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Public choice in the mix of electric power generation

Climate and Energy Decision-Making Center Advisory Board Meeting

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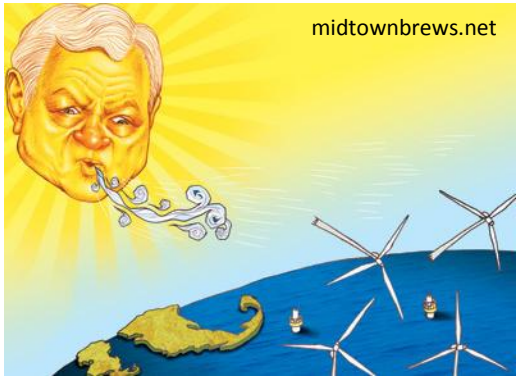
Public acceptance can be a major obstacle to energy infrastructure development



People hold gaps and misconceptions about low-carbon electricity technologies…

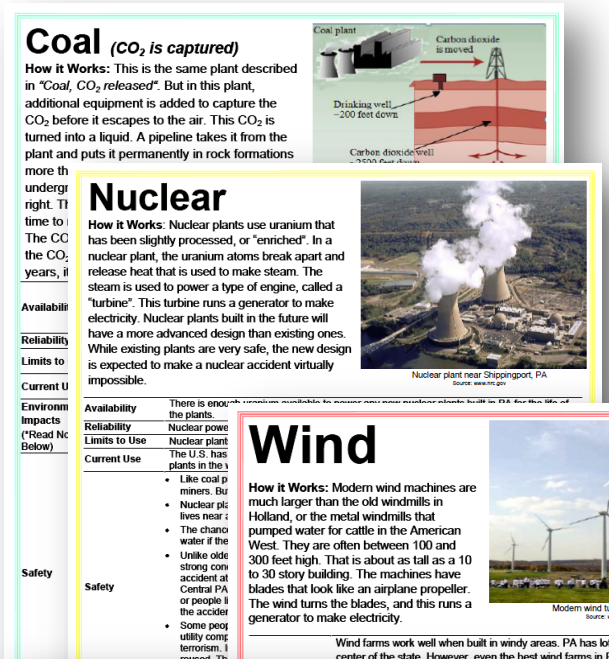
•Many public opinion studies provide un- or under-informed and unreliable results

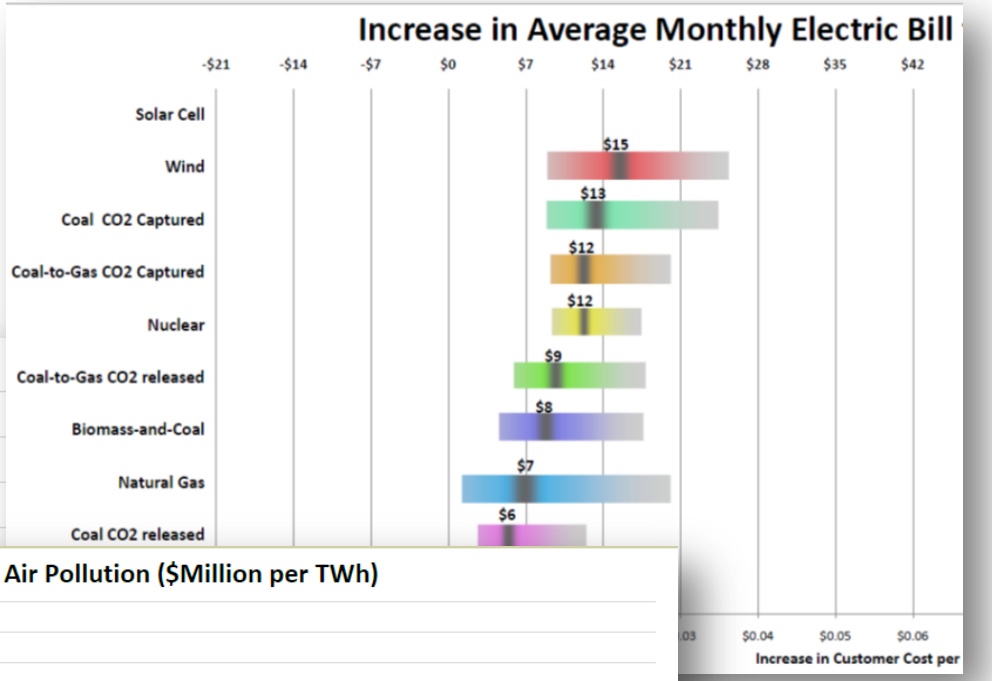
In two studies, we have aimed to:

