



Engineering  
Change Lab  
USA

»»» *Inspiring Leaders of Change*



## Engineering & Public Policy Leadership

An Engineering Change Lab - USA  
Virtual Summit

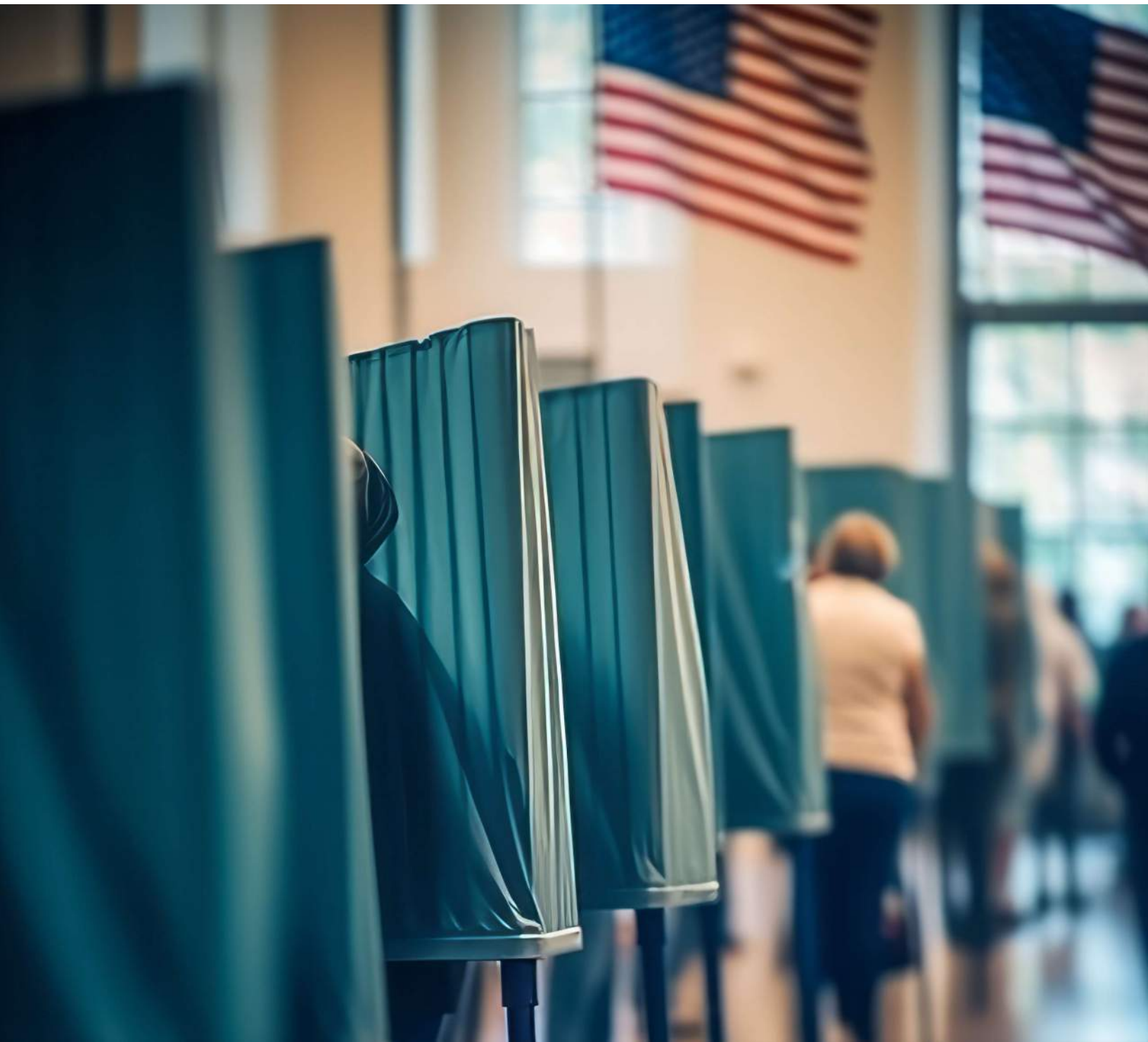
June 20, 2023





# Engineering & Public Policy Leadership

To unlock its full potential and fulfill its obligation to serve society at the highest levels, the engineering community needs to answer the “call to service” and step into the public policy arena. In this arena, priorities and funding are set and critical courses of action charted to address many of the engineering challenges of the 21st century. Engineering Change Lab – USA’s (ECL) virtual summit, Engineering & Public Policy Leadership, explored this imperative, outlined the wide variety of options for engagement, and highlighted the personal satisfaction and sense of purpose that can come with contributing to society through public policy.





