MI POWER GRID

Making the Most of Michigan's Energy Future

# Energy Programs & Technology Pilots

## Stakeholder Meeting 7

***The meeting will begin shortly at 1:31 pm to allow people to join.***

June 25, 2020

1:00-4:00 PM

MPSC

Michigan Public Service Commission

MI POWER GRID

Making the Most of Michigan's Energy Future

# Welcome and Overview

**Joy Wang**
wangj3@Michigan.gov
MPSC Staff
Smart Grid Section

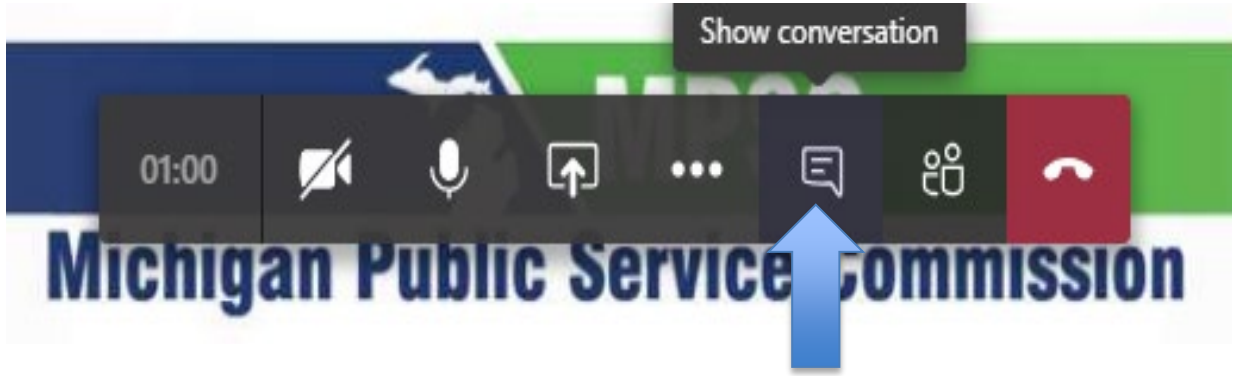
MPSC
Michigan Public Service Commission

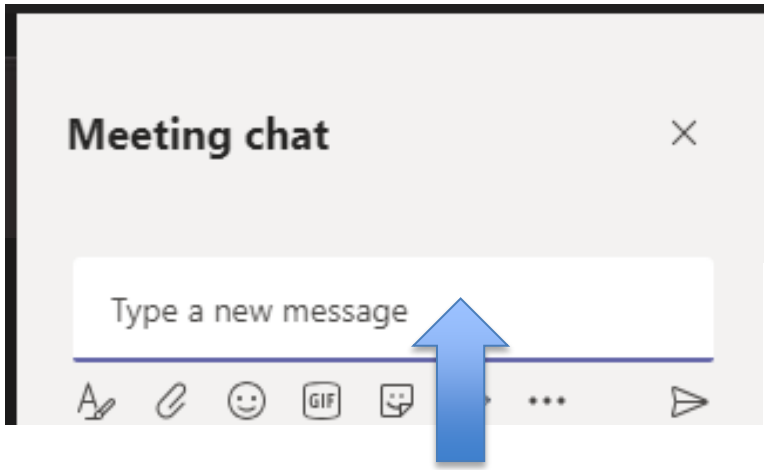
# Agenda

| | | |
|---|---|---|
| 1:00 pm | Welcome & Overview of Last Meeting | Joy Wang (MPSC Staff) |
| 1:05 pm | Opening Statements | Tremaine Phillips (MPSC Commissioner) |
| 1:15 pm | Panel: Direction for Future Pilots | *Part I: Emerging Integrated Solutions*<br>Panelists: Greg Bolino (Accenture)<br>Greg Geller (EnelX)<br>Ric O'Connell (GridLab)<br>Moderator: Ryan Katofsky (AEE)<br><br>*Part II: Michigan Project Examples*<br>Panelists: Matt Grocoff (THRIVE Collaborative)<br>Gibran Washington (EcoWorks)<br>Moderator: Laura Sherman (Michigan EIBC) |
| 2:15 pm | Flex Time/Break | |
| 2:30 pm | Emerging Technologies: Candidates for Michigan's Grid | Joe Tesar (Quantalux) |
| 2:40 pm | Pilot Program Importance & Best Practices | Sean Williams (CLEAResult) |
| 2:50 pm | Pilot Ideas from Other MI Power Grid Workgroups | Joy Wang (MPSC Staff) |
| 3:00 p.m. | Break | |
| 3:05 p.m. | Identifying the Most Promising Solutions for Reducing Carbon Emissions in Michigan: Lessons from Drawdown Georgia | Marilyn Brown (Georgia Institute of Technology) |
| 3:50 p.m. | Closing Statements | Anne Armstrong<br>(MPSC, Director, Customer Assistance Division) |
| 3:55 p.m. | Timeline and Next Steps | Joy Wang (MPSC Staff) |
| 4:00 p.m. | Adjourn | |

# Housekeeping

- This meeting is being recorded
- Recording and slides posted on workgroup website in about a week
- All audience members will be muted
- Please type questions into the chat box
  - To access chat box:

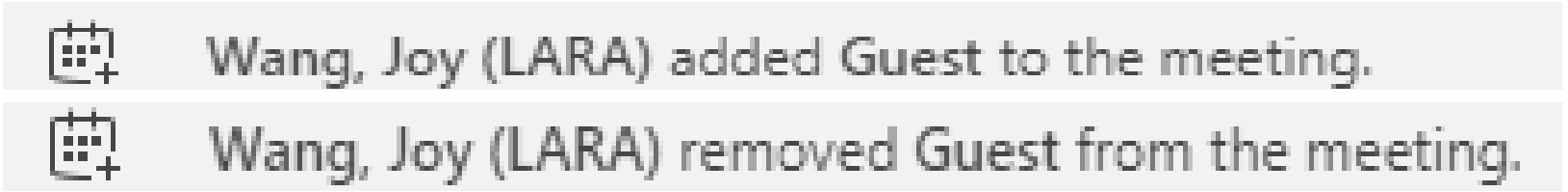



- Staff will ask chat box questions during Q&A

# Housekeeping, cont.

- During the panel discussion, if clarification of your question is needed, we will ask you to unmute.
  - To unmute:
    - Phone:  Press *6
    - Teams:  Click mic button
  - Please mute yourself again after your clarification.
- Chat box may note when audience member enter/exit.
  - These notices are automatic:




- If Teams via web browser is not working, try a different web browser.  Some browsers that may work are:
  - Google Chrome, Internet Explorer, and Mozilla Firefox

# Overview of June 11 Meeting

- Panel: Community Pilot Experience, Best Practices, and Strategic Plans
  - Panelists: Sergio Cira-Reyes (Urban Core Collective)
    Jan Culbertson (Ann Arbor 2030 District)
    Robert LaFave (Village of L'Anse)
    Amy Roth (City of Three Rivers)
    Alison Sutter (City of Grand Rapids)
  - Moderator: Sarah Mills (University of Michigan)
- Topics discussed included:
  - clean energy,
  - community engagement,
  - past and future pilots, and
  - what panelists would like from utilities to assist meeting strategic goals

# Overview of June 11 Meeting, cont.

- Panel summary cont.
  - Reinforced importance for inclusion of low-income communities, as well as people of color, when considering or launching pilot programs
  - Community engagement supported by all panelists
    - Every community is different.
    - Need to engage customers to find out who they will trust and which products and services they'll use.

# Overview of June 11 Meeting, cont.

- Brad Fingland and Paul Jaques (MSU Innovation Center – Spartan Innovations)
  - Shared examples of energy start-ups supported by MSU Foundation efforts.
  - Stressed need for:
    - Diversity
    - Targeted technology and initiatives
    - Early stage funding for start-ups
    - Partnerships with industry leaders
- Staff presentation on report timeline
- Recording and presentation slides available at workgroup website

# Agenda

| | | |
|---|---|---|
| 1:00 pm | Welcome & Overview of Last Meeting | Joy Wang (MPSC Staff) |
| 1:05 pm | Opening Statements | Tremaine Phillips (MPSC Commissioner) |
| 1:15 pm | Panel: Direction for Future Pilots | *Part I: Emerging Integrated Solutions*<br>Panelists: Greg Bolino (Accenture)<br>Greg Geller (EnelX)<br>Ric O'Connell (GridLab)<br>Moderator: Ryan Katofsky (AEE)<br><br>*Part II: Michigan Project Examples*<br>Panelists: Matt Grocoff (THRIVE Collaborative)<br>Gibran Washington (EcoWorks)<br>Moderator: Laura Sherman (Michigan EIBC) |
| 2:15 pm | Flex Time/Break | |
| 2:30 pm | Emerging Technologies: Candidates for Michigan's Grid | Joe Tesar (Quantalux) |
| 2:40 pm | Pilot Program Importance & Best Practices | Sean Williams (CLEAResult) |
| 2:50 pm | Pilot Ideas from Other MI Power Grid Workgroups | Joy Wang (MPSC Staff) |
| 3:00 p.m. | Break | |
| 3:05 p.m. | Identifying the Most Promising Solutions for Reducing Carbon Emissions in Michigan: Lessons from Drawdown Georgia | Marilyn Brown (Georgia Institute of Technology) |
| 3:50 p.m. | Closing Statements | Anne Armstrong<br>(MPSC, Director, Customer Assistance Division) |
| 3:55 p.m. | Timeline and Next Steps | Joy Wang (MPSC Staff) |
| 4:00 p.m. | Adjourn | |

MI POWER GRID

Making the Most of Michigan's Energy Future

# Energy Programs & Technology Pilots

## Opening Statements:
## Commissioner Tremaine Phillips
## 1:05 – 1:15 PM

Stakeholder Meeting 7

June 25, 2020

MPSC

Michigan Public Service Commission

MI POWER GRID

Making the Most of Michigan's Energy Future

# Energy Programs & Technology Pilots

## Panel: Direction for Future Pilots

## 1:15 – 2:15 PM

Stakeholder Meeting 7

June 25, 2020

MPSC

Michigan Public Service Commission

MI POWER GRID

Making the Most of Michigan's Energy Future

# Energy Programs & Technology Pilots

## Flex Time/Break: 2:15 – 2:30 PM

Stakeholder Meeting 7

June 25, 2020

MPSC

Michigan Public Service Commission

QUANTALUX™

Enlightened Solutions

# LONG DURATION RENEWABLE STORAGE

25 JUNE 2020

# Energy Storage is essential & the “usual answer” is Li-Ion batteries

Li-Ion Batteries are usually the go-to answer for storage

**But !!**

- Limited Duration (typically 4-5 hours max)
- Cost remains stubbornly high …

How to solve the “duration” problem?

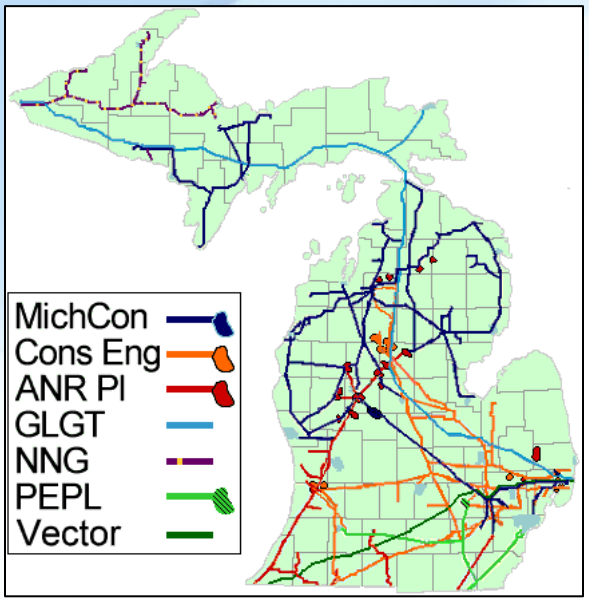
- Renewable Natural Gas (RNG)
- Hydrogen

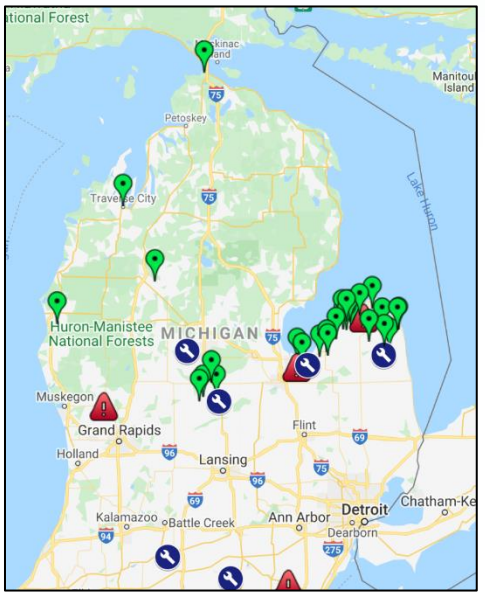
*Pressurized gas means easier storage*
*(not trivial, but easier….)*


How to solve the “cost” problem?

- Integrate/Augment current technology
- Leverage existing infrastructure (see next slide)

# Existing Energy Assets in Michigan



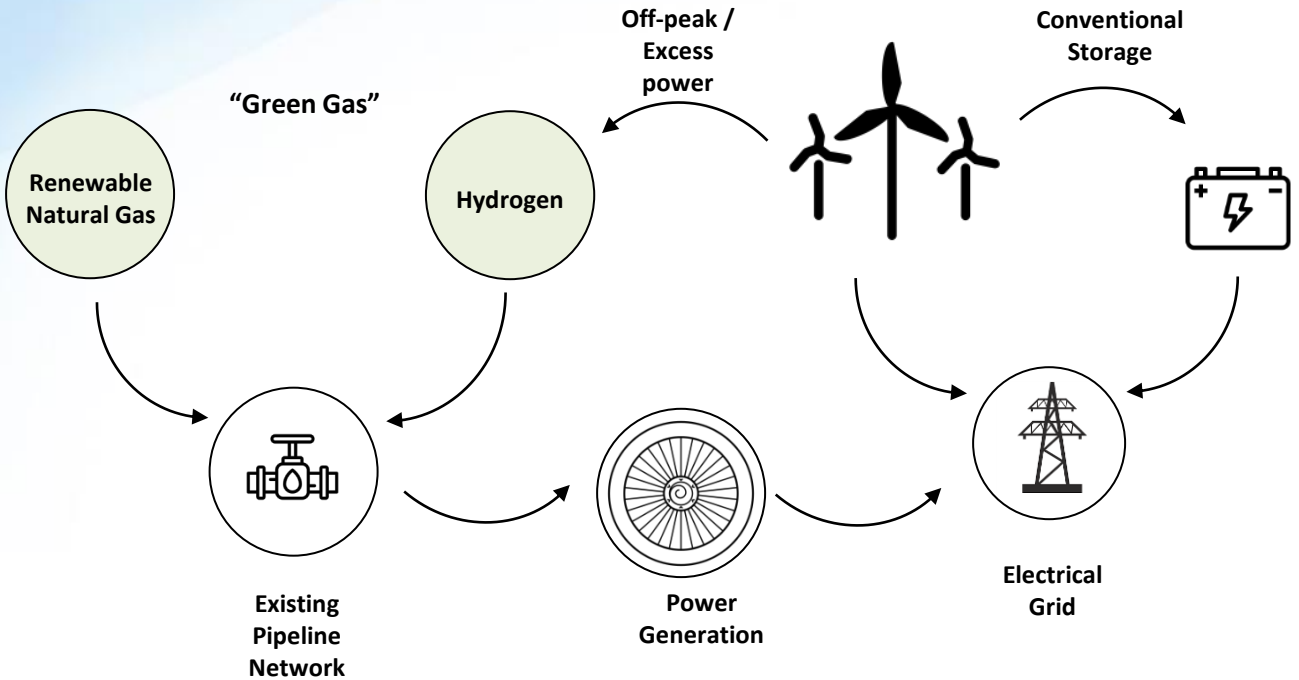

Michigan's natural gas pipelines:
59,000 miles of distribution , 3.3 million service lines, and 9,000 miles of transmission-gathering (Lower and Upper Peninsulas).