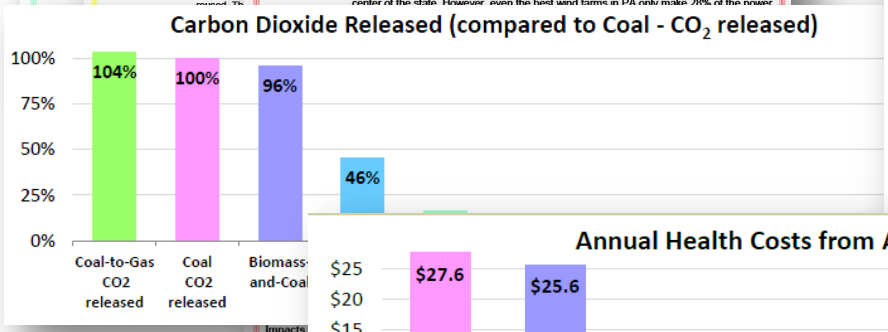
- Better inform people about low-carbon electricity technologies and portfolios
- Overcome the barriers of their misconceptions and knowledge gaps
- Elicit preferences informed by correct and balanced information

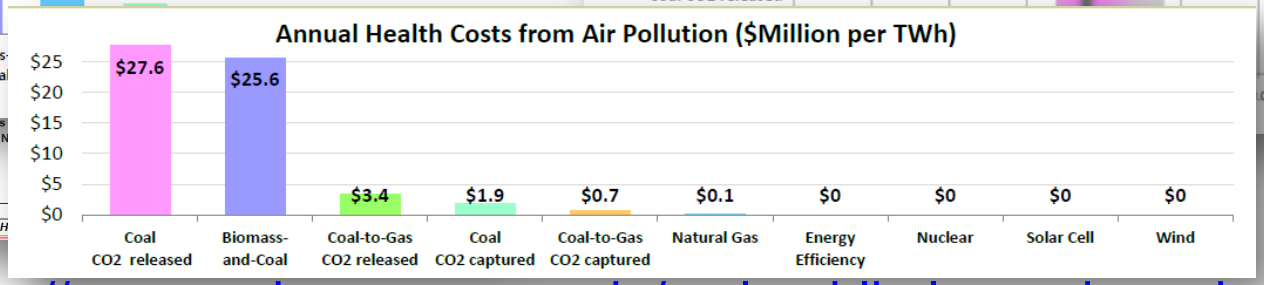
Participants receive "homework materials" that …

- are technically accurate and understandable
- present 10 electricity technologies
- provide multi-attribute descriptions of the costs, risks and benefits of each technology
- facilitate a ranking of technologies at home









Materials: http://www.cedm.epp.cmu.edu/tool-public-lowcarbon.php

In a first study, participants asked to rank pre-determined low-carbon portfolios before and after a group discussion