Provocation



# Provocation – Engineering & Public Policy: The Challenge & Opportunity



**GEORGE SPARKS**  
**President & CEO, Denver Museum of Science & Nature**

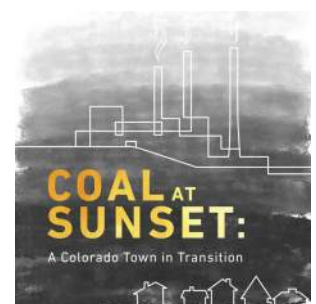
George Sparks has been the President/CEO of the Denver Museum of Nature and Science since November 2004. He spent 24 years in the electronics measurement business at Hewlett-Packard and Agilent Technologies. George’s passion is public policy, particularly around science and education. He is on the Boards of Colorado Education Initiative, Colorado Inclusive Economy, Colorado Business Round Table, Colorado Music Hall of Fame, Denver Council of Foreign Relations, and current board chair at Denver Metro Chamber of Commerce.

George Sparks, President & CEO of the Denver Museum of Science & Nature, kicked off the summit by emphasizing the challenge and opportunity of engagement in public policy. According to Sparks, with the passage of such Federal programs as Operation Warp Speed, the Infrastructure Investment and Jobs Act, the Chips Act, and the Inflation Reduction Act, the U.S. is entering a new era of industrial policy. This era is characterized by the need to address the lack of resilience in our supply chains exposed during the COVID 19 pandemic and by the urgent need to address climate change. In this era, there is a critical need for engineers, scientists, and other technical experts to work alongside and guide legislators, administrators, and bureaucrats in setting goals, making rules, and implementing policies and programs. As an example, he highlighted the need for public policy that will enable major expansion of our electrical transmission grid, an imperative to taking full advantage of advances and cost reductions in wind and solar energy.

In 2018, Sparks led the museum to establish the Institute of Science and Policy to help society solve our most complex state, national, and global challenges. Founded on the principle that science should be the foundation for good policy, the Institute acts as a “convenor and honest broker.” Its programs bring together people with diverse viewpoints in an atmosphere of trust to address critical issues of energy, water, and public health through collective action guided by sound public policy. The Institute ensures that “science is at the table” in discussing policy.

Issues that the Institute of Science and Policy has tackled include energy, water, public health, and technology, all concerns related to the work of the engineering community. They seek to educate the public using a variety of methods – panel discussions of subject matter experts, webinars, and podcasts. Two award-winning podcast series from the Institute include “[Water Under Pressure](#),” which investigates the true cost of Colorado’s water and “[Coal at Sunset: A Colorado Town in Transition](#),” which tracks the human implications of the decision to shut down a coal-fired power plant in the town of Craig, Colorado.

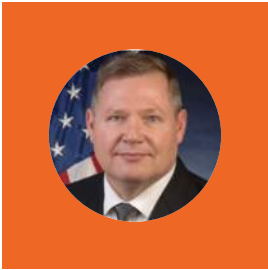
**The key takeaway for the engineering community from George Sparks’ work at the museum is the power to convene around major challenges that stems from relationships and trust.**





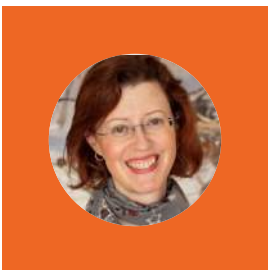
Provocation

# Provocation – The Call to Service: Federal Fellows Panel from the National Institute of Science and Technology



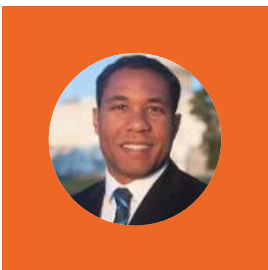
**MODERATOR : MICHAEL MOLNAR,**  
**Director NIST Office of Advanced Manufacturing**

Mike Molnar is the founding director of the Advanced Manufacturing National Program Office, the interagency team responsible for the Manufacturing USA program. Mike also leads the NIST Office of Advanced Manufacturing and serves as co-chair of the National Science and Technology Council, Subcommittee on Advanced Manufacturing – the team responsible for the National Strategic Plan for Advanced Manufacturing.



**PANELIST : ERIN LAVIK,**  
**AAAS Science Policy Fellow**

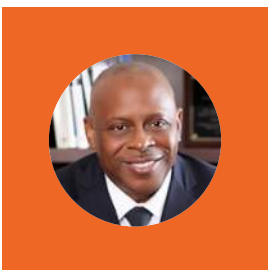
Erin Lavik is an AAAS Science Policy Fellow in the Policy and Strategy Division at the National Institute of Standards and Technology (NIST) Advanced Manufacturing National Program Office (AMNPO). Erin received an Sc.D. in Materials Science and Engineering (Polymers) from MIT. She is on fellowship leave from UMBC where she is a Professor and Associate Dean. In her fellowship, she is working to develop strategies to increase the impact of the Manufacturing USA education and workforce development efforts.



**PANELIST : CLIFTON RAY,**  
**Advanced Manufacturing Policy Fellow**

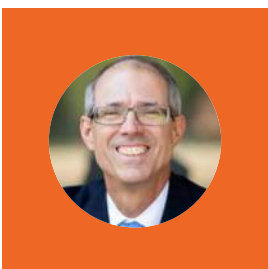
Clifton Ray, Ph.D. is an Advanced Manufacturing Policy Fellow at the NIST Advanced Manufacturing National Program Office (AMNPO). Prior to joining AMNPO, Clifton worked as a Senior Scientist for ZenBio, Inc, leading contract research services and product development. At AMNPO, Clifton works with federal agency staff to develop research, development, and educational strategies to improve the impact of institutes in the Manufacturing USA network on the manufacturing ecosystem and on domestic supply chains. He also works on advanced manufacturing research

and analyses, reports, and policies.