Wind Production:
As of May 2020: Michigan has 1149 turbines producing 2,330 MW.
End of 2020: 1284 turbines producing >3100 MW.

***Long duration storage can build on this infrastructure***

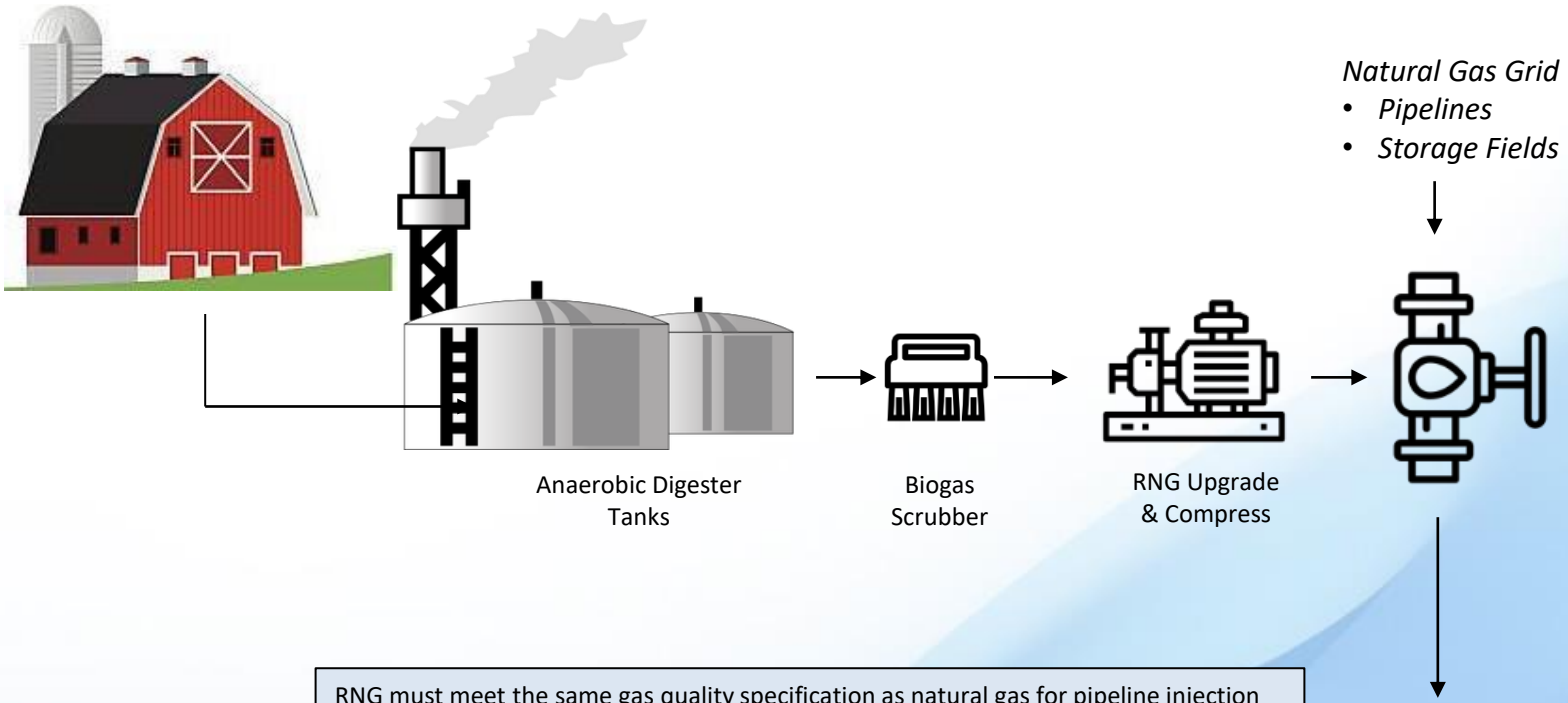
# Renewable Natural Gas/Hydrogen:
## Candidates for Long Duration Storage

- *Take advantage of existing pipelines and wind for "Green Gas"*
- *Store gases in existing pipelines/storage fields*
- *Recover gas and produce power when needed*



# #1. Long-duration Storage: Renewable Natural Gas (RNG)

- Organic wastes naturally produce biogas
- Sources include: Dairy farms, municipal wastewater, landfills, food waste
- Build anaerobic digester and make biogas (60% CH4, 40% CO2)
- Upgrade to RNG (99% methane)




RNG must meet the same gas quality specification as natural gas for pipeline injection

# Biogas: Energy and environmental benefits

***Harvest Energy Garden (FL)***

- *Feedstock: biosolids, fats, oils and food waste (Walt Disney)*

***South Campus AD, MSU***

- *Feedstock: dairy manure + other organic wastes.*

***Fremont Community Digester (MI)***

- *Feedstock: Food waste + agricultural organic waste*

***Sacramento (CA)***

- *Feedstock: 40,000 tons/yr food waste*

***Junction City (OR)***

- *Feedstock: 25,000 tons/yr food waste*

**Kroger's Anaerobic Digester (IN)**

- *Feedstock: Food Waste (from grocery supply chain).*

***These biogas facilities are all potential sources of biogas/RNG***

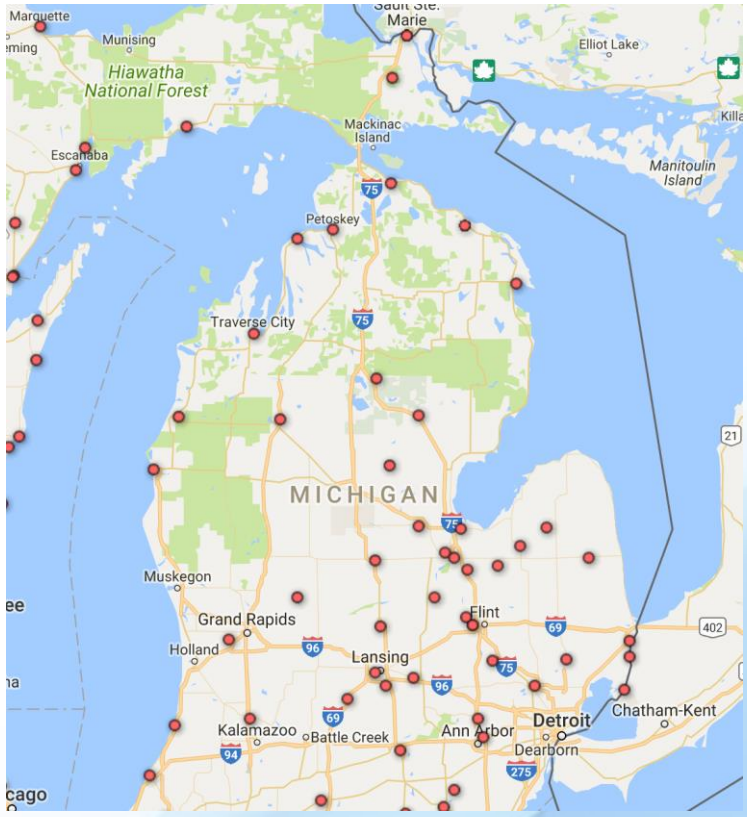
# Biogas from Wastewater Treatment Plants (WWTPs)

Over 65 wastewater plants produce biogas in Michigan.

1) Plants are geographically distributed across the entire state (incl. U.P.)
2) Biogas production 24/7

***Note:*** Nearly all WWTPs flare their naturally-occurring biogas.

*There is no "market" for renewable gas from WWTPs in Michigan.*




*Data from http://www.resourcerecoverydata.org/*

# Unique market for RNG: the LCFS

In 2016, the California legislature approved the:

***Low Carbon Fuel Standard (LCFS)***


RNG (LCFS) →

*Any Interstate Pipeline that terminates in California can carry LCFS RNG.*

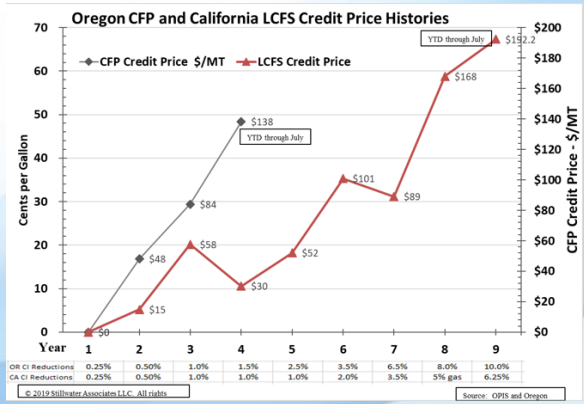
→



$CH_4 + O_2 + heat = CO_2 + energy$

The LCFS has created a dynamic market across the U.S. for renewable fuels to replace gas/diesel.

Current market value of RNG: $40+/MMBtu *
Current market value of natural gas: < $4/MMBtu




**** RNG from dairy farms***

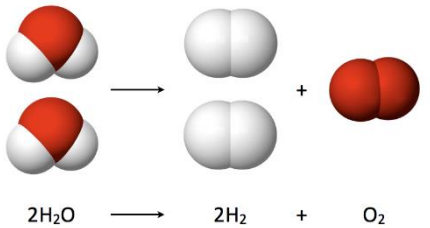
# #2: Long Duration Storage: Green Hydrogen

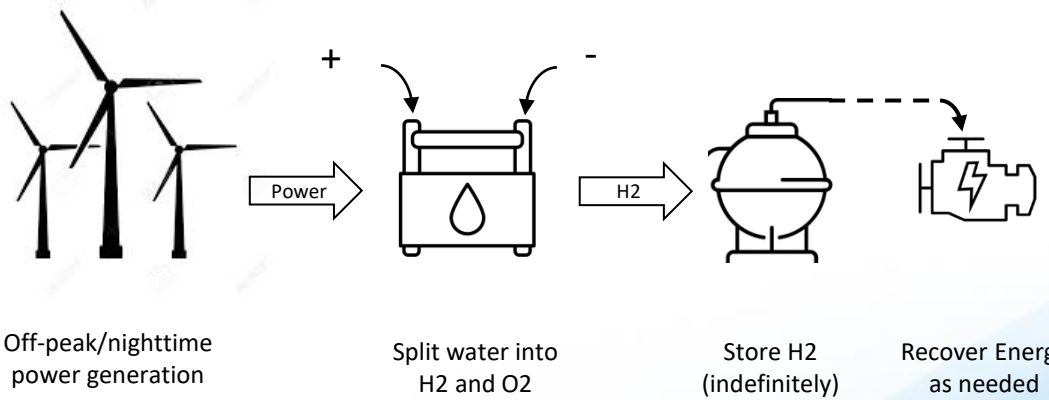
Produce Hydrogen (H2) from water using electrolysis

- Use off-peak/surplus renewable energy

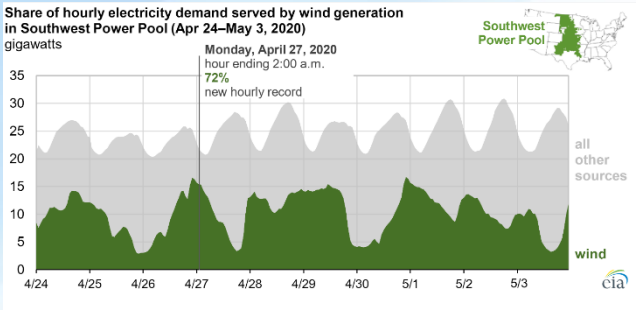
Store H2

Produce power from stored H2 during peak demand



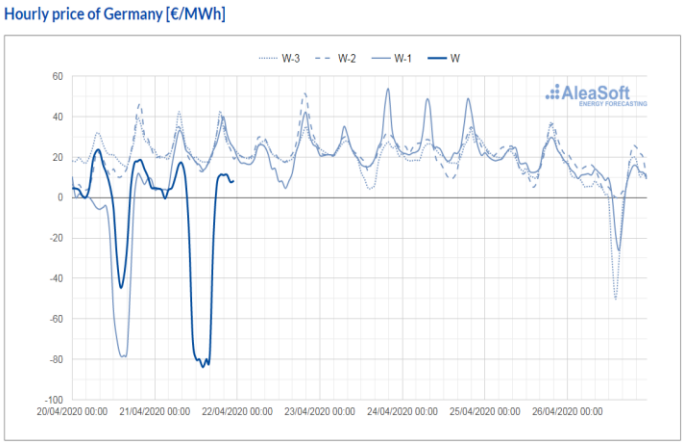



# Green H2: Growing Deployments in Wind Generation
## …… and occasional negative prices….




Southwest Power Pool generated a record 72% of power generated from wind resources (April 2020)

In October 2019, power prices fell below **minus $10 a megawatt-hour** for much of the SPP region.

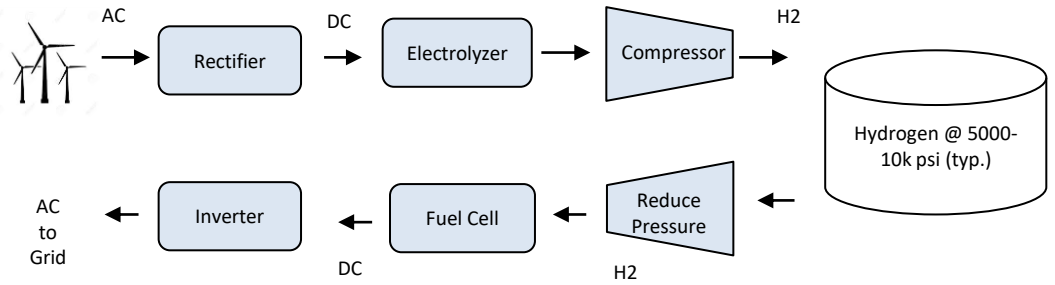



Negative power prices are also occurring in N. Europe when North Sea wind turbines are humming ….