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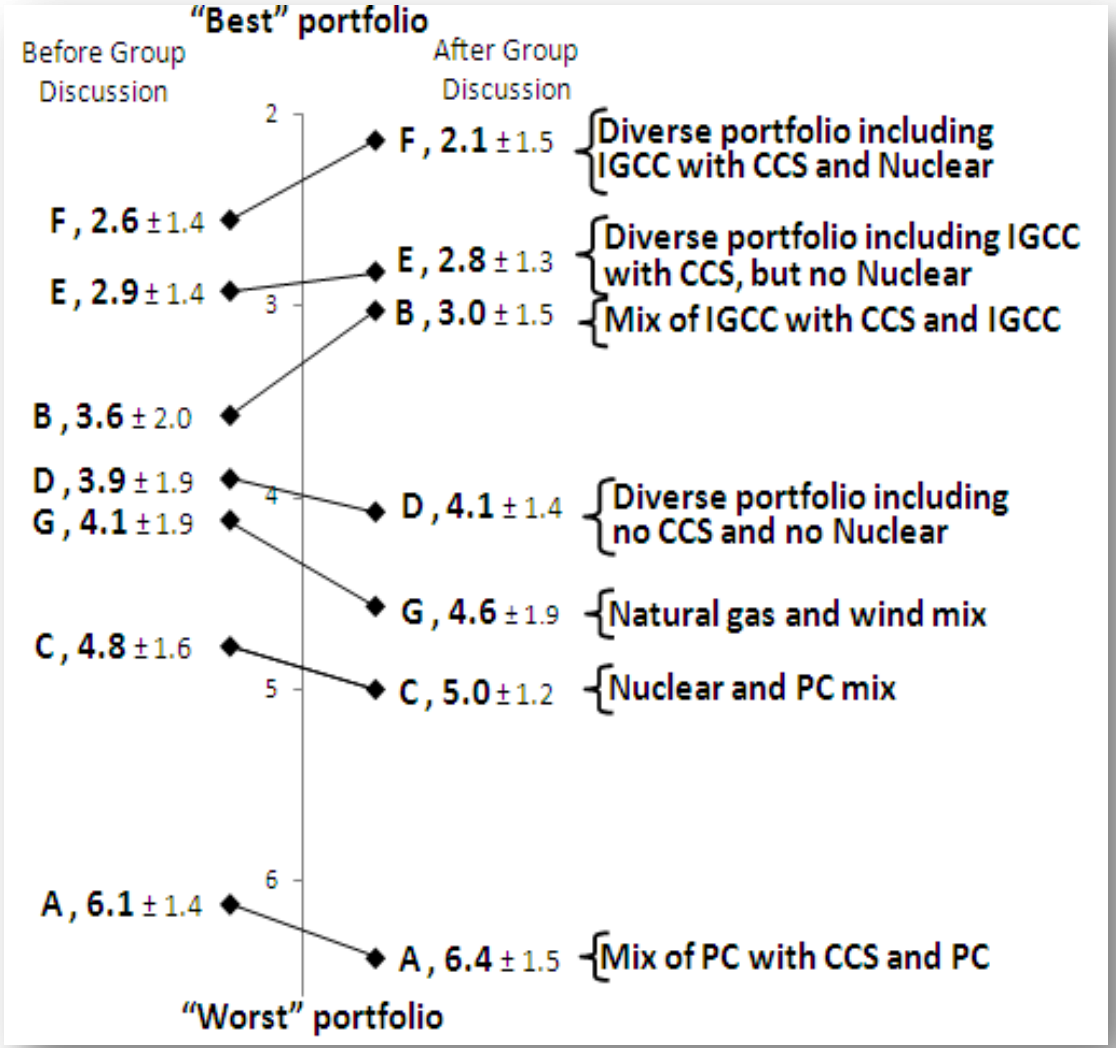

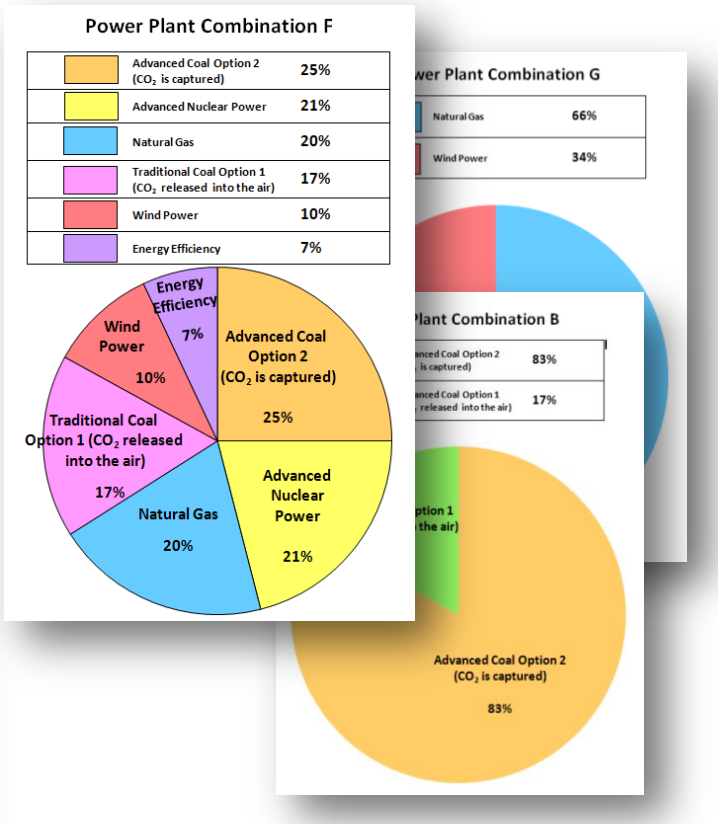

Mean participant portfolio rankings (±SD), from 1 (best) to 7 (worst)

Fleishman LA, Bruine de Bruin, W and Morgan, MG. (2010) Informed Public Preferences for Electricity Portfolios with CCS and Other Low-Carbon Technologies, 2010, *Risk Analysis*, 30(9):1399-1410.