**PANELIST : CRAIG SCOTT,**  
**Assistant Director for Research Partnerships**

Craig J. Scott is an Advanced Manufacturing Policy Fellow at the National Institute of Standards and Technology (NIST) Advanced Manufacturing National Program Office (AMNPO). Craig received a Ph.D. in Electrical Engineering from Howard University, an M.S. in Electrical Engineering from Cornell University, and a B.S. in Electrical Engineering from Howard University. In 1982, he joined the faculty at Morgan State University. He currently serves as Professor and Chairperson of the Department of Electrical and Computer Engineering at Morgan State University.



**PANELIST : DONALD UFFORD,**  
**Assistant Director for Supply Chain and Ecosystem Development**

Don Ufford is Assistant Director for Supply Chain and Ecosystem Development at the NIST Advanced Manufacturing National Program Office (AMNPO) where he works with federal staff to build partnerships to improve the impact of the Manufacturing USA institutes on the manufacturing ecosystem and on domestic supply chains. He also works on ecosystem research and program development for educational and technical transfer programs in manufacturing.

Prior to joining AMNPO, Don had over 30 years of experience creating and delivering cars and trucks as a leader at the Ford Motor Company.

# Provocation – The Call to Service: Federal Fellows Panel from the National Institute of Science and Technology

Michael Molnar, Director of the National Institute of Standards and Technology (NIST) Office of Advanced Manufacturing moderated a panel discussion of NIST Fellows, who reflected on their personal decisions to answer the “call to service” to engage in public policy as a way of making a real difference.

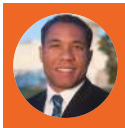
Molnar felt the call to service after 9/11. In his introduction, he emphasized that technology is at the heart of nearly every major public policy issue that we face. He highlighted that technology moves very quickly, exponentially faster than the legislative and executive branches. Programs such as the NIST Fellows program can help the government close this gap and reach the needed pace. He also reminded participants that, while developing good policy is important, the implementation of policy is also critical for having a real impact.

The NIST fellows, who ranged from early-career professionals to retired executives, highlighted several key observations based on their experience in the public policy arena.

## WHY IS THERE A NEED FOR FEDERAL FELLOWS TO BE INVOLVED IN POLICY?



**Erin Lavik.** Engineering skills are a benefit in breaking down complex policy issues



**Clifton Ray.** Problem-solving and analytical skills are useful in establishing the metrics for progress and success that are needed to guide funding.



**Don Ufford.** Engineers have a natural connection to and interest in technology. This vision of the future can guide other disciplines involved in policy development.

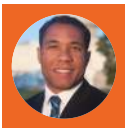


**Craig Scott.** Fellows can bring the perspective that the application of science and technology should be for the benefit of people.

## WHAT IS YOUR REASON FOR WANTING TO BE A FEDERAL FELLOW?



**Don Ufford.** After retiring from Ford, I was looking for an opportunity to work in government and connect the different sectors of the manufacturing ecosystem. I wanted to connect my passion for manufacturing with the ability to impact policy that promotes manufacturing opportunities in the U.S, promoting global manufacturing excellence and competitiveness. I was also hoping to contribute to improving resilience of the supply chain exposed by COVID.



**Clifton Ray.** I made the decision to move to the Fellows Program early in my career. Social issues and policy failures such as the Flint water crisis were motivating factors. I could not understand how the Flint situation could happen given the engineering capabilities in the U.S. Engaging in public policy as an engineer was a way for me to help prevent and/or solve these types of problems.



**Craig Scott.** I was working at an HBCU and looking to provide more opportunities for students with respect to public policy. I learned that lobbying is only one way to engage in public policy, many other paths are available to engineers.

## Provocation – The Call to Service: Federal Fellows Panel from the National Institute of Science and Technology

### WHAT PREPARATION, EXPERIENCE OR TRAINING WAS MOST HELPFUL TO YOU IN YOUR FELLOW’S ROLE?



**Erin Lavik.** Facilitation and convening skills developed in my role as dean at UMBC. My past experience as a stage manager for theatrical productions, gave me skills and the ability to do things quickly with limited knowledge.



**Clifton Ray.** Top notch communication skills, particularly writing. Understanding complex topics and being able to communicate in simple language and messaging.



**Don Ufford.** Understanding of systems is the perfect background for policy development, along with the ability to think broadly and critically regarding impacts and inter-relationships.

### SHARE AN EXAMPLE OF A CONTRIBUTION THAT IMPACTED DEVELOPMENT OR IMPLEMENTATION OF POLICY OR AN INITIATIVE.



**Craig Scott.** My contributions to a CHIPS program paper on workforce development. I emphasized the importance of DEI in decision-making. The recommendations that I contributed to are being implemented.



**Don Ufford.** Contributions to the national strategy for advanced manufacturing. I had the opportunity to engage with stakeholders and contribute to strategy for organizing federal actions.





