Energy Data Privacy: How Climate Changes Everything

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The Carbon Cycle

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Atmosphere

200 Gigatons

200 Gigatons

Land / Water

Global Atmospheric Concentrations of Carbon Dioxide Over Time

800,000 BCE to 2015 CE

Carbon dioxide concentration (ppm)

Year (negative values = BCE)

1950 to 2015 CE

Year

Data source: Compilation of 10 underlying datasets. See www.epa.gov/climate-indicators for specific information.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climate-indicators.
Climate Change

Data: SSP database (IIASA)/GCP

Scenarios:
- Baseline (3–5.1°C)
- 6.0 W/m² (3.2–3.3°C)
- 4.5 W/m² (2.5–2.7°C)
- 3.4 W/m² (2.1–2.3°C)
- 2.6 W/m² (1.7–1.8°C)

Emissions from fossil fuels and land-use change (GtCO₂/yr)

1980 2000 2020 2040 2060 2080 2100

<2°C <3°C <4°C <5°C <6°C

net-negative global emissions

Global Carbon Project

“Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate. Climate-related risks to health, livelihoods, food security, water supply, human security, and economic growth are projected to increase with global warming of 1.5°C and increase further with 2°C.”
Carbon Bubble

**CARBON BUBBLE**

Emissions from burning all known reserves of coal, oil and natural gas.

2.795 billion tons of CO₂

565 billion tons of CO₂

Remaining carbon budget

This is how much CO₂ can be emitted until 2050 and still give a reasonable chance of staying below 2 degrees Celsius of global warming.

Source: Carbon Tracker Initiative 2013 / Potsdam Institute for Climate Impact Research
Illustration: Felix Müller (www.zukunft-seiernachen.de) Licence CC-BY-SA 4.0
My favorite climate change joke

They say we won’t act until it’s too late...
They say we won’t act until it’s too late...

Luckily, it’s too late!
Energy in the United States

Estimated U.S. Energy Consumption in 2017: 97.7 Quads

Source: LBNL April 2019, Data is based on OKUHIA MAR (1997). If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. This chart was revised in 2017 to reflect changes made in mid-2006 to the Energy Information Administration's analytic methodology and reporting. The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 45% for the residential sector, 45% for the commercial sector, 21% for the transportation sector, and 49% for the industrial sector which was updated in 2017 to reflect DOE's analysis of manufacturing. Totals may not equal sum of components due to independent rounding. LBNL-137107

https://flowcharts.llnl.gov/commodities/energy
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https://flowcharts.llnl.gov/commodities/energy
Decarbonizing energy

Energy consumption in the U.S. economy, 2010–2050

Rocky Mountain Institute © 2011. Published by Chelsea Green in Reinventing Fire. For more information see www.rmi.org/ReinventingFire.

https://rmi.org/insight/reinventing-fire/
Conclusion:

We need to:

★ Install massive amounts of renewables.
★ Install massive amounts of energy efficiency.
★ Electrify everything.
Renewable Intermittency

The Effect of Sky Conditions on Solar Panel Power Output

https://www.vernier.com/innovate/the-effect-of-sky-conditions-on-solar-panel-power-output/
Renewable Intermittency

Figure 2: The duck curve shows steep ramping needs and overgeneration risk

Net load - March 31

- Ramp need
  ~13,000 MW in three hours

Overgeneration risk

Conclusion:

We need to:

★ Install massive amounts of renewables.
★ Install massive amounts of energy efficiency.
★ Electrify everything.
★ Deploy stupid amounts of load flexibility.
Distributed Energy Resource (DER) - noun - A variety of small, modular power-generating technologies that can be combined with energy management and storage systems and used to improve the operation of the electricity delivery system, whether or not those technologies are connected to an electricity grid.
The need for customer utility data

- Customer Acquisition
- Installation/Deployment
- Operation & Maintenance
The need for customer utility data

Need historical utility data for feasibility analysis.

"How much do you currently spend on energy?"
The need for customer utility data

Need historical utility data for feasibility analysis.
"How much do you currently spend on energy?"

Need ongoing utility data to monitor performance.
*Savings reporting in dollars, not kilowatt-hours*
Utility data access

Problems:

1) There hasn’t ever been a big reason to share customer utility data.

2) No API or standards for sharing customer utility data at scale.

3) No pre-established privacy protections around utility data sharing.
Present day solutions:

1) Manual data entry  
   (e.g. dig up old bills and hand type them in)

2) Paper data request form  
   (e.g. fax the utility a signed authorization form)

3) Login credentials sharing  
   (e.g. ask for access to online utility account)
Privacy concerns:

1) Interval data is personal (e.g. can tell your lifestyle)
2) Bill data reveals credit (e.g. how often you pay your bill)
3) Credential re-use (e.g. same logins as banks)

https://spectrum.ieee.org/energy/the-smarter-grid/privacy-on-the-smart-grid
Ownership concerns:

1) Who owns your utility usage and bill data? Mixed rulings:
   - Court Grants Feds Warrantless Access to Utility Records
   - Smart meters protected by the Fourth Amendment

2) Who owns your smart energy device data? Wild west:
   - All your solar panels are belong to ME

3) GDPR? Still unknown:
   - GDPR in the Energy Sector
Conclusion:

We need to:

★ Install massive amounts of renewables.
★ Install massive amounts of energy efficiency.
★ Electrify everything.
★ Deploy stupid amounts of load flexibility.
★ Not destroy customer privacy in the process.
DataGuard (from U.S. Department of Energy SmartGrid.gov)

1) Voluntary Code of Conduct for requesting and handling energy data.
2) Outlines guidelines around energy data privacy.
   a) Scoped consent and transparency
   b) Safe data handling and redress
   c) Basically GDPR for energy data in the U.S. ... except voluntary :(

https://www.dataguardprivacyprogram.org/
Green Button (originally from NIST, spun off into Green Button Alliance)

1) OAuth-style utility data sharing
2) Requires utilities to adopt standard
   a) Unfortunately, usually poorly implemented by utilities
   b) Usually only offered when mandated by regulators
   c) Slowly getting better (hopefully via UtilityAPI adoption)

https://www.greenbuttonalliance.org/
UtilityAPI (platform used by DER/EE companies to request and download utility data)

1) Trying to establish consent-driven as default “best practice”.
2) Helps establish better data access standards/regulation:
   a) On the Green Button Alliance board + technical working group.
   b) Promotes DataGuard guidelines and privacy standards.
   c) Wrote CPUC CDAC “Click-through” technical solutions.
      (California Public Utilities Commission, Customer Data Access Committee)
Thanks!

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Contact me if you want to use non-cited stuff from this presentation.