In a second study, participants are asked to *create* a low-carbon portfolio with a decision tool

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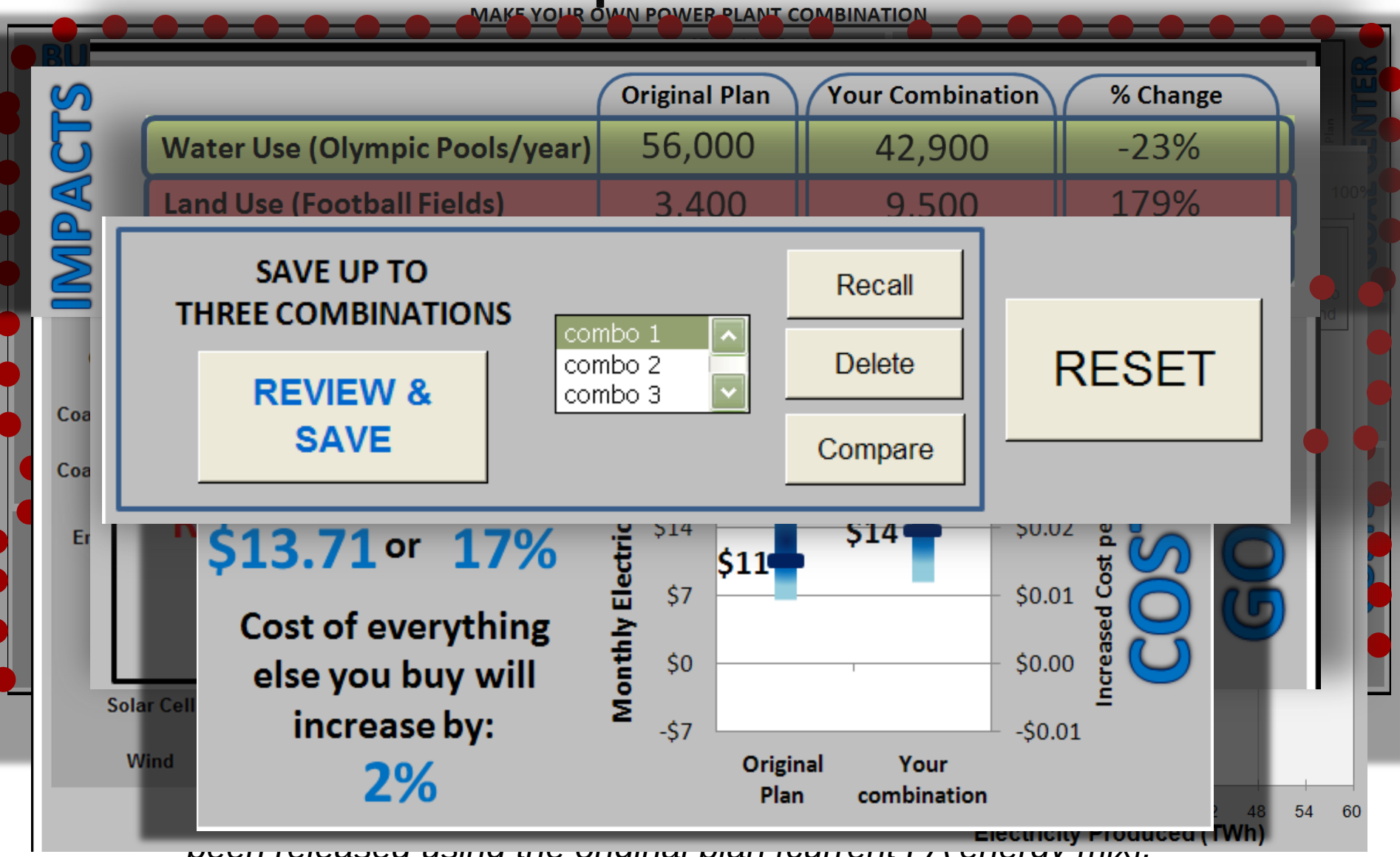
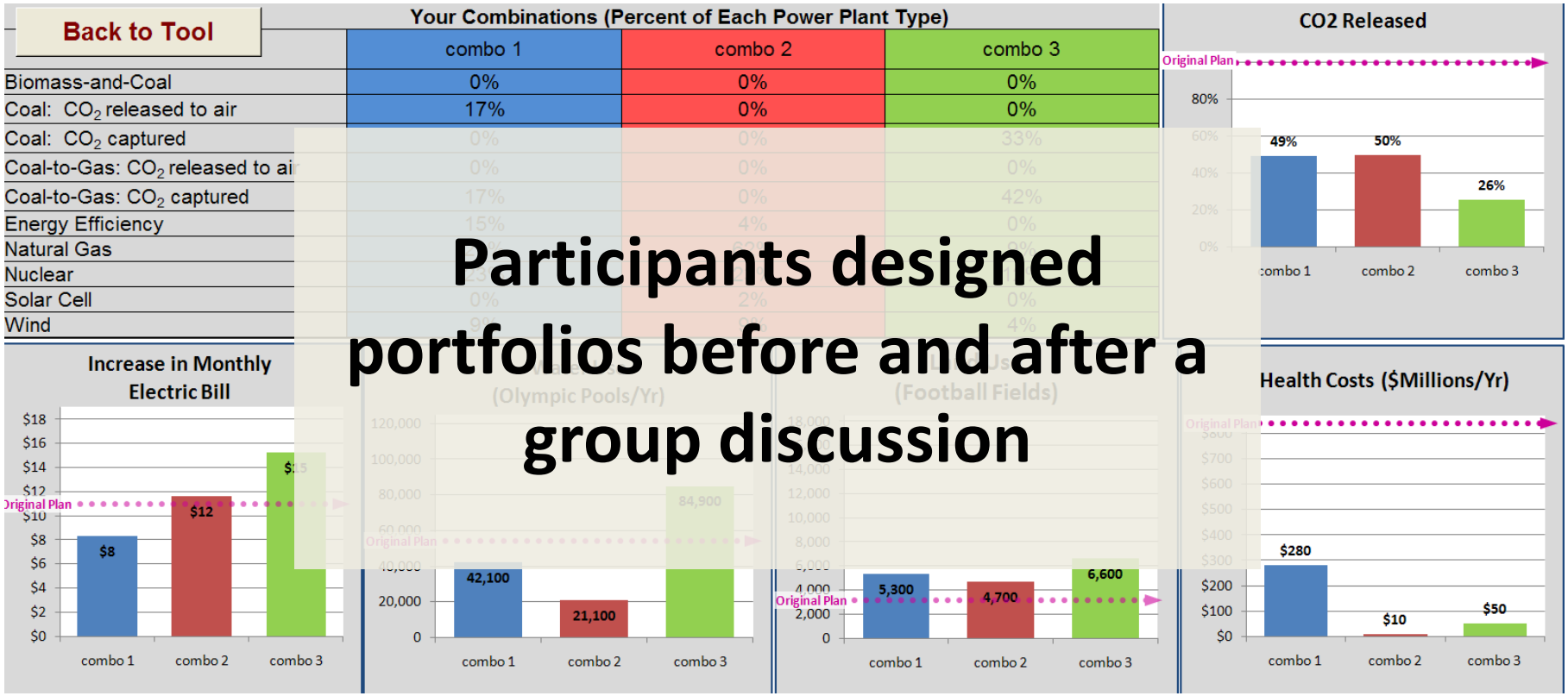