## Provocation – The Call to Service: Federal Fellows Panel from the National Institute of Science and Technology

### WHAT DID YOU LEARN THAT WAS MOST SURPRISING OR UNEXPECTED?



**Erin Lavik.** How well people work across agencies and the willingness to listen and collaborate. An example was the willingness to collaborate around neuro-diversity issues to ensure that policy reflects the entire population.



**Clifton Ray.** For me it was seeing the devotion to public service in federal agencies.



**Don Ufford.** It was fascinating working with people of varied backgrounds and seeing the capability of the people in the U.S. government. There are intriguing questions to explore that offer the opportunity to make a real difference and move things forward with potentially groundbreaking work.



**Craig Scott.** I realized I can have an impact on people beyond being a dean. Public policy offers a third career track for engineers beyond traditional technical and administrative tracks.



### WHAT ARE YOUR PLANS WHEN YOU FINISH YOUR TERM AS A FELLOW? DID YOUR FELLOW EXPERIENCE INSPIRE YOU TO STAY INVOLVED IN PUBLIC POLICY DEVELOPMENT?



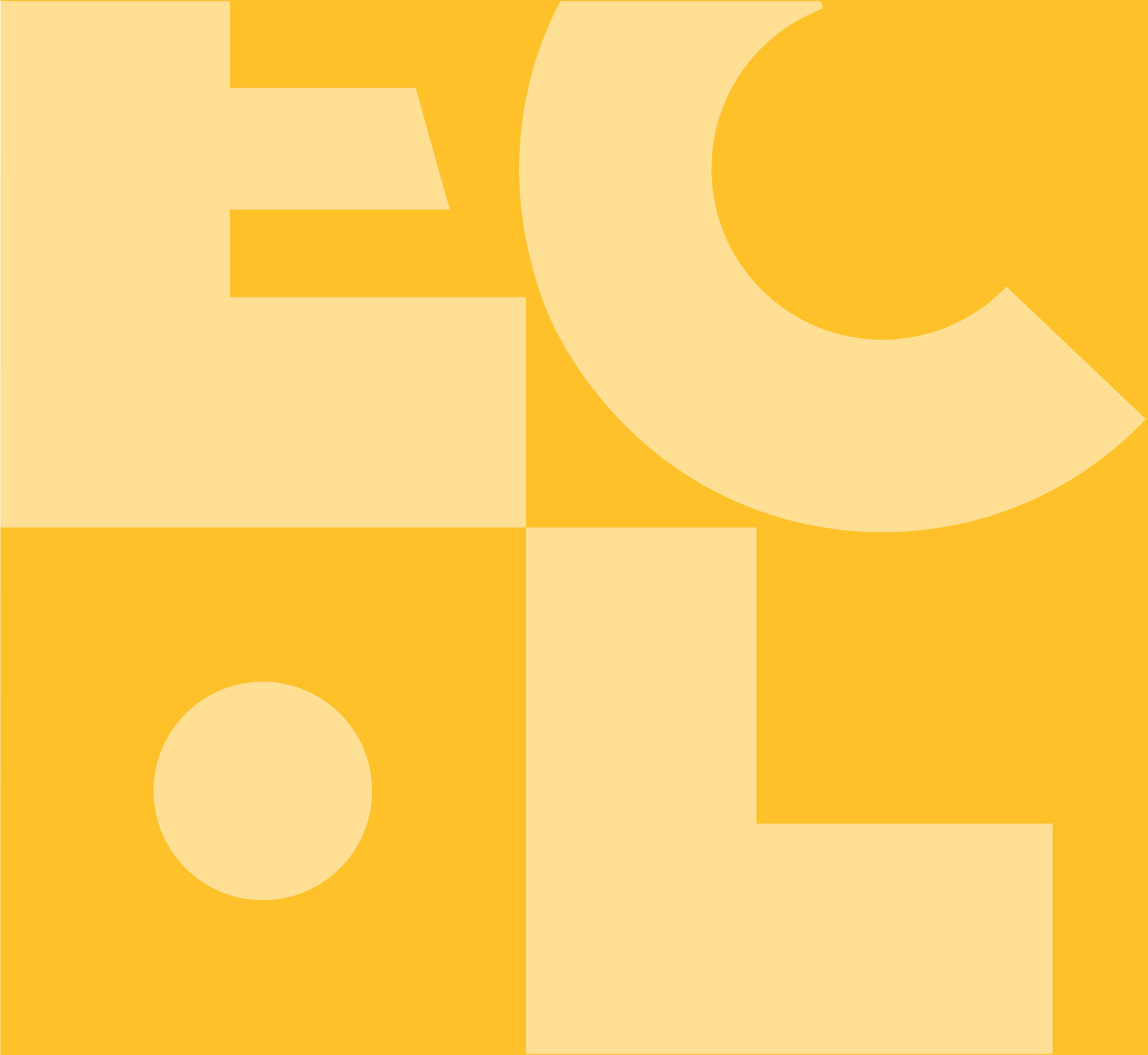
**Erin Lavik.** I am hungry to stay involved in programs at this level.



