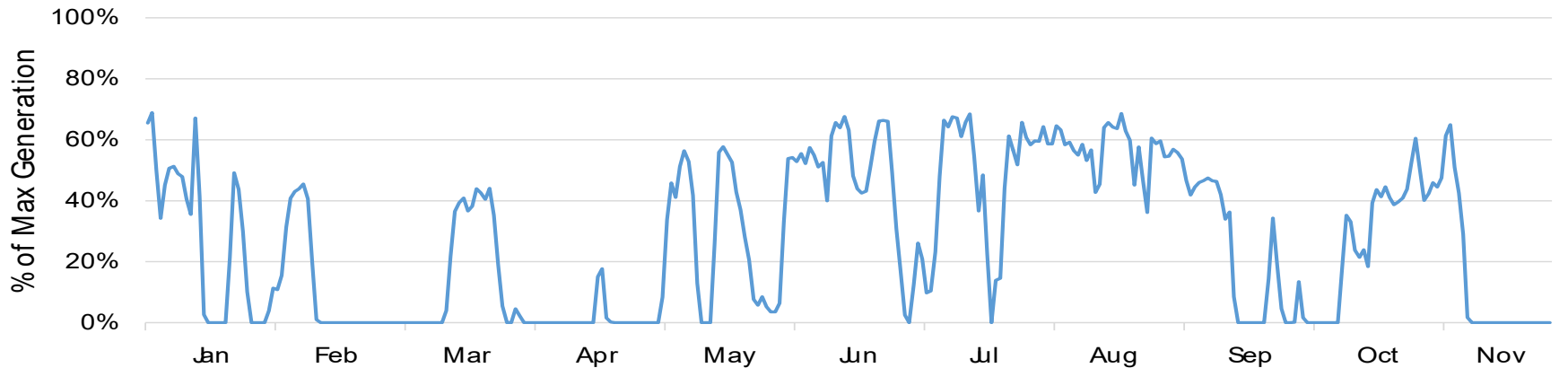
# Intermittency of renewables hinder their ability to reliably serve load even with storage

## Brown Solar Generation



Live Brown Solar data at: <https://lge-ku.com/live-solar-generation>

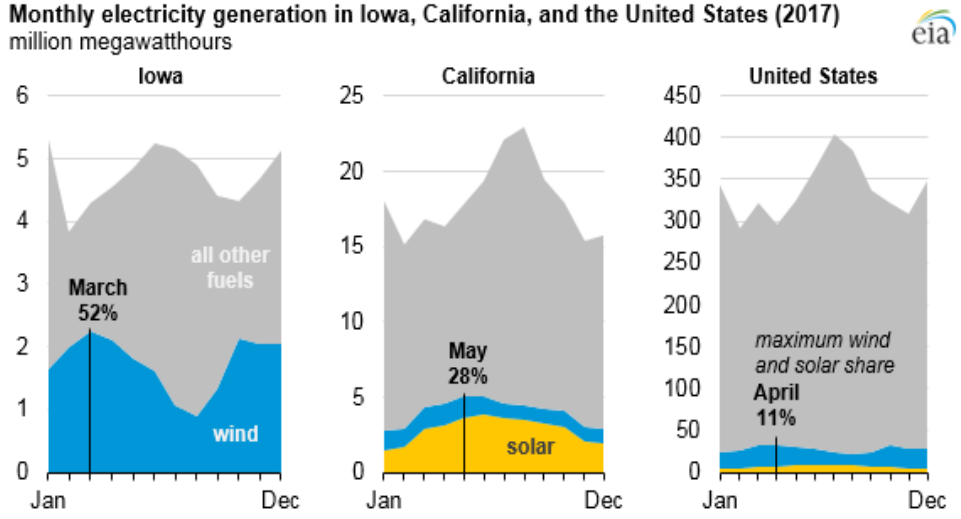
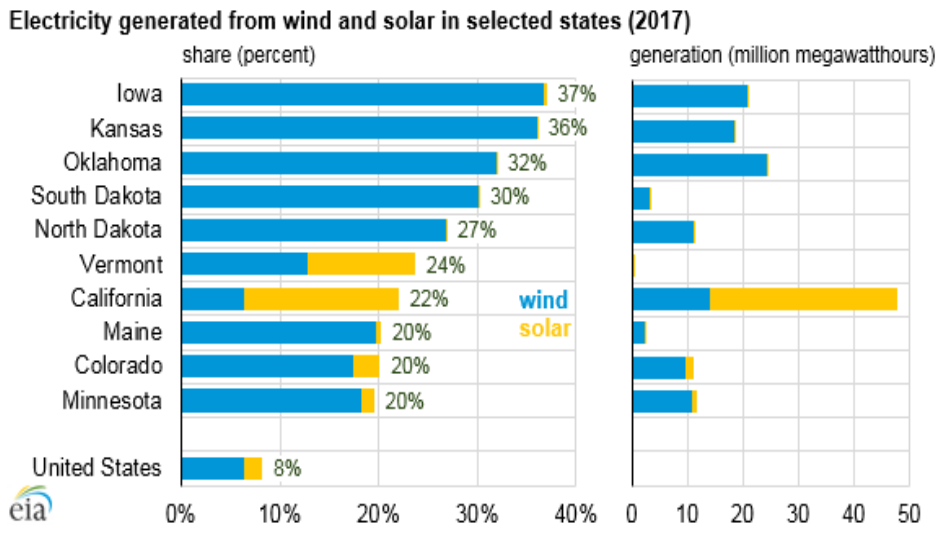
## Ohio Falls Generation



# Our citizens, small business, and major employers rely on natural gas – would that still be possible in 2035?

- Will existing gas customers need to retrofit to all -electric?
  - 250,000 residential customers
  - 20,000 commercial customers
  - 900 industrial customers
- Gas is important to many industries
  - Restaurants & hotels
  - Distilleries
  - Autos, appliances, healthcare
  - Education
  - Tourism: airport, convention center, fairgrounds, YUM Center
- Many back-up power systems in homes, business, and hospitals are fueled by gas

# The nation is taking a balanced approach to its electricity needs with renewables growing in places that make sense



Source: Energy Information Administration, October 2018