been released using the original plan [current PA energy mix].

Compare Screen



Participants designed portfolios before and after a group discussion

When you have saved 3 combinations you like, hit the "compare" button. Compare the combinations and decide which one you would like to use as "your advice to the governor"

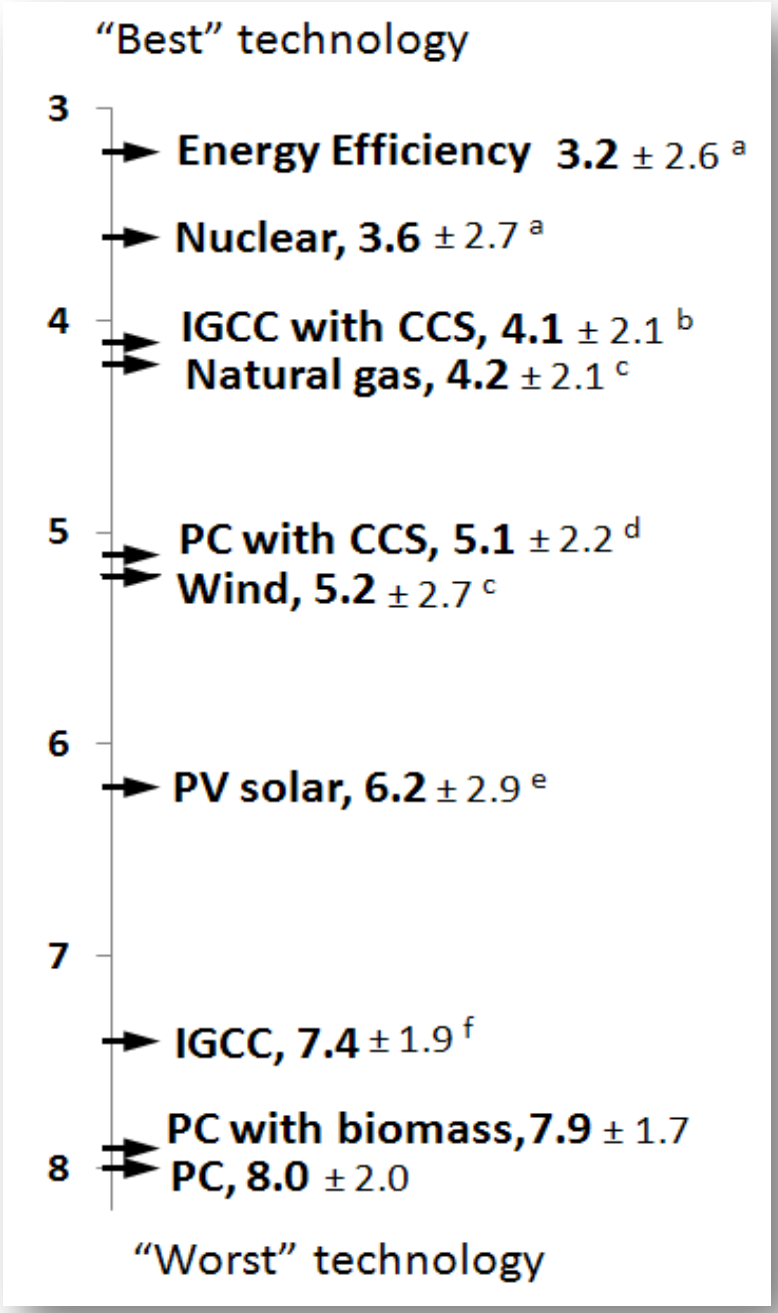
Participants

10 Workshops:

- Held at local community organizations
- Including 4-9 participants each
- Lasting 2.5 – 3.5 hours
- Carefully scripted following Risk Ranking procedures
- Paid $95 (to keep or donate to organization)

69 Participants:

- Ages 22 to 85 years old (m=53.9)
- 70% Females, 13% African-American or other minority
- All had HS diploma, 58% at least a Bachelor's degree



Technology Rankings

Graph shows mean participant technology rankings (±SD), from 1 (best) to 10 (worst)

- Energy efficiency, nuclear, IGCC with CCS and natural gas were not ranked significantly different from one another
- Both coal technologies with CCS were ranked better than IGCC and PC
- IGCC with CCS ranked better than PC with CCS

Note: Superscripted letters next to mean technology rankings refer to Wilcoxon paired-rank tests results ($p < 0.01$), suggesting that:
a: PC with CCS, Wind, PV Solar, IGCC, PC with biomass and PC were ranked significantly worse
b: PC with CCS, PV Solar, IGCC, PC with biomass and PC were ranked significantly worse
c: PV Solar, IGCC, PC with biomass and PC were ranked significantly worse
d: IGCC, PC with biomass and PC were ranked significantly worse
e: PC with biomass and PC were ranked significantly worse
f: PC was ranked significantly worse