**Don Ufford.** I believe I can go back to industry and raise awareness regarding what is actually happening in government.



**The key takeaway from the NIST Fellows was that engagement in public policy is a meaningful way to contribute at any point in your career, and comes with opportunities to have a real impact and move important programs forward.**



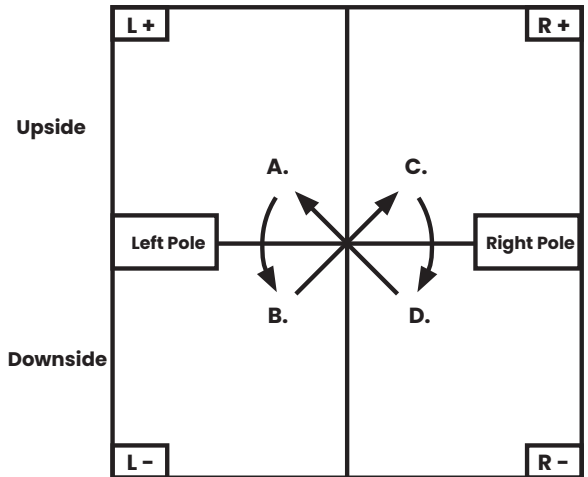
# Group Exercise 1

## Group Exercise 1: Crossing the Threshold to Service

In the first group exercise of the summit, participants explored crossing the threshold to service in public policy. The exercise utilized polarity thinking, comparing the upsides and downsides of remaining in a technical problem solver role to adopting a role in public policy.

Kyle Davy, ECL Creative Director and Lead Facilitator, introduced participants to the concept of “polarity thinking.” When confronted with a situation or dilemma where there are two seemingly opposite choices that are in fact interdependent, leaders can take a “polarity thinking” approach to generate possible responses.

- Polarities are sets of opposites that do not function well independently.
- Because the two sides of a polarity are interdependent, you cannot choose one as a “solution” and neglect the other.
- Polarity management attempts to get the best of both opposite sides while avoiding the limits of each.
- This approach uses a “polarity map” to represent, understand, and make choices about these situations and dilemmas.



From *Polarity Management. Identifying and Managing Unsolvable Problems*, Barry Johnson

Working in small groups, participants examined the polarities of engagement in public policy. The left pole of the polarity map was represented as staying in the role of a technical problem solver implementing policies set by others, while the right pole was represented as taking an active role in public policy service. Key elements of the four quadrants of this issue are captured in the polarity map included below.

### ENGINEERING & PUBLIC POLICY POLARITY MAP

#### Technical Problem Solver Upside (L+)

- Staying in our comfort zone.
- Tangible, objective technical solutions compared to the smoke and mirrors of public policy.
- Logic and data prevail.
- Stability and safety

#### Public Policy Service Upside (R+)

- Positive contributions to society.
- Rich learning environment. Understand different perspectives.
- Increased scope of influence from one project to entire communities.
- Potential for positive impacts on our reputation. Increased trust.
- Application of technical expertise to policy and to protecting the public.
- Expanded opportunities to apply our technical background.

#### Technical Problem Solver Downside (L-)

- People issues and full impacts of work are missed.
- Diversity of solutions is narrow.
- Not everything can be quantified.
- Ineffective communication of technical solutions.
- Isolation.
- Communication skills undeveloped.
- Stereotyped as technicians.
- Trapped in working on the wrong problems defined by someone

#### Public Policy Service Downside (R-)

- Professional and reputational risk.
- Motivations questioned.
- Frustrating and less rewarding as ideas are stifled by politics.
- Lower pay.
- Potential for influence to be overridden by those without technical background.
- Loss of technical “edge.”

## Group Exercise 1: Crossing the Threshold to Service

### KEY TAKEAWAYS FROM THE GROUP DISCUSSION ARE CAPTURED BELOW.



- The engineering community brings credibility to the public policy arena that can translate into trust from the public. This can generate a virtuous cycle of engagement and trust building between engineers and the public.



- Trust, influence, and recognition will come with consistent involvement.



- Public policy engagement offers the opportunity to increase our impact – from individual projects to problem-solving that involves a much bigger community and larger scale challenges.



- The engineering community can bring an ethical and principled approach that is often missing in policy discussions.



- Engagement in public policy offers the opportunity to develop important skills, including an appreciation for diverse viewpoints and communication to non-technical audiences.