Negative prices also have been seen in Nordpool UK

***Inexpensive green power is a gateway for H2 storage***

## a. Traditional: Pure Hydrogen Storage

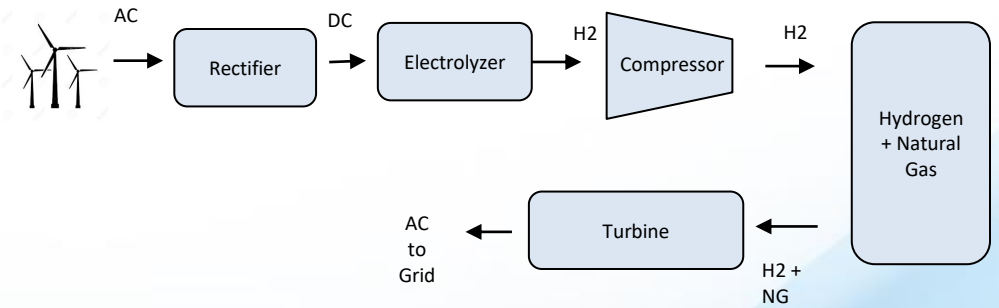



Store H2 in carbon fiber tanks, steel tanks, etc.

Generate power using Fuel Cell

---

## b. A better way: Blended H2 and Natural Gas




Co-mingle H2 in existing natural gas infrastructure

- Pipelines
- Storage fields

Generate power using modified turbine

***Blended H2 builds on existing equipment and technical expertise***

# Storage Round Trip (RT) Efficiency

Battery RT efficiency ~ 85% (AC-AC)
Hydrogen RT Efficiency ~ 35% (AC-AC)

⇦ *How can we increase RT efficiency for H2??*

**Traditional Hydrogen Storage:**
Higher capital costs
- Extreme High Pressure tanks & H.P. Compressors
- Immature fuel cell technology

Result:
Low round-trip efficiency

**Blended Hydrogen Storage:**
Fewer capital costs
- Leverage existing Pipelines, storage fields
- Mature turbine technology (*operational!*)

Result:
Improved round-trip efficiency

Note also: an NREL study showed that H2 storage makes financial sense for:
Duration > 13 hours
…… which was our goal in the first place!

https://www.nrel.gov/docs/fy19osti/73520.pdf

# Potential Pilot Projects *(… my wish list…)*

## Renewable Natural Gas ("Green Gas")

**Challenge:** Michigan is being "outbid" for any RNG production by LCFS

**Answer:** Develop a pilot project for creating an RNG marketplace in Michigan

- Match buyers/sellers of RNG
- Respond to excess demand for renewables *
- Create a market clearing mechanism
- Assure high transparency and easy access.

*Market Pilot*

* "Ford, Dow and other Michigan companies want renewable energy, so why aren't they buying more?" Utility Dive Newsletter, Article: https://www.utilitydive.com/news/the-midwest-is-full-of-renewables-why-arent-michigan-companies-buying-mor/564137/ author: Michigan EIBC

## Blended Hydrogen ("Green Hydrogen")

**Challenge:** How to use Michigan's existing pipelines/fields for H2 storage?

**Answer:** Develop a pilot project that produces/stores green H2

- Validate available excess wind power (when? where?)
- Test H2/NG blend-rates (maximum H2 = 20%?, more?)
- Learn how to measure/manage leakage in steel/plastic (acceptable losses?)
- Identify how to decrease cost of storage.

*Technology Pilot*


*Joe Tesar*
*President*
*Quantalux LLC*
*jtesar@quantalux.com*

# Pilot Program Importance & Best Practices

CLEAResult®

&

MI POWER GRID

We change the way people use energy™

*June 2020*

**Presented by:**
Sean Williams
Program Director
CLEAResult Consulting, Inc.

# TODAY'S AGENDA

- Introductions
- What Is a Pilot?
- Best Practice Recommendations
- Importance of Pilots

## PRESENTER

**Sean Williams**

- 10 years with CLEAResult
- Primarily Great Lakes
- Sector experience
  - Commercial & Industrial
  - Pilots
  - Residential
  - Income Qualified
  - Education
  - Appliance Recycling



# What Is a Pilot?

New program design or delivery

New technology

Change in current methodology or process

Something new to try

Potential solution to a given opportunity

## MOST IMPORTANTLY, PILOTS ARE:

The method of attempting to solution an opportunity *(e.g., process, measure or technology)* and conducting a study to review, analyze and measure results



# Best Practice Recommendations

## Choose a Pilot

- Identify the opportunity
  - Gap in program design
  - New technology opportunity
  - Enhancement to current methodology or process
- Brainstorm potential solutions with key stakeholders
  - *There are no bad ideas!*
- Set up scoring criteria (examples below)
  - Budget
  - Timeline
  - Innovation
  - Risks vs opportunities

## Planning for Success

- Identify & secure funding
  - Look for partners & collaboration *Multiple small budgets can add up!*
- Hypothesis (macro level)
  - What to measure
  - What's considered success
- Operating plan (micro level)
  - Operations
    - Outreach/marketing
    - Coordinate with utility Account Managers
    - Participation
    - Tracking
  - Engineering
    - Measurement & verification
    - Evaluation

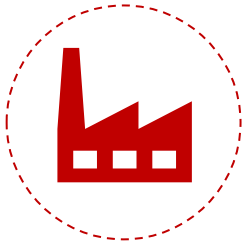
## Implementation/Launch

- Identify sample set (customer base)
- Coordinated launch
  - Launch meeting
  - Milestone dates/targets
- Review initial success
  - Set early but reasonable timeline
  - Initial market acceptance and feedback
  - Data collection integrity
  - Be open to change if necessary
- Continued monitoring through pilot duration

# What Are We Looking at Next?

- Residential sector
  - New technologies
  - Incremental energy savings
    - Controlling already installed “larger” measures
    - How do we fine-tune energy efficiency measures?
  - Education around new smart devices or energy-efficient devices



- C&I
  - Technology demonstrations
  - Sector-specific initiatives
  - Solving segment participation barriers
    - Introduction of best practices
    - Awareness

# INSPIRATION

**I have not failed.**
**I've just found 10,000 ways**
**it won't work**

**Thomas A. Edison**

CLEAResult®

# Importance of Pilots

01

Facilitate and encourage testing of new ideas and technologies

02

Help grow and advance program offerings — integration of technology, which impacts energy

03

Not all will be deemed successful, but will provide results and answers

04

Offer opportunities to learn

05

Create a controlled environment to test new concepts and work out inefficiencies on a small scale to be more effective when launching on a large scale to customers



CLEAResult®

# THANK YOU

Sean Williams, Program Director
CLEAResult Consulting, Inc.

MI POWER GRID

Making the Most of Michigan's Energy Future

# Energy Programs & Technology Pilots

## Pilot Ideas from Other MI Power Grid Workgroups

Stakeholder Meeting 7

June 25, 2020

MPSC

Michigan Public Service Commission

# Pilot Ideas From Multiple Areas

- Kickoff meeting:  How will pilot ideas from other MI Power Grid workgroups get to this one?
- Email sent to other ongoing or completed workgroups:
  - *Demand Response*
  - Interconnection Standards and Worker Safety
  - Grid Security and Reliability Standards
    - Service Quality and Reliability Standards for Electric Distribution Systems
    - Technical Standards for Electric Service
    - Technical Standards for Electric Service - Cybersecurity
  - *Electric Distribution Planning*

# Pilot Ideas: Demand Response

- Pilot to explore partnerships with DR aggregators/service providers
- Pilot to explore DR value stacking
  - Register customers on multiple DR programs-economic/emergency

# Pilot Ideas: Elec. Distribution Planning

- Pilots on non-wires alternatives to explore:
  - Geo-targeted load relief
  - Power quality support
  - Reliability improvement for customers
  - Behind the meter load management
  - Operational support
  - Confidence in reliability of NWAs
    - Leveraging energy efficiency and demand response to reduce peak load to address distribution capacity needs

# Pilot Ideas: Elec. Distribution Planning

- Hosting capacity analysis pilots to explore:
  - Time, costs, and resources to perform hosting capacity
    - Accuracy and ability of tools to make more accurate assessment than less intensive methods
  - How greater customer access to distribution system be provided without system harm
  - How proactive provision of hosting capacity on circuits impact DER interconnections

# Any pilot ideas from the audience?

- In time remaining, any future pilot ideas or areas the audience has that we've not discussed in this stakeholder process?

**Thank you!**

MI POWER GRID

Making the Most of Michigan's Energy Future

# Energy Programs & Technology Pilots

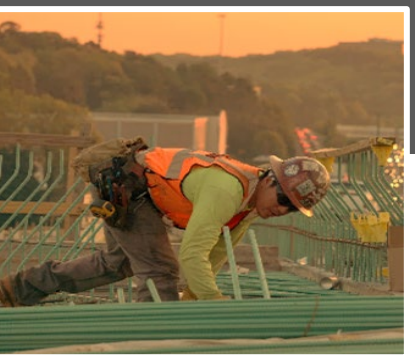
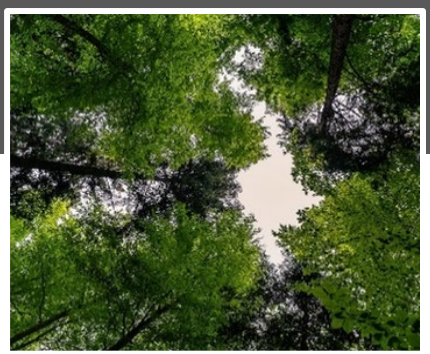
## Break: 3:02 – 3:07 PM

Stakeholder Meeting 7

June 25, 2020

MPSC

Michigan Public Service Commission

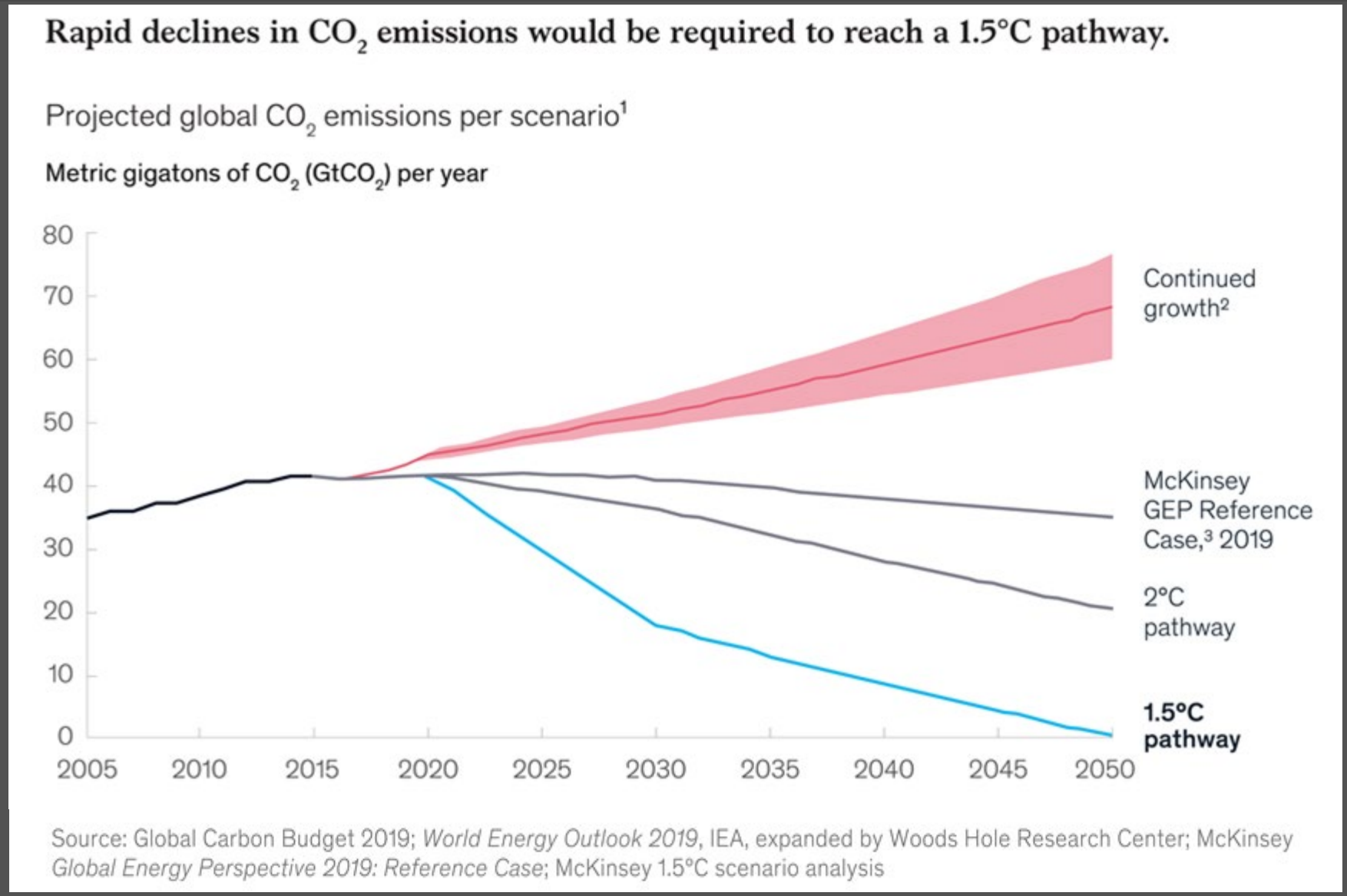

# Identifying the most promising solutions for reducing carbon emissions in Michigan: Lessons from "Drawdown Georgia"

Dr. Marilyn Brown, Interim Chair, School of Public Policy
Georgia Institute of Technology