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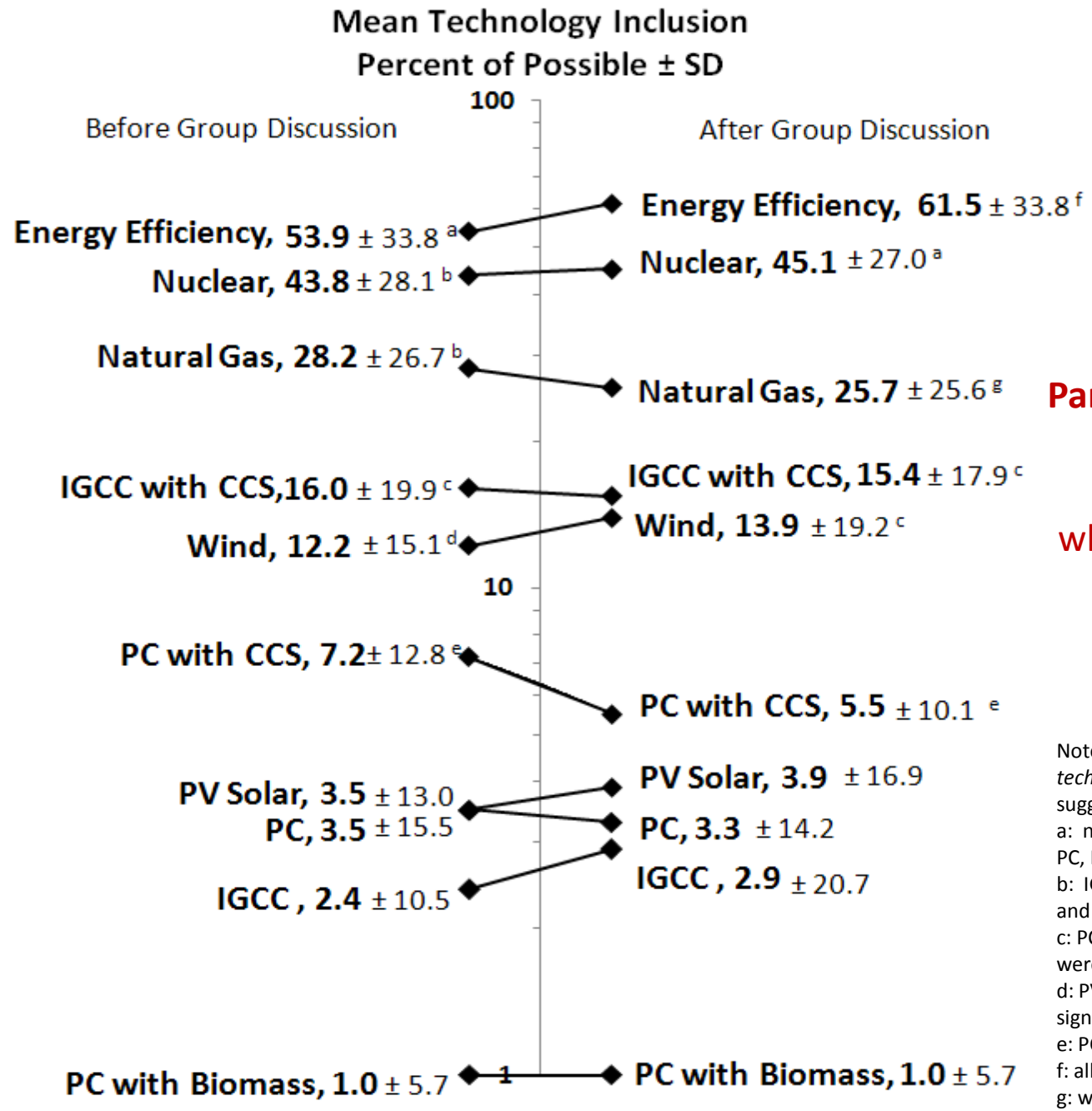
Portfolio Designs



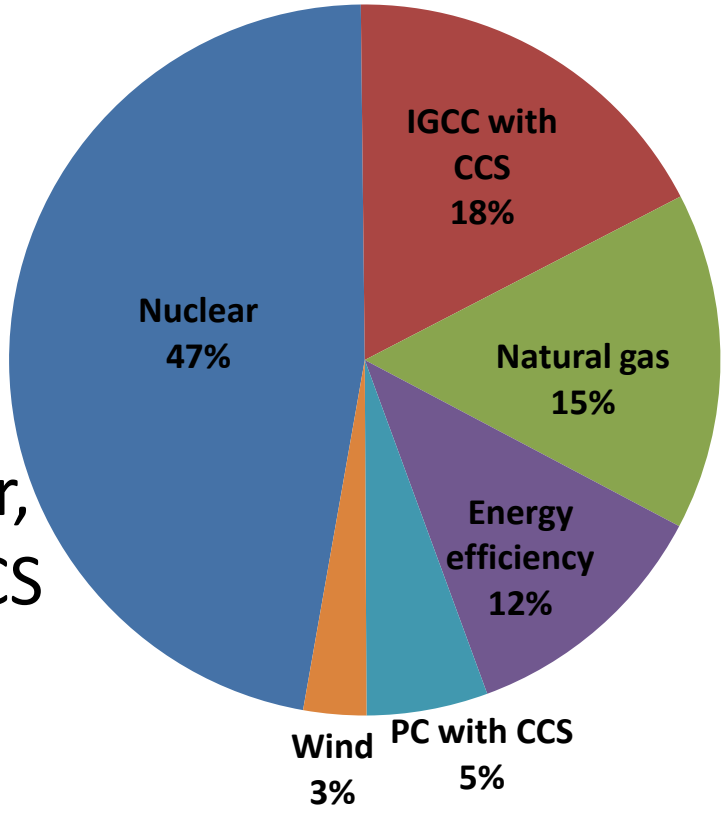
Participants' mean standardized technology percentages
± standard deviation,
where 0 is no inclusion and 100 is full inclusion in portfolio