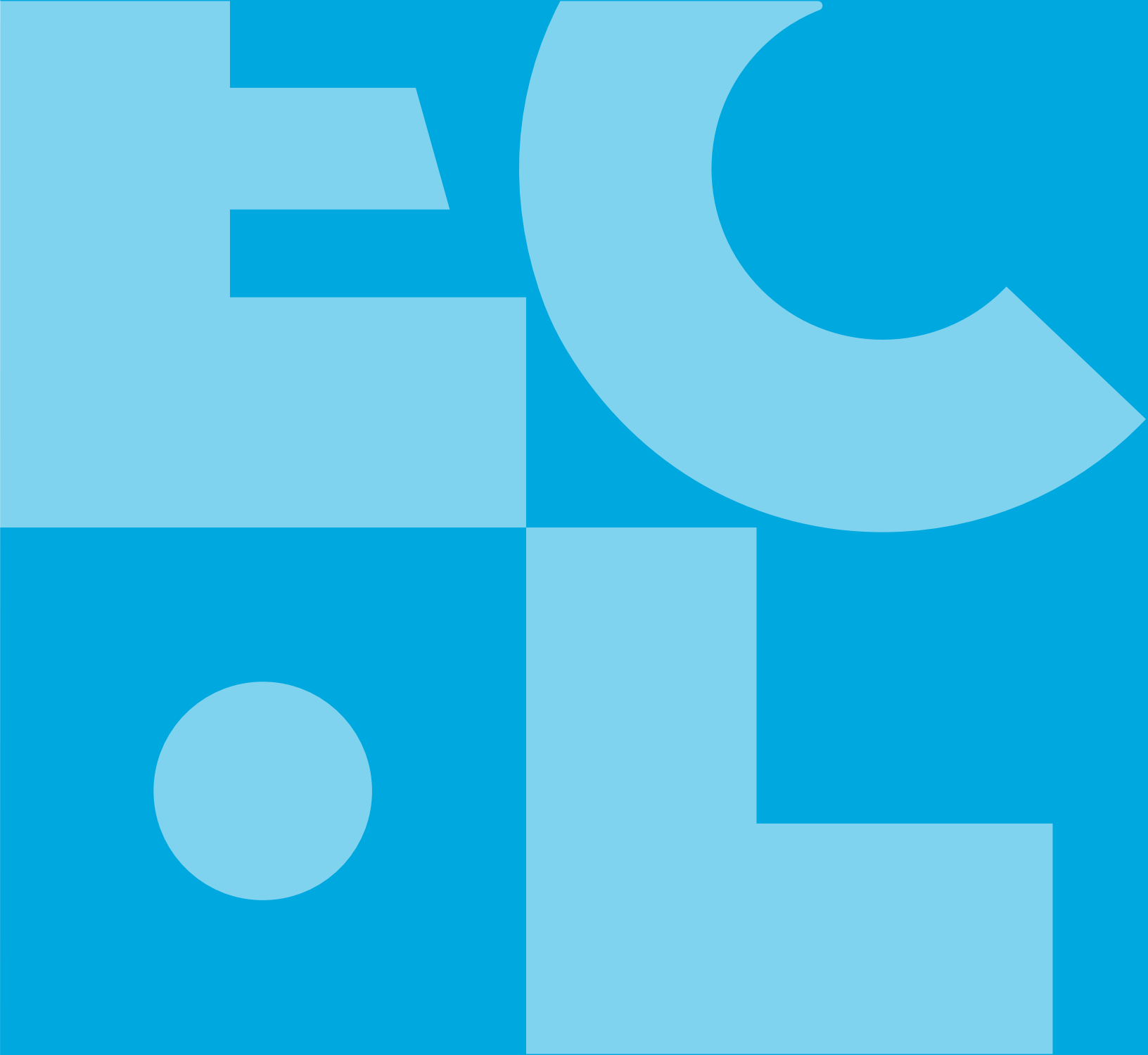


- Involvement needs to start with college education, motivating students to engage in policy issues and building skills to do this successfully.



- Public policy engagement requires a mindset shift – from the stereotypical black-and-white of engineering to a more nuanced view of the world.





Provocation



# Engineering & Public Policy Leadership: The Journey

The second half of the summit featured three leaders from the engineering community who offered their perspectives on the public policy journey.

## Provocation – Engineering & Public Policy, An Education Perspective



**DEANNA MATTHEWS,**  
**Associate Department Head for Undergraduate Affairs, Engineering and Public Policy at Carnegie Mellon University**

Deanna Matthews is Associate Department Head for Undergraduate Affairs and Teaching Professor in Engineering and Public Policy at Carnegie Mellon University. She oversees the department educational programs, curricula development, undergraduate student advising and professional development, and teaches courses in engineering and public policy. Her research focuses on engineering education pedagogy, life cycle assessment, corporate environmental management, and educating the public about energy-environment issues. She earned a BS from Duke University and MS and PhD in from Carnegie Mellon University.

Deanna Matthews, Associate Department Head for Undergraduate Affairs, Engineering and Public Policy at Carnegie Mellon University, offered a perspective on how academia is preparing engineering students to engage in public policy. The mission of Carnegie Mellon’s Engineering and Public Policy program is to “create engineers with a difference.”

Carnegie Mellon offers undergraduates from all engineering disciplines the opportunity to add a public policy focus to their basic degree. M.S. and Ph. D. degrees are also part of the public policy program. Participants in the undergraduate public policy program represent less than ten percent of the total engineering college population. The purpose of the program is to address connections between engineering systems and society.