MI Power Grid - Energy Programs and Technology Pilots Meeting
June 25, 2020

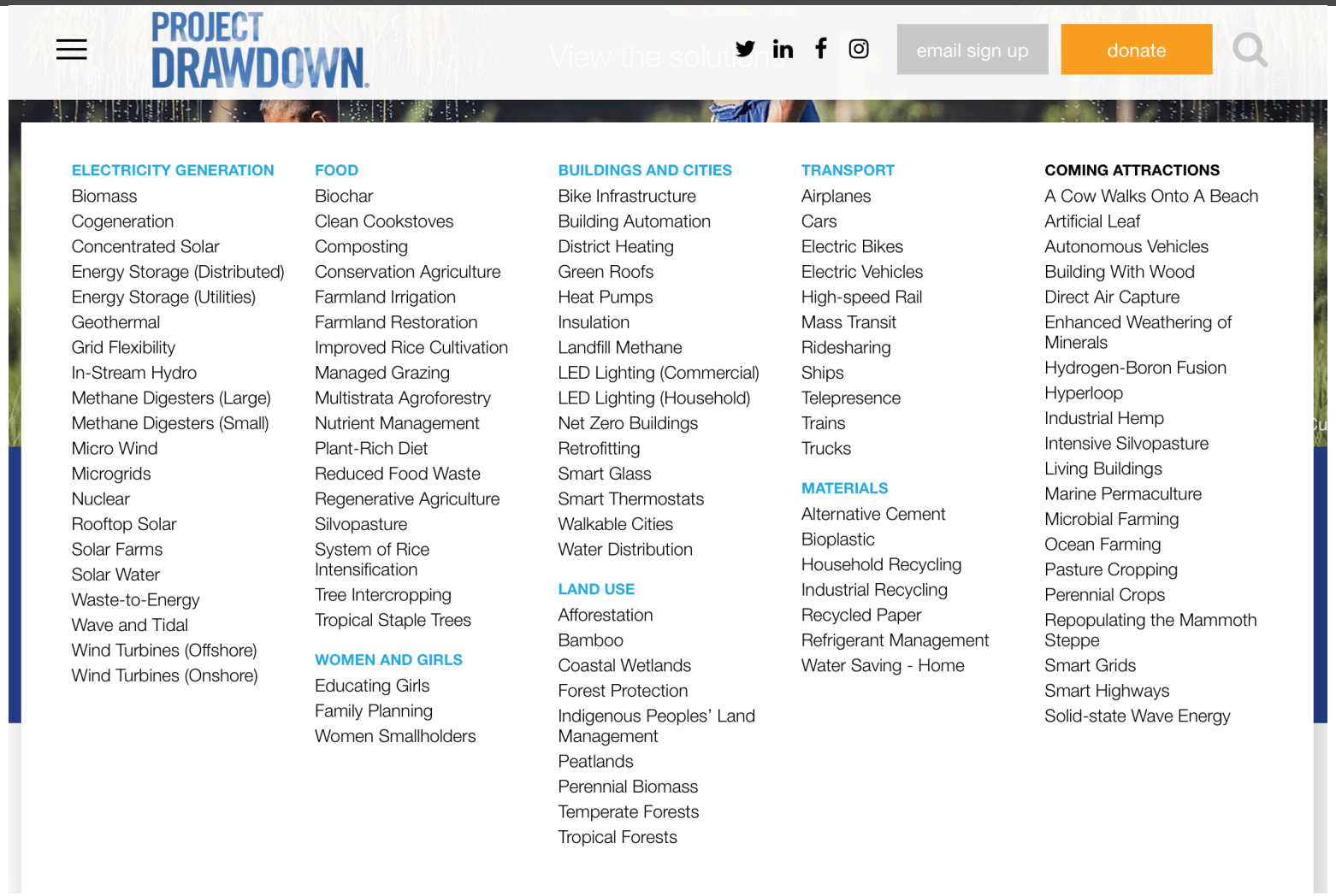
Georgia Tech
UNIVERSITY OF GEORGIA
EMORY UNIVERSITY
the RAY C. ANDERSON foundation

# WHAT IS OUR CLIMATE FUTURE?

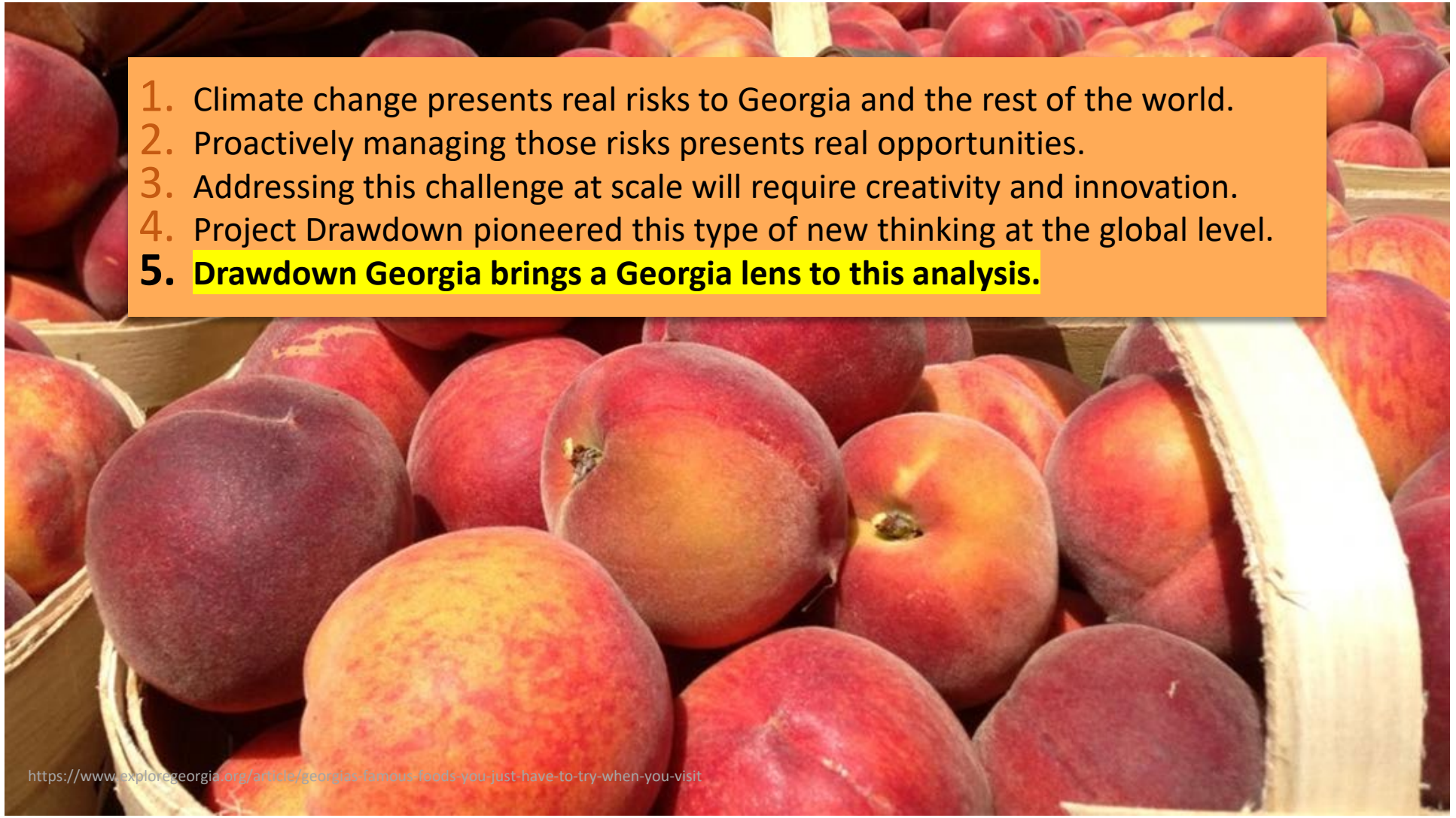



McKinsey & Company, "Climate math: What a 1.5-degree pathway would take," *McKinsey Quarterly*, April 2020

# OUR STARTING POINT: PROJECT DRAWDOWN SOLUTIONS




**21 High Impact Solutions**



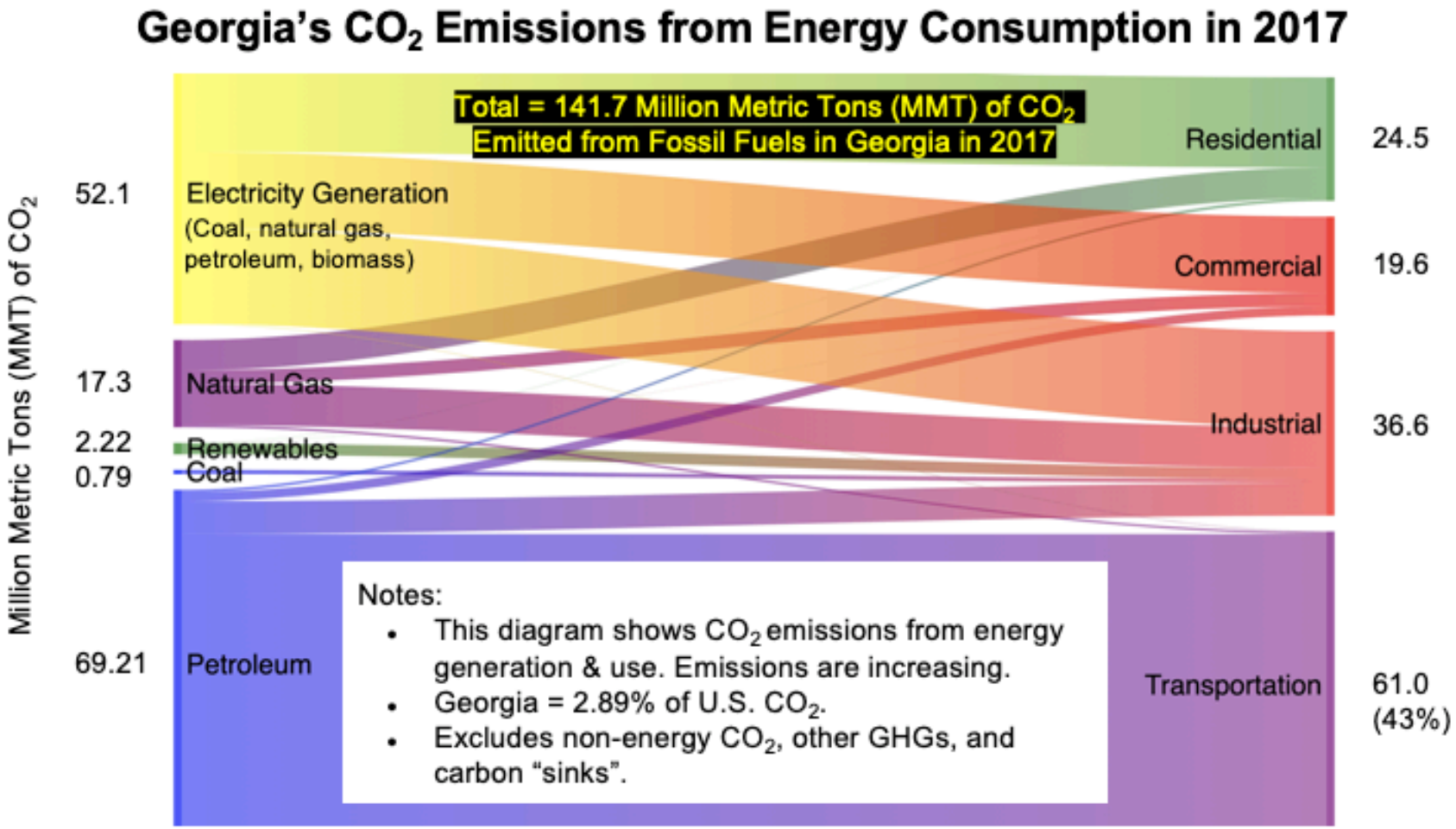
1. Climate change presents real risks to Georgia and the rest of the world.
2. Proactively managing those risks presents real opportunities.
3. Addressing this challenge at scale will require creativity and innovation.
4. Project Drawdown pioneered this type of new thinking at the global level.
5. **Drawdown Georgia brings a Georgia lens to this analysis.**

https://www.exploregeorgia.org/article/georgias-famous-foods-you-just-have-to-try-when-you-visit

# GEORGIA AND ATLANTA CAN LEAD BY EXAMPLE: WHERE DO WE STAND?

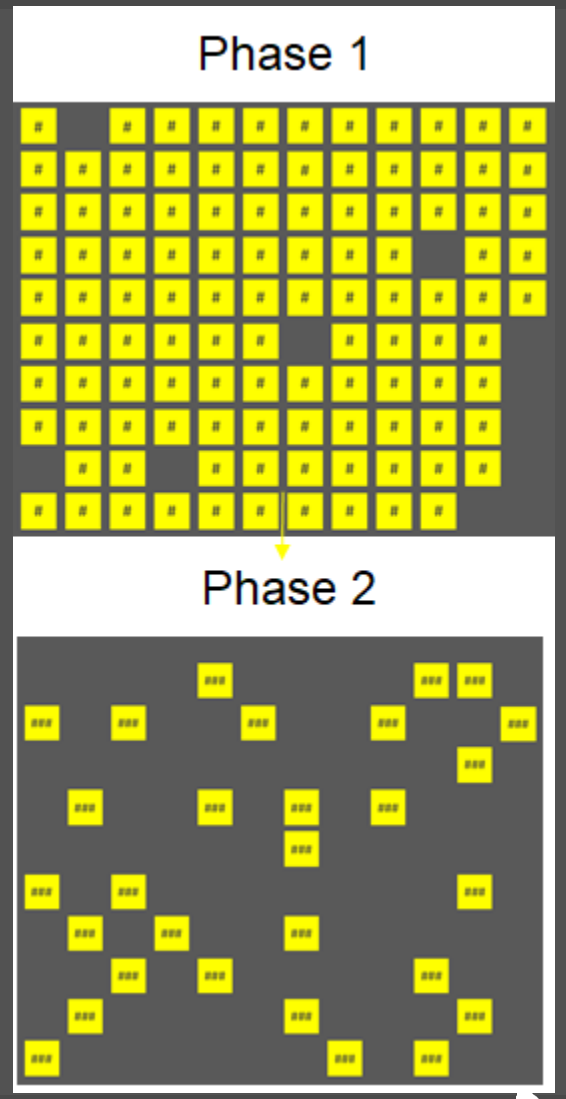
| | Energy-Based $CO_2$ Emissions |
|---|---|
| United States | 5,133,437,000 metric tons |
| Georgia | 141,700,000 metric tons |
| Atlanta Metropolitan Area | 74,000,000 metric tons |
| City of Atlanta | 10,750,000 metric tons |

# Initial Work | Georgia's Current Carbon Footprint ~ 100 Million Metric Tons



# DOWN-SELECT CRITERIA: REFLECTS CONCEPTS OF TECHNOLOGY DIFFUSION, SUPPLY CHAINS, LEARNING CURVES,…

1. Is the solution technology & market ready for Georgia?
2. Is there sufficient local experience and available data?
3. Can the solution reduce 1MTCO$_2$e annually by 2030?
4. Is the solution cost-competitive?
5. What are the “beyond carbon” considerations?