### What is Engineering and Public Policy?

- Addressing the connections between engineering systems and society



Need for transparent privacy policies for apps



Communicating vaccine effectiveness

Identify transit and COVID exposure inequities during the pandemic

Understanding air pollution and health impacts from food production

Security & Privacy Overview			
Smart Device Co.			
Smart Video Doorbell NS2000 Firmware version: 2.5.1 - updated on: 11/12/2020 The device was manufactured in: China			
Security Mechanisms	Security updates: Automatic - Available until at least 1/1/2022	Access control: Password - Factory Default - User changeable, Multi-factor authentication. Multiple user accounts are allowed.	
Sensor data collection	Visual	Audio	Physiological
Sensor type	Microphone		
Purpose			
Data stored on device			
Data stored on cloud		Identified - Outlets to outside	
Shared with	Manufacturer		
Sold to	Not disclosed	Not sold	

## Provocation – Engineering & Public Policy, An Education Perspective

The undergraduate program is focused on understanding the basics of public policy and building skills and knowledge in economics, statistics/data analysis, decision making, and communication. It also includes a capstone project. Example capstone projects have focused on public transit post-pandemic (role of scooters, understanding passenger demographics, etc.), vehicle electrification, cybersecurity resilience, future of automated alerts and warnings, and decarbonizing residential energy usage.

Master's and Ph. D. public policy programs look to build additional depth of skills in the theory and practice of policy plus quantitative analysis, plus technical understanding. Research focus areas for master's and Ph. D. programs include climate and environment, energy systems, risk analysis, technology innovation, and information and communication technology.



### Technology Policy Electives - examples

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- Regulation of Internet Edge Platforms
- Patents, Licensing, and Innovation
- Science and Innovation Leadership
- Policies of Wireless Systems
- Climate Change Science and Solutions
- Sustainable Energy in the Development World
- Cryptocurrencies, Blockchains, and Applications
- Energy Innovation and Entrepreneurship
- Privacy Policy, Law, and Technology

Engineering and Public Policy students pursue a variety of career options – graduate programs, consulting, research and development, finance, and industry. The challenges faced in interesting students in the program are the beliefs that you need a technical job first and that policy positions are not real jobs. The program is attracting politically active students who are interested in issues such as climate change, biomedical ethics, and AI/social media.



Provocation

## Provocation – The Non-Profit Perspective



**JIMMY HAGUE,**  
**Policy Advisor Federal Fresh Water Priorities, The Nature Conservancy**

Jimmy Hague has been the Senior Water Policy Advisor for The Nature Conservancy (TNC) since August 2016. Located in Washington, D.C., Jimmy leads the development and coordination of TNC’s federal freshwater conservation policy and advocacy for nature-based water infrastructure, drought resilience, clean water, flood risk reduction, ecosystem restoration, and other issues. Prior to coming to TNC, he worked for seven years in the U.S. Senate and House of Representatives.

Jimmy Hague, Policy Advisor for Fresh Water Priorities at The Nature Conservancy (TNC), provided the perspective of an engineer and scientist engaged in public policy leadership through his work at a non-profit focused on conservation. TNC’s organizational priorities are addressing climate change and biodiversity loss. Policy is a critical tool in addressing these priorities.

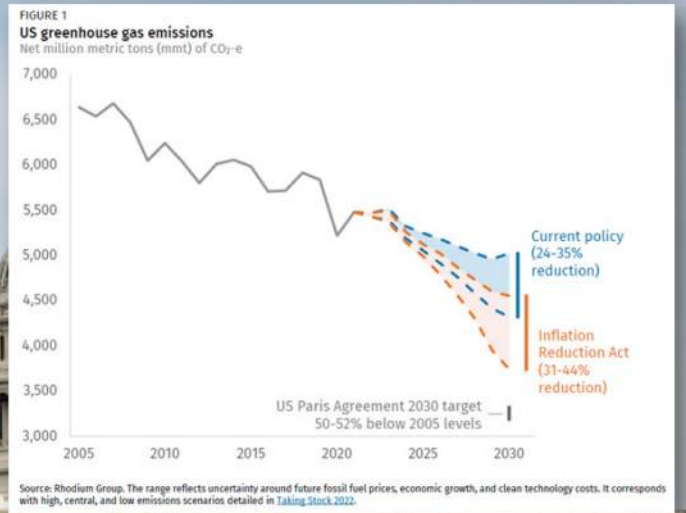
Hague described TNC’s approach as science-based, non-partisan, on-the-ground, and at all levels of government. He suggested that behind-the-scenes work with agency staff can be just as important as lobbying Congress. An example of this is the need to focus on budgeting and appropriations in the implementation of policies. TNC also prioritizes their policy engagement, looking for areas with the largest potential impact.

He described TNC’s contributions to the major investment in climate change and conservation included in the Infrastructure Investment and Jobs Act and the Inflation Reduction Act. TNC has been working on these issues for ten years.

### Inflation Reduction Act of 2022

Total \$740 billion

\$370 billion for climate and resilience over 10 years



## Provocation – The Non-Profit Perspective

### Infrastructure Investment and Jobs Act of 2021

\$550 billion over 5 years

- Climate and Clean Energy
- Water and Transportation Infrastructure
- Fish and Wildlife Habitat
- Hydropower and Dams



#### Hague offered several areas of advice and caution.



- If you are not at the table, you're on the menu.



- Find the role you want to play and the tactics you want to use.