# ACROSS 5 WORKING GROUPS, 21 PRIORITY SOLUTIONS HAVE BEEN IDENTIFIED

## ELECTRICITY GENERATION

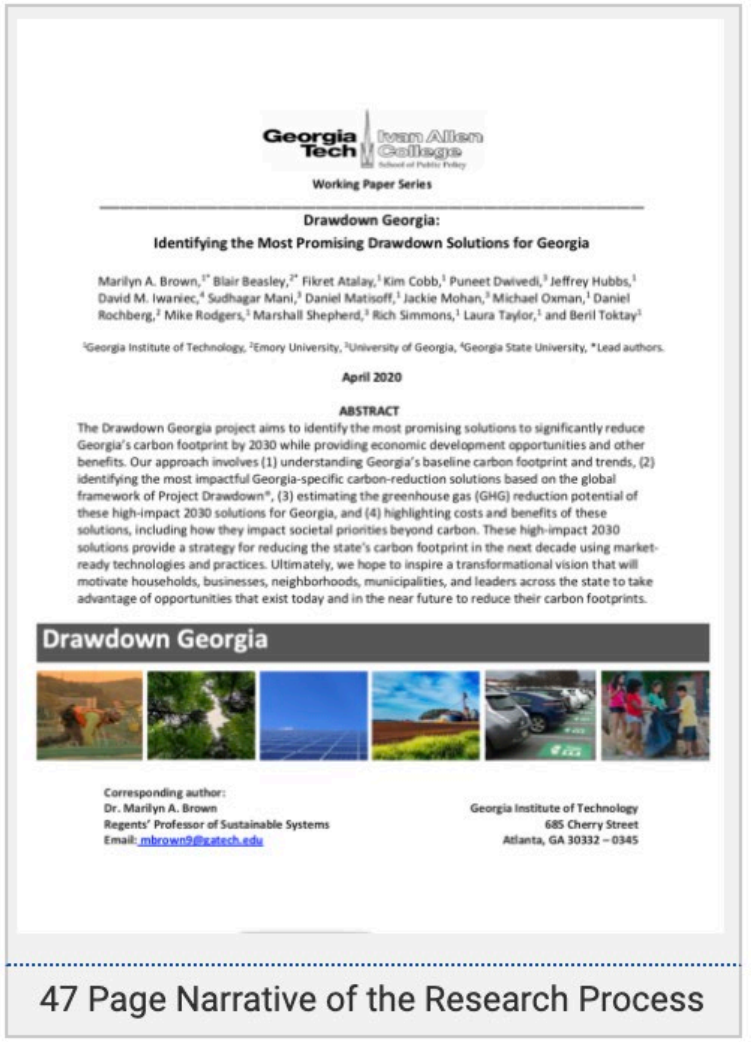
- Cogeneration
- Demand Response
- Solar Farms & Community Solar
- Rooftop Solar

## TRANSPORTATION


- Aviation Groundworks
- Electric Vehicles
- Energy-Efficient Cars
- Energy-Efficient Trucks
- Mass Transit

## BUILT ENVIRONMENT & MATERIALS

- Alternative Mobility
- Landfill Methane
- Recycling / Waste Management
- Refrigerant Management
- Retrofitting



Georgia Tech Ivan Allen College School of Public Policy

Working Paper Series

**Drawdown Georgia:**
**Identifying the Most Promising Drawdown Solutions for Georgia**

Marilyn A. Brown,[1*] Blair Beasley,[2*] Fikret Atalay,[1] Kim Cobb,[1] Puneet Dwivedi,[3] Jeffrey Hubbs,[1] David M. Iwaniec,[4] Sudhagar Mani,[3] Daniel Matisoff,[1] Jackie Mohan,[3] Michael Oxman,[1] Daniel Rochberg,[1] Mike Rodgers,[1] Marshall Shepherd,[3] Rich Simmons,[1] Laura Taylor,[1] and Beril Toktay[1]

[1]Georgia Institute of Technology, [2]Emory University, [3]University of Georgia, [4]Georgia State University, *Lead authors.

April 2020

**ABSTRACT**

The Drawdown Georgia project aims to identify the most promising solutions to significantly reduce Georgia's carbon footprint by 2030 while providing economic development opportunities and other benefits. Our approach involves (1) understanding Georgia's baseline carbon footprint and trends, (2) identifying the most impactful Georgia-specific carbon-reduction solutions based on the global framework of Project Drawdown®, (3) estimating the greenhouse gas (GHG) reduction potential of these high-impact 2030 solutions for Georgia, and (4) highlighting costs and benefits of these solutions, including how they impact societal priorities beyond carbon. These high-impact 2030 solutions provide a strategy for reducing the state's carbon footprint in the next decade using market-ready technologies and practices. Ultimately, we hope to inspire a transformational vision that will motivate households, businesses, neighborhoods, municipalities, and leaders across the state to take advantage of opportunities that exist today and in the near future to reduce their carbon footprints.

Drawdown Georgia

Corresponding author:
Dr. Marilyn A. Brown
Regents' Professor of Sustainable Systems
Email: mbrown9@gatech.edu

Georgia Institute of Technology
685 Cherry Street
Atlanta, GA 30332 – 0345

47 Page Narrative of the Research Process

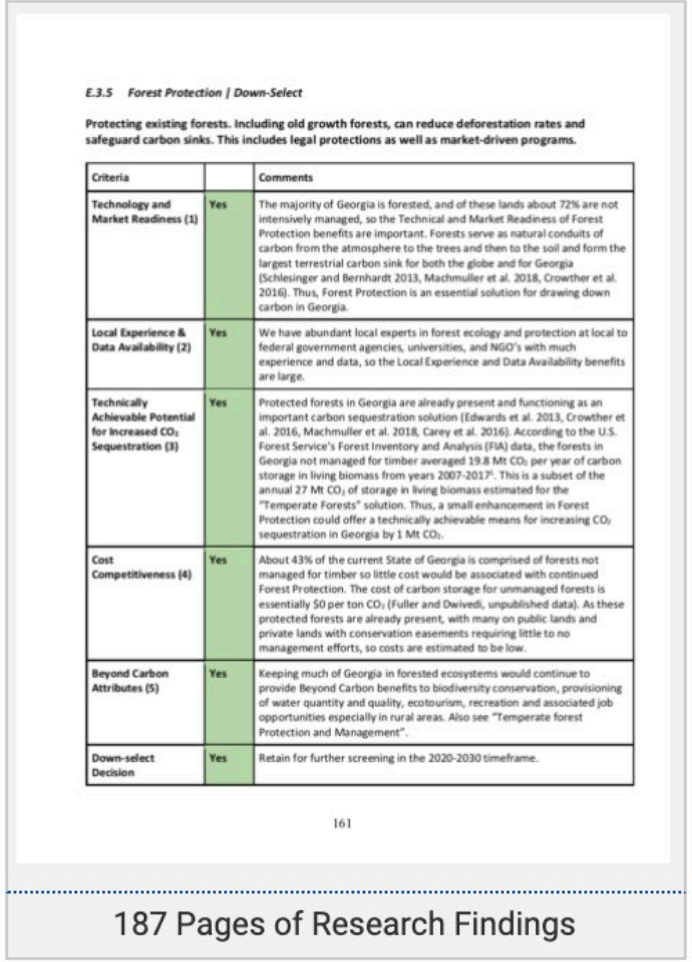
# ACROSS 5 WORKING GROUPS, 21 PRIORITY SOLUTIONS HAVE BEEN IDENTIFIED

## FOOD SYSTEMS

- Composting
- Conservation Agriculture
- Plant-Rich Diet
- Reduced Food Waste

## FORESTS AND LAND USE

- Afforestation & Silvopasture
- Coastal Wetlands
- Temperate Forests Protection & Management



*E.3.5 Forest Protection | Down-Select*

**Protecting existing forests. Including old growth forests, can reduce deforestation rates and safeguard carbon sinks. This includes legal protections as well as market-driven programs.**

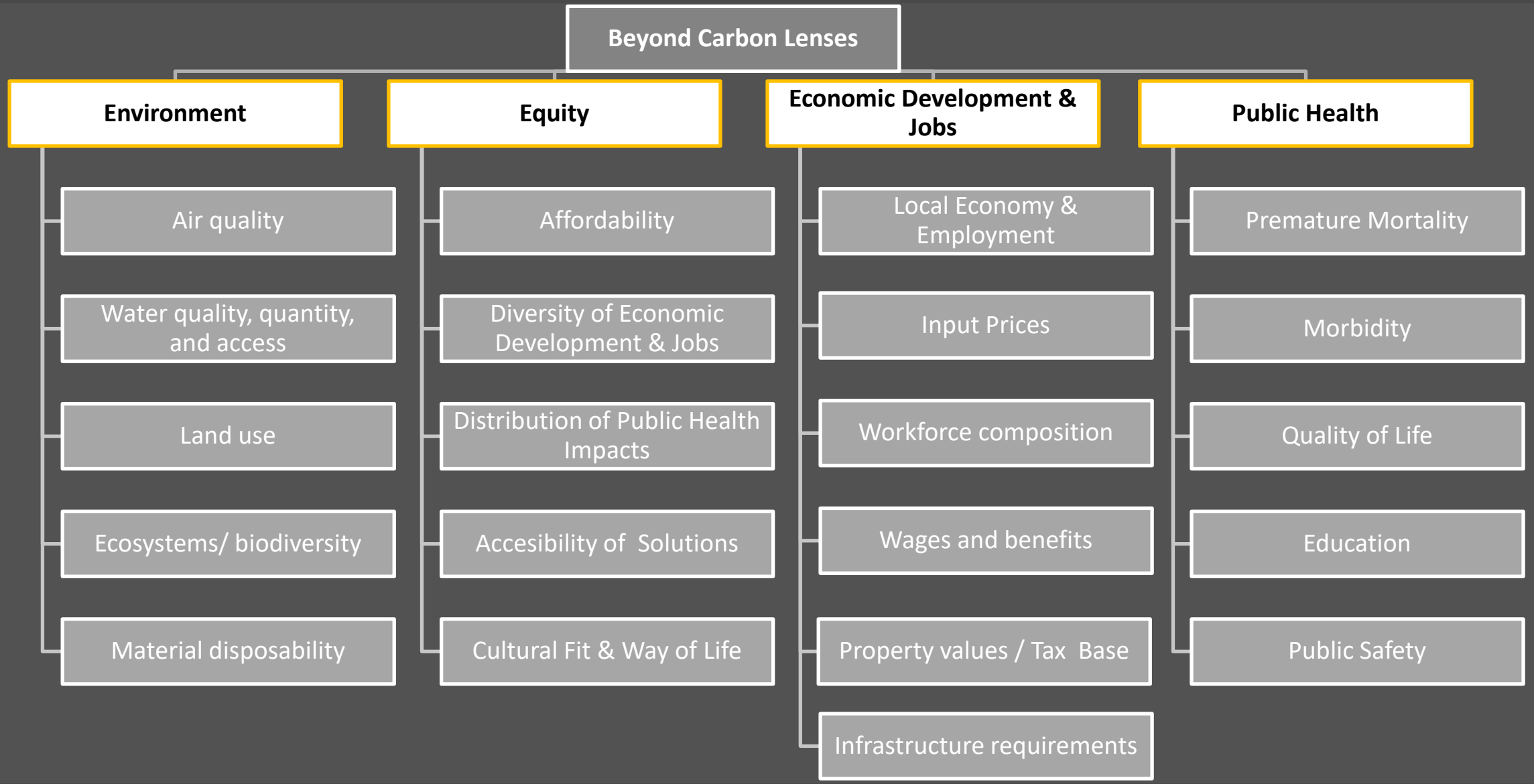
| Criteria | | Comments |
|---|---|---|
| **Technology and Market Readiness (1)** | Yes | The majority of Georgia is forested, and of these lands about 72% are not intensively managed, so the Technical and Market Readiness of Forest Protection benefits are important. Forests serve as natural conduits of carbon from the atmosphere to the trees and then to the soil and form the largest terrestrial carbon sink for both the globe and for Georgia (Schlesinger and Bernhardt 2013, Machmuller et al. 2018, Crowther et al. 2016). Thus, Forest Protection is an essential solution for drawing down carbon in Georgia. |
| **Local Experience & Data Availability (2)** | Yes | We have abundant local experts in forest ecology and protection at local to federal government agencies, universities, and NGO's with much experience and data, so the Local Experience and Data Availability benefits are large. |
| **Technically Achievable Potential for Increased $CO_2$ Sequestration (3)** | Yes | Protected forests in Georgia are already present and functioning as an important carbon sequestration solution (Edwards et al. 2013, Crowther et al. 2016, Machmuller et al. 2018, Carey et al. 2016). According to the U.S. Forest Service's Forest Inventory and Analysis (FIA) data, the forests in Georgia not managed for timber averaged 19.8 Mt $CO_2$ per year of carbon storage in living biomass from years 2007-2017[c]. This is a subset of the annual 27 Mt $CO_2$ of storage in living biomass estimated for the "Temperate Forests" solution. Thus, a small enhancement in Forest Protection could offer a technically achievable means for increasing $CO_2$ sequestration in Georgia by 1 Mt $CO_2$. |
| **Cost Competitiveness (4)** | Yes | About 43% of the current State of Georgia is comprised of forests not managed for timber so little cost would be associated with continued Forest Protection. The cost of carbon storage for unmanaged forests is essentially $0 per ton $CO_2$ (Fuller and Davivedi, unpublished data). As these protected forests are already present, with many on public lands and private lands with conservation easements requiring little to no management efforts, so costs are estimated to be low. |
| **Beyond Carbon Attributes (5)** | Yes | Keeping much of Georgia in forested ecosystems would continue to provide Beyond Carbon benefits to biodiversity conservation, provisioning of water quantity and quality, ecotourism, recreation and associated job opportunities especially in rural areas. Also see "Temperate forest Protection and Management". |
| **Down-select Decision** | Yes | Retain for further screening in the 2020-2030 timeframe. |

161

187 Pages of Research Findings

**MODELING AND FULL SUMMARIES UNDERWAY FOR EACH SOLUTION**

# BEYOND CARBON ASSESSMENTS CONSIDER A RANGE OF ATTRIBUTES

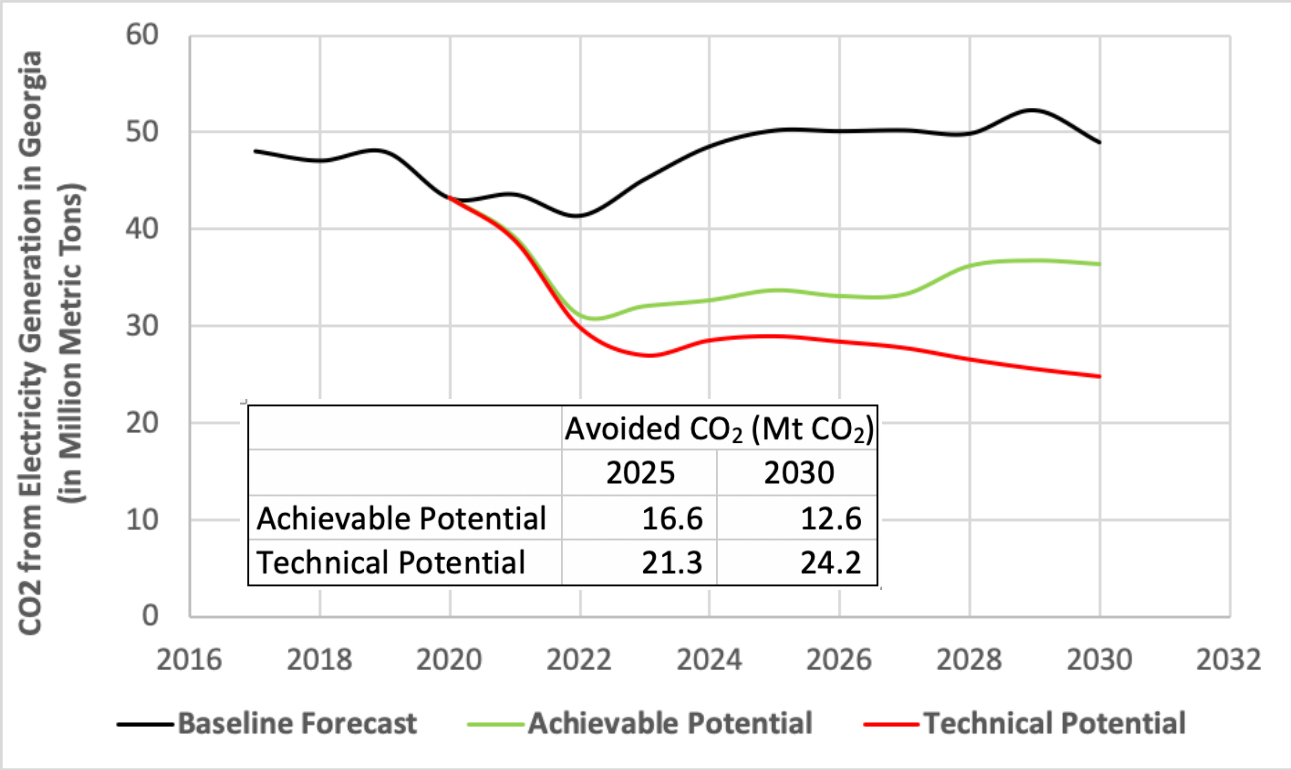


# ELECTRICITY GENERATION

- Cogeneration
- Demand Response
- Solar Farms and Community Solar
- Rooftop Solar

# Solar Farms and Community Solar

## OUR WORKING SCENARIOS SUGGEST SIGNIFICANT CARBON REDUCTION POTENTIAL BY 2030




| | Avoided $CO_2$ (Mt $CO_2$) | |
|---|---|---|
| | 2025 | 2030 |
| Achievable Potential | 16.6 | 12.6 |
| Technical Potential | 21.3 | 24.2 |

**Baseline =** GT-NEMS forecasts 2.5 GW of "utility-scale" solar in GA by 2030.

**Achievable Potential** = Reduction of 13 $MtCO_2$ in 2030, with 5.4 GW of "utility-scale" solar in GA by 2030, and associated energy-system upgrades.

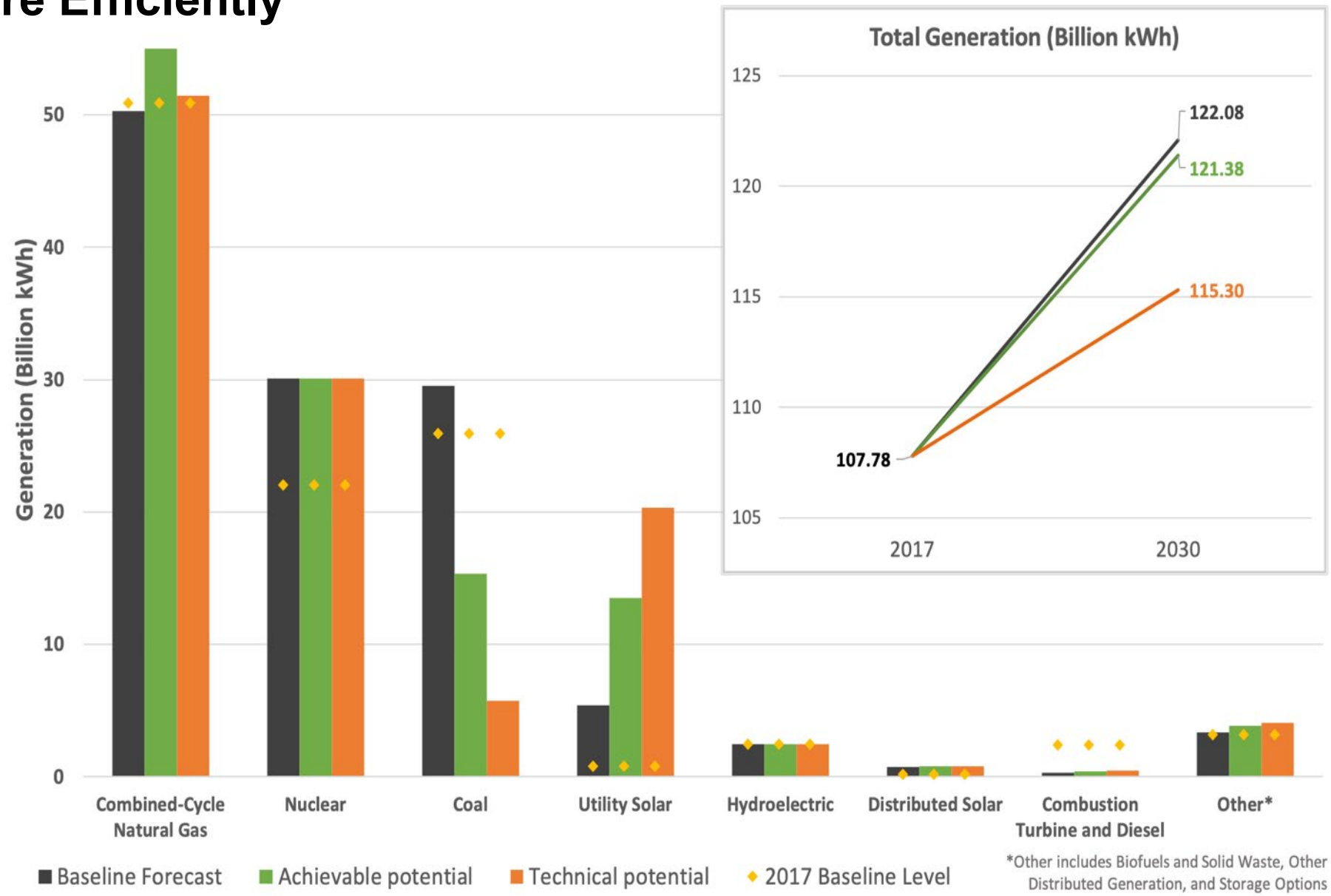
**Technical Potential** = Reduction of 24 $MtCO_2$ in 2030, with 8.7 GW of "utility-scale" solar in GA by 2030, and associated energy-system upgrades.

**1 $MtCO_2e$ solution** in 2030 = 20 more 50 MW solar farms and 36 more 5 MW community solar systems in 2030, for a total of ~1.2 GW, occupying ~15 square miles of land.

- ~0.1% of Georgia's farmland
- ~0.04% of Georgia's 24 million acres of forestland
- <size of Dalton, GA

+Local jobs and local taxes
+Rents to landowners
+Less air pollution
+Public health benefits
-Ecosystem impacts
-Costs/$tCO_2$ averted = $51-

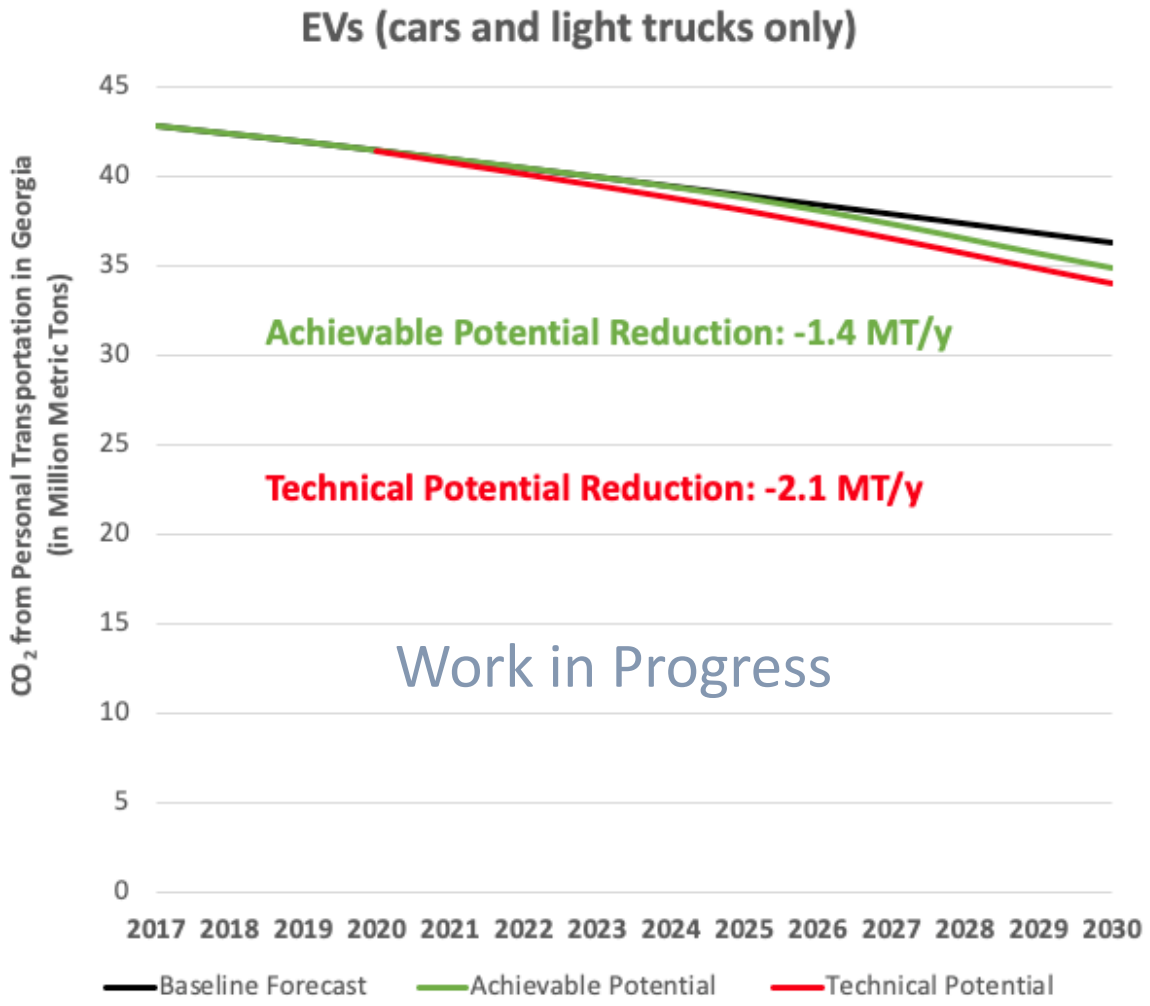
# Electricity Generation in Georgia in 2030 Would be Significantly Cleaner & Used More Efficiently



# TRANSPORTATION


- Aviation Groundworks
- Electric Vehicles
- Energy-Efficient Cars
- Energy-Efficient Trucks
- Mass Transit

# ELECTRIC VEHICLES




## Baseline

Assumes business as usual for fuel economy and CO2 reductions driven by new vehicle technologies and Federal CAFÉ regulations.

## Achievable Potential: -1.4MTCO2e/y

Approximately 300,000 electric vehicles in the Georgia Light Duty Vehicle Fleet, (4% of the total fleet), and accounting for about 15% of new LDV sales in 2030.

## Technical Potential: -2.1 MTCO2e/y

Approximately 750,000 electric vehicles in the Georgia Light Duty Vehicle Fleet, (9% of the total fleet), and accounting for about 35% of new LDV sales in 2030.

Uptake of EVs is concurrent with a rapid decarbonization of the Georgia Electric Power Grid which is slated to become 50% less $CO_2$ intensive between 2012 and 2030.

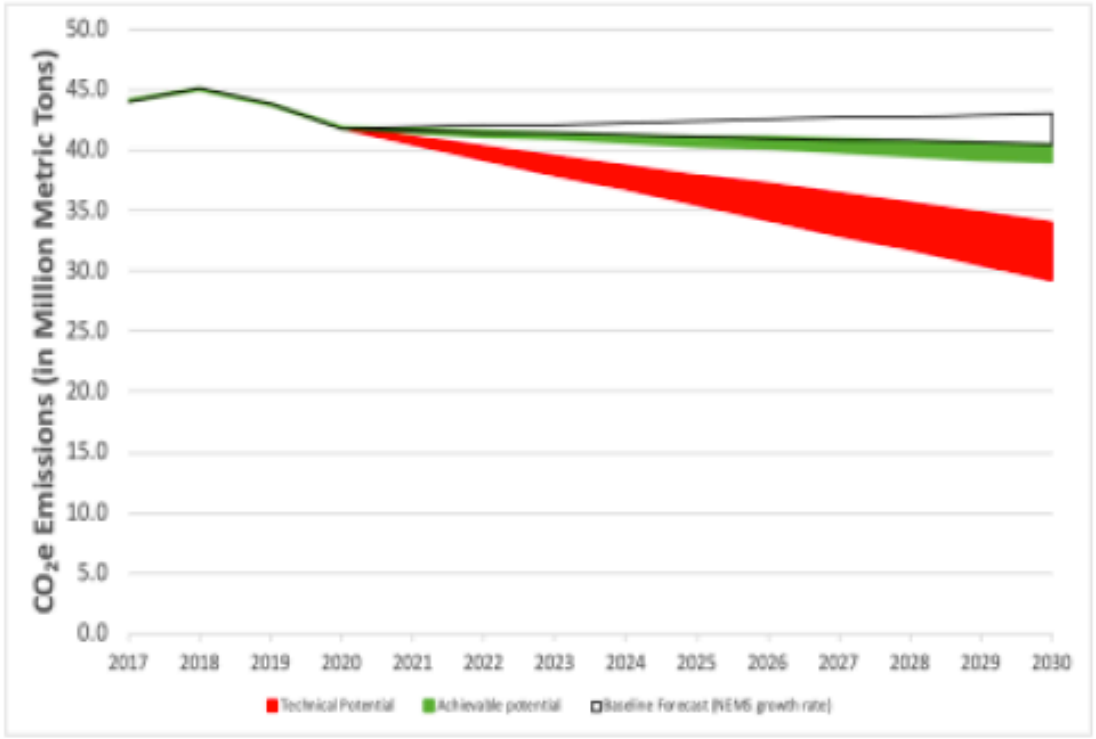
**1 $MtCO_2e$ solution** in 2030 = About 350,000 cars taken off the road.