- Remember the policy implementation process.



- Embrace the uncertainty of working in a messy business.



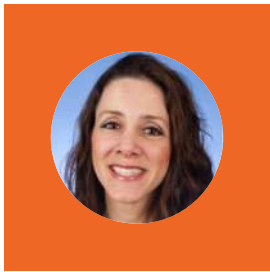
- Be prepared for the long haul; policy development at the federal level can be a years-long process.





Provocation

## Provocation – The Public Sector Perspective



**PATRICIA GOMEZ,**  
**Director of Energy and Deputy Chief Resilience Office, Miami-Dade County**  
**Office of Resilience**

Dr. Patricia Gómez is a leader in planning and implementing climate adaptation and mitigation programs, with over 20 years of direct experience working on engineering, resilience, and sustainability-related opportunities in both the public sector and private sectors. Currently serving as the Director of Energy and Deputy Chief Resilience Officer in Miami-Dade County's Office of Resilience. Dr. Gomez holds a Ph.D. in Industrial Engineering from the University of Miami and is a Board member of the Envision Review Board affiliated with the Institute for Sustainable Infrastructure.

Patricia Gomez, Director of Energy and Deputy Chief of Resilience for Miami-Dade County, described her policy role in the public sector. The Office of Resilience is a regional entity that focuses on issues related to climate change, energy, and resilience. Local, state, and federal regulations all have an impact on their work.



**The Office of Resilience's mission is to lead Miami-Dade County to a resilient and sustainable future by identifying vulnerabilities, coordinating stakeholders, and facilitating innovative solutions.**



Gomez cited several examples of her work on policy implementation related to these areas.

- Adaptation to sea level rise in an area subject to sunny-day flooding and storm surge impacts.
- Biscayne Bay water quality issues.
- Extreme heat impacts on outdoor and agricultural workers.
- Strategies to make the community cooler such as tree plantings.
- Zero waste.

With respect to climate change, she described the county's connected strategies approach. She highlighted that, despite these strategies, emissions continue to increase. The county's ultimate goal is net zero emissions by 2050.

# Provocation – The Public Sector Perspective

## 7 Approaches to reach our goal



### GETTING TO NET ZERO EMISSIONS BY 2050 7 APPROACHES TO REACH OUR GOAL



[www.miamidade.gov/climateactionstrategy](http://www.miamidade.gov/climateactionstrategy)

She described why her engineering background has been helpful and important in her role, particularly the ability to understand complex topics and the skills to identify the benefits of policies based on data. She also outlined the new skills she has developed while working in public policy, including communication skills that allow her to work effectively with different stakeholders and translate complex issues in simple terms.

Gomez expressed her personal satisfaction and sense of purpose that her role has provided. She feels she is positively impacting future generations. She also emphasized that policy implementation can be successful even in different political environments through maintaining adaptable and flexible approaches.



# Group Exercise 2

## Group Exercise 2: Empowerment and Getting Things Done

In the second group exercise of the summit, participants engaged in a futuring exercise intended to spur greater engagement in the public policy arena. Participants reflected individually on the following prompts and then shared their individual reflections in small group discussions.

Imagine that it is ten years from now. You wake up ... and you are actively engaged in the public policy arena.

- What issue / challenge are you working on?
- What are you doing to influence public policy with respect to the issue / challenge? (How are you using your unique skills and personal strengths to help?)
- What level of government / civil society are you engaged with?
- What impact have you had / are you having?
- How did you get involved in the first place?
- What support have you had that you particularly valued?
- How do you feel about what you have contributed?



Areas of engagement envisioned by participants included the following.

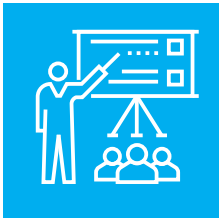
<b>Affordable housing.</b> 	<b>Forestry development in rural communities.</b> 	<b>Transforming environmental regulatory processes.</b> 	<b>Wildlife habitat protection.</b> 
<b>Protection of pedestrians.</b> 	<b>Climate change.</b> 	<b>Supporting local agencies.</b> 	<b>Cyber security.</b> 
<b>Smarter development.</b> 	<b>Wealth disparity.</b> 	<b>Electrification</b> 	<b>Needs of underserved populations.</b> 
<b>Sustainable and innovative solutions for energy.</b> 			

A common driver of these envisioned futures was the call to contribute to making communities better. A common theme was the need for senior leaders to support public policy engagement in younger generations.



## Conclusion

The technical knowledge and experience of the engineering community are critical to effective public policy. To have a greater impact in the public policy arena, we will need to move from a sense of disempowerment to empowerment; from believing that we only implement the policies and ideas of others to active engagement in defining the right problems in the right way. We will need to apply this empowerment in new ways, with great respect and empathy for the impact of public policy on people, on communities, and on the environment. By doing so, we will experience a heightened sense of purpose in the work of the engineering community.



All provocateur presentations are available at the link below.

[\*\*Engineering & Public Policy Provocateur Presentations\*\*](#)



A full recording of the summit is available at this link.

[\*\*Engineering & Public Policy Recording\*\*](#)