+Fuel expenditure savings
+Approaching TCO cost parity
+Improved air quality

# BUILT ENVIRONMENT AND MATERIALS

- Alternative Mobility
- Landfill Methane
- Recycling / Waste Management
- Refrigerant Management
- Retrofitting

# RETROFITTING THE BUILT ENVIRONMENT




**Baseline** = From 44.1 $MtCO_2e$ in 2017 for commercial and residential buildings, GT-NEMS growth rate forecasts ~43 $MtCO_2e$ in GA in 2030.

**Achievable Potential** = Reduction of 2.6-4 $MtCO_2e$ in 2030, considering a cumulative retrofit rate of 20% for deep residential retrofits and for the cost-effective commercial retrofit solutions by 2030.

**Technical Potential** = Reduction of 9-13.7 $MtCO_2e$ in 2030, with a cumulative retrofit rate of 50% for all retrofit solutions by 2030.

**1 $MtCO_2e$ solution** in 2030 = retrofitting around 20% of Georgia's single-family residential homes (approximately 600,000 homes) to achieve an average energy savings of 20% per home by 2030.

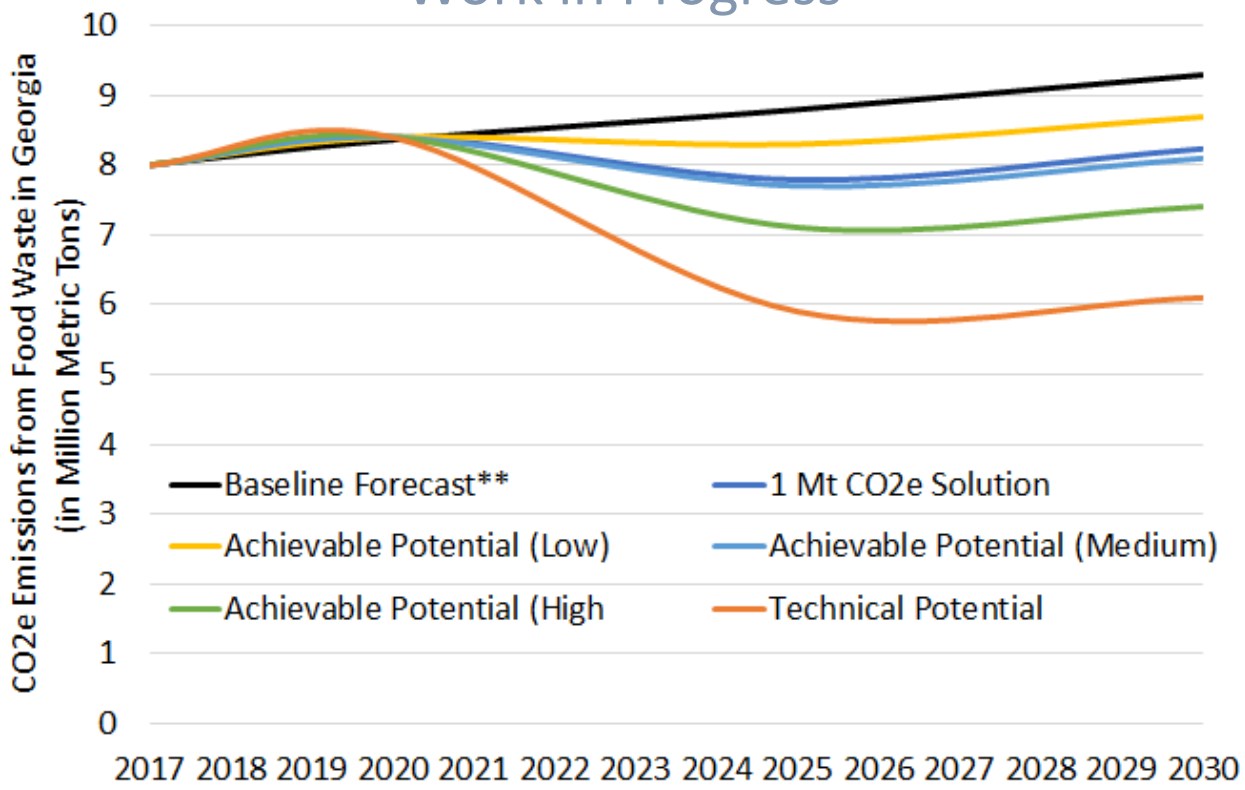
+Less air pollution
+Local jobs
+Less energy burden
+Public health benefits
-High upfront cost

# FOOD SYSTEMS

- Composting
- Conservation Agriculture
- Plant-Rich Diet
- Reduced Food Waste

# FOOD WASTE

Work in Progress




**1 $MtCO_2e$ solution** in 2030 = About 250,000 tons of avoided food waste and 250,000 tons of food waste diverted from landfill to composting and anaerobic digestion.

**Baseline =** Estimate based on the life cycle emission and end of life disposal of food waste.

**Achievable Potential (High)** = Reduction of about 2 $MtCO_2e$ in 2030, with ~15% reduction of food waste and 50% diversion of landfill food waste to composting in GA in 2030.

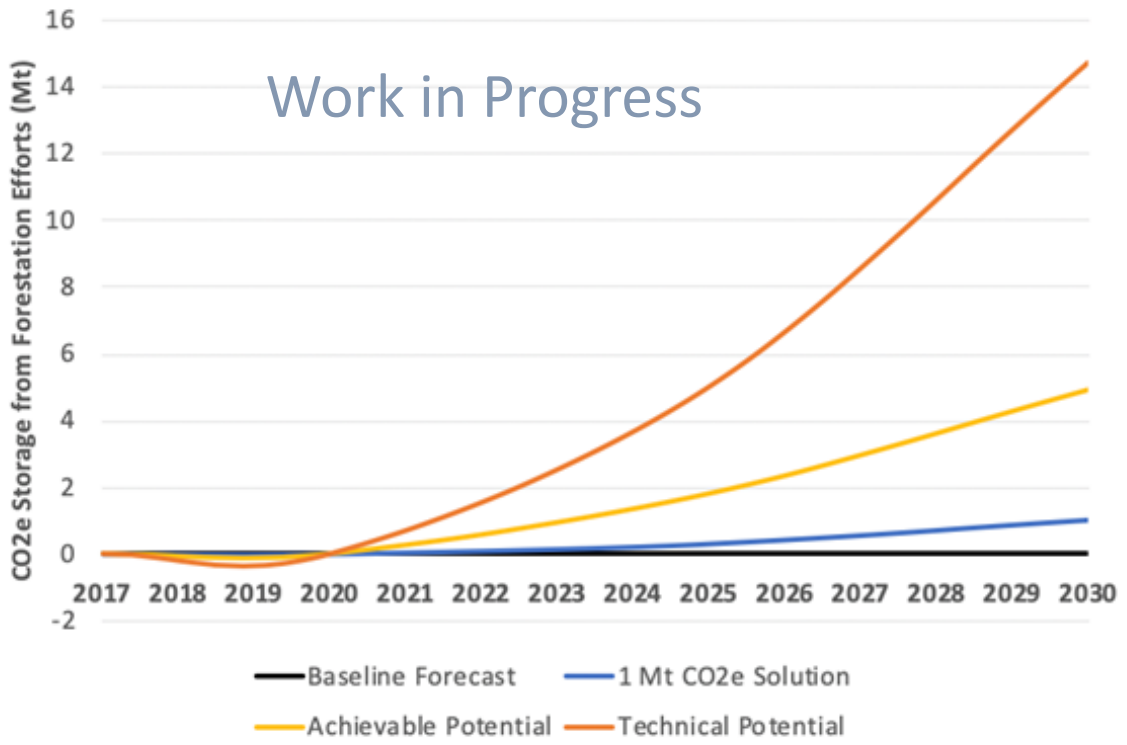
**Technical Potential** = Reduction of 3.2 $MtCO_2e$ in 2030, with ~25% reduction of food waste and 100% diversion of landfill food waste to composting in GA in 2030.

+Local jobs
+Less food insecurity
+Tax benefits to food chains
+Less air pollution

# FORESTS AND LAND USE

- Afforestation
- Coastal Wetlands
- Temperate Forest Protection and Management

# AFFORESTATION AND SILVOPASTURE




**1 $MtCO_2e$ solution** in 2030 = 2% of current Crop and Pasture lands planted with mixed tree species.

+Improved health & productivity of livestock
+Biodiversity
+Improved stream water quality

**Baseline** = Currently very little Silvopasture efforts in Georgia.

**Achievable Potential** = Planting 10% of current crop and pasture lands with mixed tree species (loblolly pine + hardwoods) by 2030. Uses staggered tree planting half in 2020-2021 timeframe; half around 2025. Includes $CO_2e$ stored in trees and soil.

**Technical Potential** = Planting 30% of current crop and pasture lands with mixed tree species (loblolly pine + hardwoods) by 2030. Uses staggered tree planting half in 2020-2021 timeframe; half around 2025. Includes $CO_2e$ stored in trees and soil.

# EACH FINAL SOLUTION SUMMARY TO CONTAIN A BEYOND CARBON NARRATIVE

Example: Afforestation & Silvopasture

*Work in Progress*

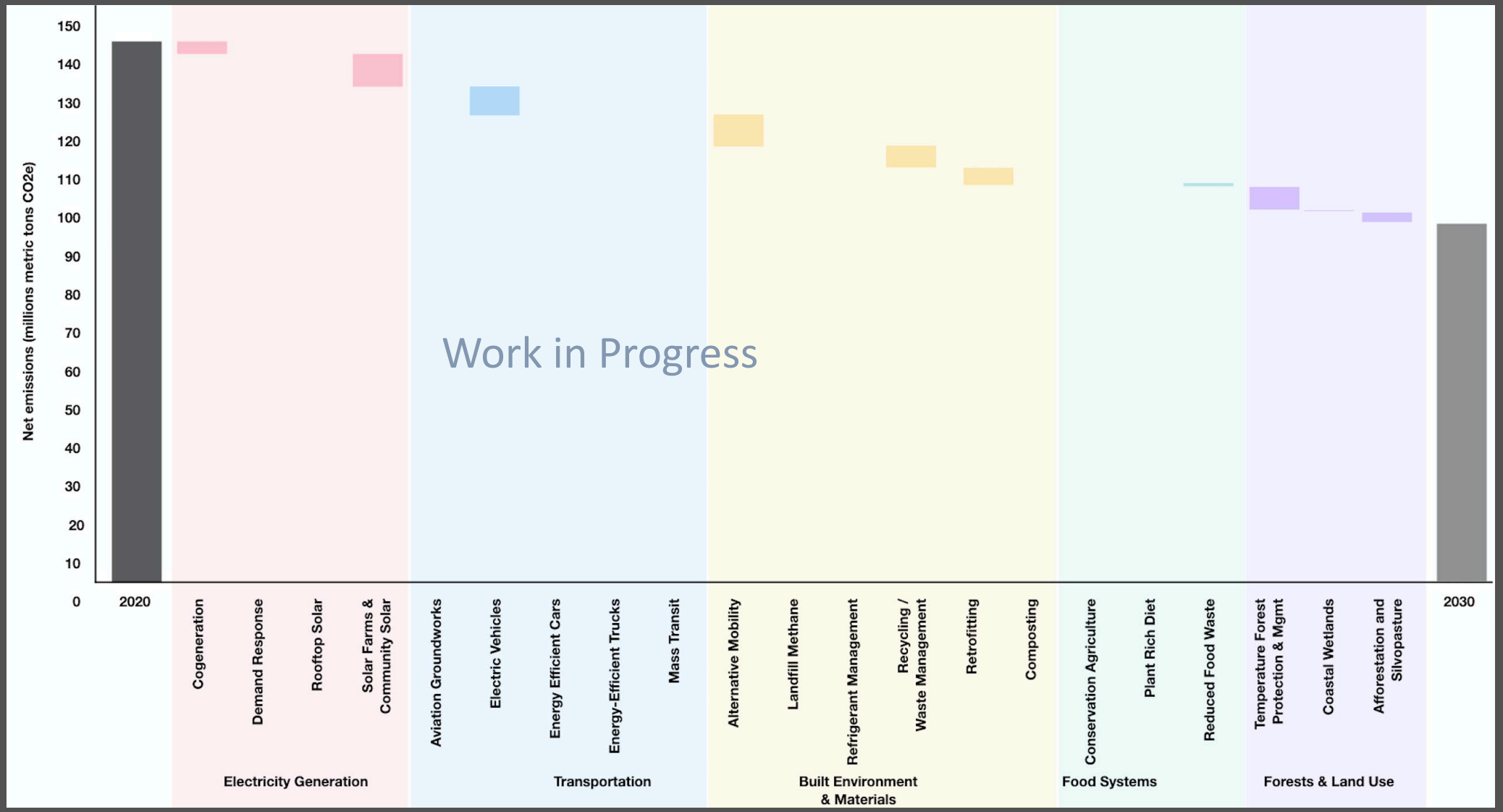
## BENEFITS & IMPACTS TO MANAGE

- Air and water quality
- Soil fertility and reduced erosion
- Diversity in workforce
- Installation & maintenance costs
- Reduced land avail. for agriculture
- Accessibility of solution
- Outdoor recreational opportunities

## PROMISING APPROACHES

- FINANCIAL INCENTIVES
- TRAINING AND TECHNICAL ASSISTANCE INITIATIVES
- TREE PLANTINGS CAMPAIGNS / "SILVOPASTURE FIELD DAYS"
- TARGETED LOW-INCOME GRANTS AND FINANCING

# “IMAGE” OF WHAT’S REALISTICALLY ACHIEVABLE BY 2030






Georgia Tech

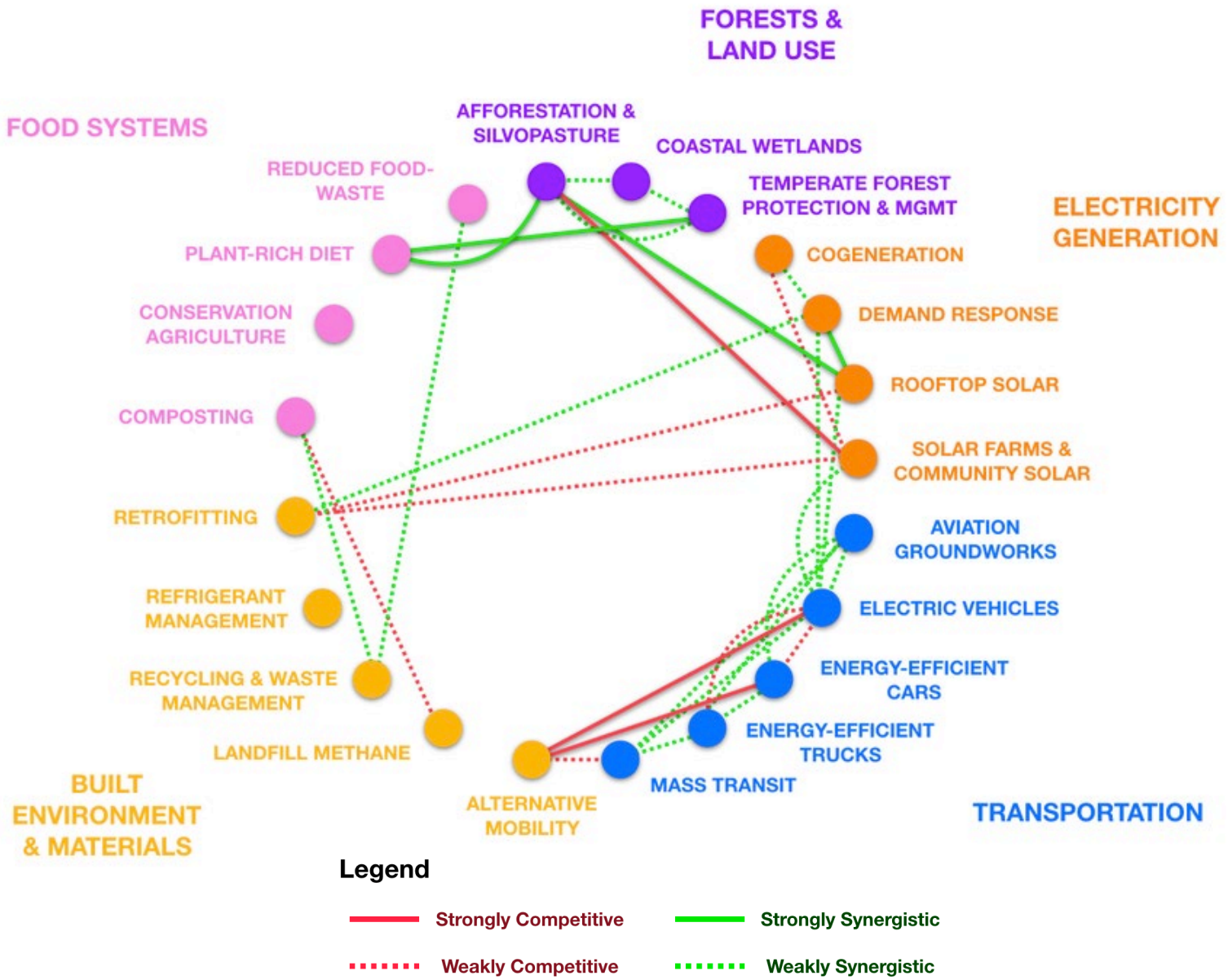
UNIVERSITY OF GEORGIA

EMORY UNIVERSITY

the RAY C. ANDERSON foundation

# “IMAGE” OF WHAT’S TECHNICALLY ACHIEVABLE BY 2030

# Interactions Between Solutions Need to be Modeled



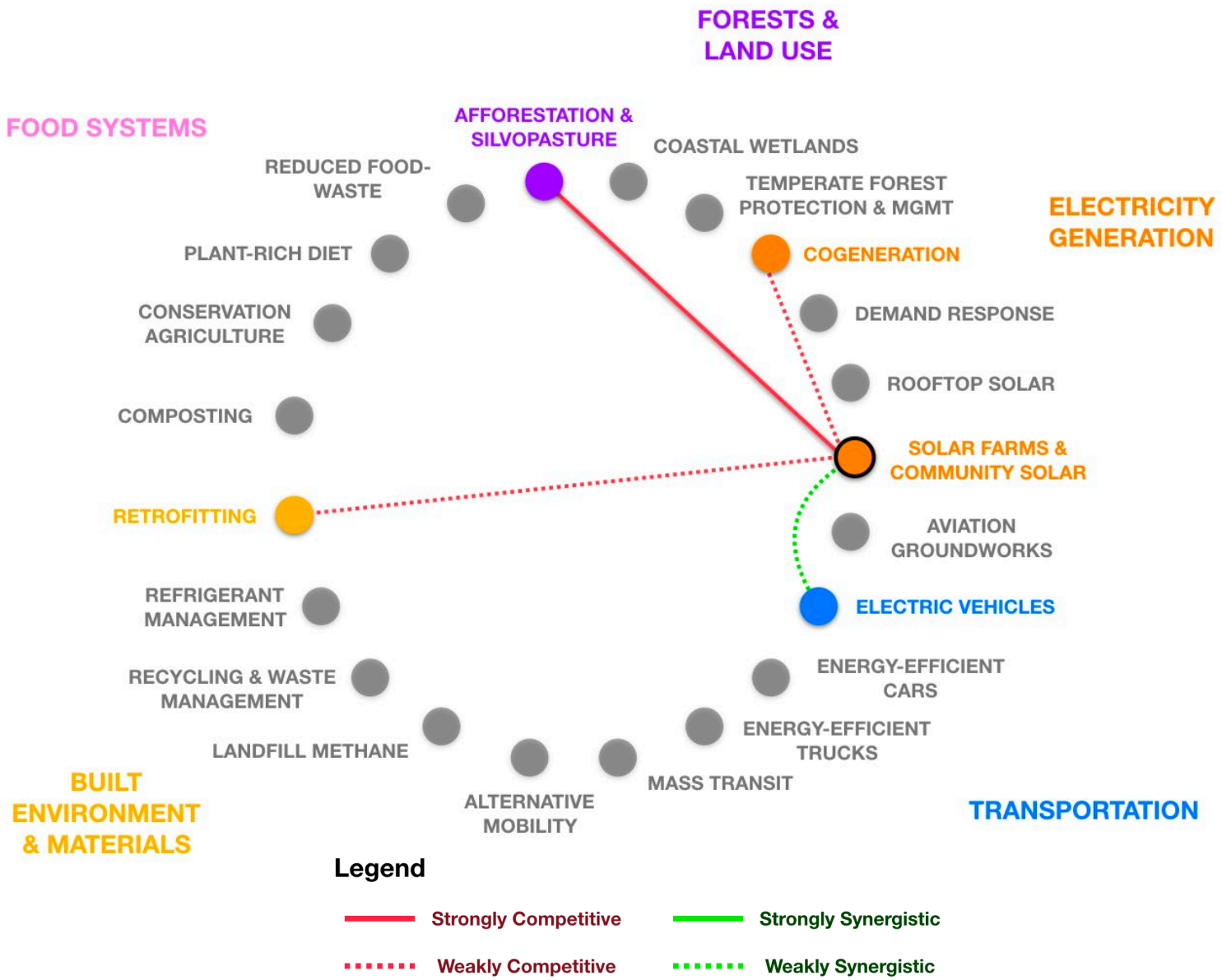

Solutions can influence each other's carbon-reduction potential and ease of implementation

Types of interactions:

- ***Synergistic***: both solutions maximize each other's carbon-reduction potentials, cost-competitiveness, policy motivation, or ease of installation
- ***Competitive***: solutions lessen each other's emissions reduction potential, create installation obstacles, or compete in costs

A systems approach and strategic deployment of solutions is critical.

# Solar Farms & Community Solar




Electric Vehicles

- By decarbonizing electricity, solar farms help EVs become more impactful as a low-carbon transport option.

**Cogeneration**

- Solar farms do not produce heat during electricity generation and provide no cogeneration options.

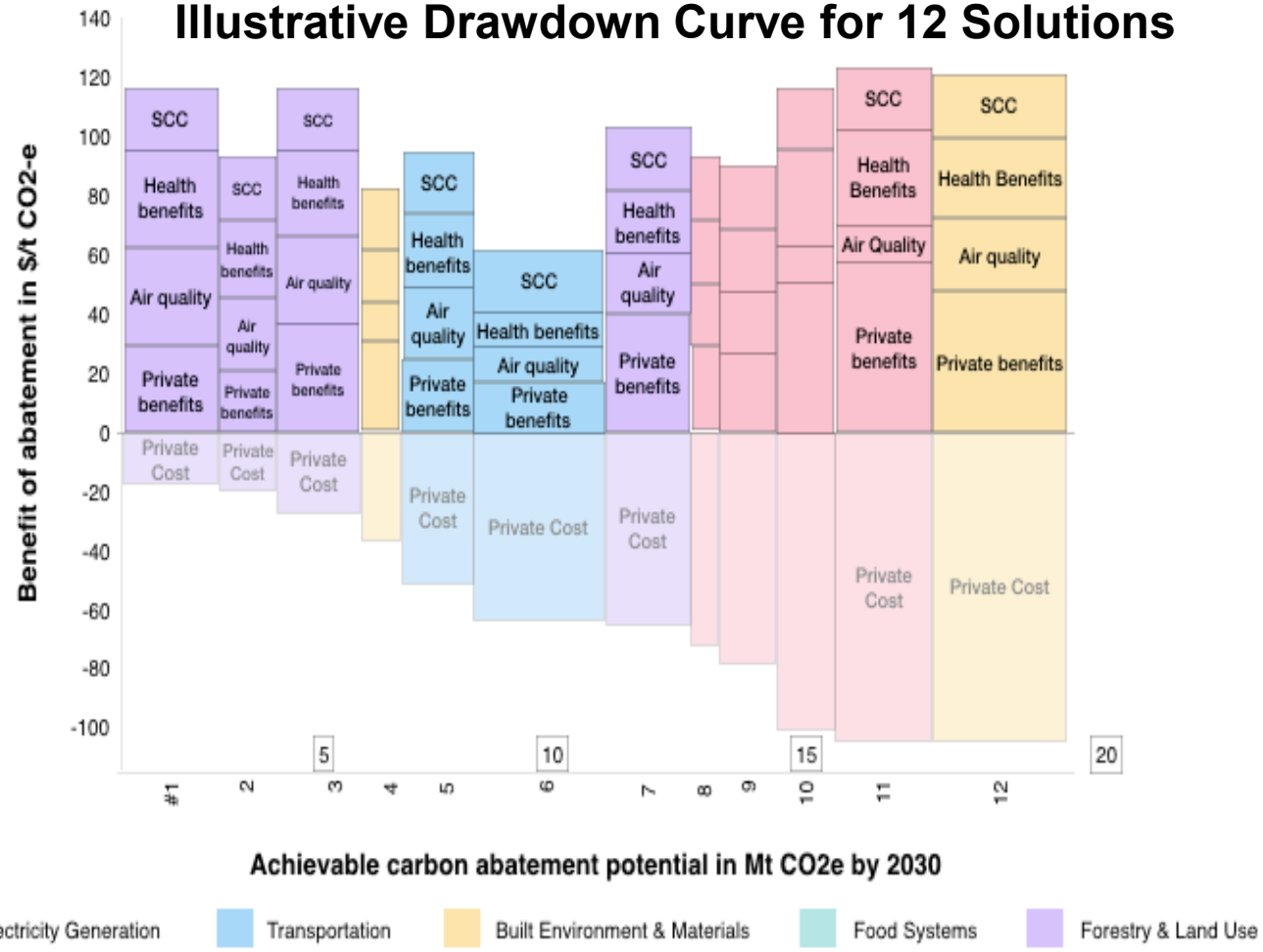
**Retrofitting**

- Low-carbon electricity from solar farms reduce the carbon reduction potential of retrofitting buildings.

**Afforestation & Silvopasture**

- With limited acreage in the state, new solar farms would occupy lands that otherwise could be used for growing trees or crops.

# Georgia Drawdown still has much to do



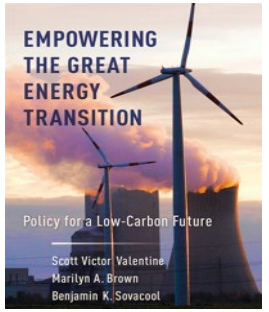


The Georgia Drawdown Curve will address solution interactions, the logic of plausible policies, understanding innovators, opinion leaders, stakeholders,…

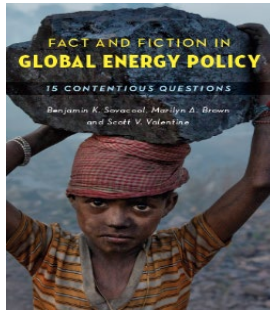
# For More Information — and some late night reading??

**Dr. Marilyn A. Brown,** Regents' and
Brook Byers Professor of Sustainable Systems
School of Public Policy
Georgia Institute of Technology
Atlanta, GA 30332-0345
Marilyn.Brown@pubpolicy.gatech.edu
Climate and Energy Policy Lab:
www.cepl.gatech.edu

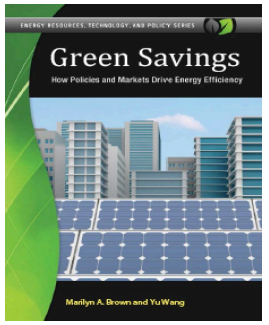
CLIMATE AND ENERGY POLICY LABORATORY
SCHOOL OF PUBLIC POLICY



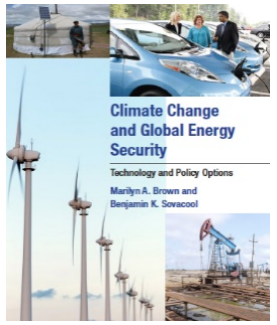

2019




2016




2015




2013

MI POWER GRID

Making the Most of Michigan's Energy Future

# Energy Programs & Technology Pilots

## Closing Statements: Anne Armstrong-Cusack

Stakeholder Meeting 7

June 25, 2020

MPSC

Michigan Public Service Commission

MI POWER GRID

Making the Most of Michigan's Energy Future

# Energy Programs & Technology Pilots

## Timeline and Next Steps

Stakeholder Meeting 7

June 25, 2020

MPSC

Michigan Public Service Commission

# Timeline & Next Steps

- Next week: Listserv message
  - Meeting presentation, recording posted
  - Link to stakeholder survey
- July 31: Draft Staff report posted on workgroup website
  - Listserv message notifying stakeholders
- August 17: Comments on draft report due
  - Send to Joy Wang (wangj3@Michigan.gov)
  - Comments will be posted on workgroup website and included in appendix of final Staff report (likely summaries).
- September 30: Final report posted to docket
  - Case No. U-20645

# Thank You and Please Stay Engaged

- Thank you for your participation today and throughout this stakeholder process.
- We look forward to any comments you might share regarding the draft Staff report.
- Other MI Power Grid workgroups ongoing or starting soon.
  - Check them out at the MI Power Grid webpage

**Thank you!**