Note: Superscripted letters next to mean *standardized technology percentages* refer to *t*--test results ($p < 0.01$) suggesting that *standardized technology percentages of*:
a: natural gas, IGCC with CCS, wind, PC with CCS, PV solar, PC, IGCC, and PC with biomass were significantly less
b: IGCC with CCS, wind, PC with CCS, PV solar, PC, IGCC, and PC with biomass were significantly less
c: PC with CCS, PV solar, PC, IGCC, and PC with biomass were significantly less
d: PV solar, PC, IGCC, and PC with biomass were significantly less
e: PC with biomass was significantly less
f: all other technologies were significantly less
g: wind, PC with CCS, PV Solar, PC, IGCC, and PC with biomass were significantly less

Portfolio Designs

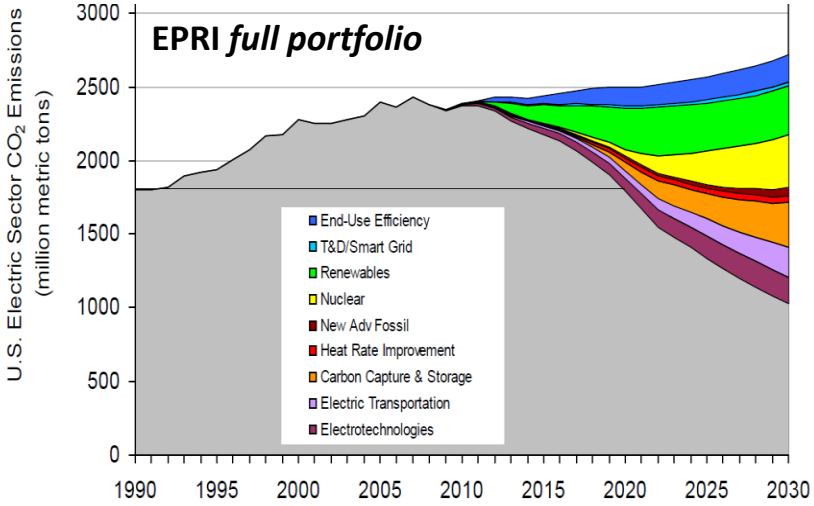
- Participants had to include at least one low-carbon baseload technology (natural gas, coal with CCS, nuclear) in portfolio
  - Most frequent design included all three (58.2% *pre-discussion, 60.3% post-discussion)*
- The most common portfolio included energy efficiency, nuclear, natural gas, wind and coal with CCS (31% *pre-discussion,* 38% *post-discussion)*

Most common portfolio, on average, *post-discussion*



Overall Conclusions

- It is possible to design communications to inform people about the costs, risks, benefits and limitations of low-carbon electricity technologies and portfolios
- Our informed participants
  - designed diverse portfolios including nuclear, CCS, energy efficiency, wind and natural gas – similar to EPRI *full*→
  - preferred coal with CCS to coal without CCS
- Results contrast those of other studies showing much lower preference of CCS and nuclear
  - our participants were given balanced and comparative information and adequate time



Source: www.epri.com

Thank You!

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CEDM Climate and Energy Decision Making

EPRI ELECTRIC POWER RESEARCH INSTITUTE

CDMC Climate Decision Making Center
Carnegie Mellon University
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Back Up

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Group Workshop Procedure

Step 1: "Homework Assignment"	
Received: Technology-related information	Provided: ***Pre-discussion* technology rankings**

Experimenter explanation of "homework" materials & introduction of computer tool

Step 2: Computer Tool (*pre-discussion*)	
Received: Computer tool	Provided: ***Pre-discussion* portfolio designs**

***Group discussion**: Participants present portfolio designs on a projected "Compare" screen*

Step 3: Computer Tool (*post-discussion*)	
Received: Pre-set portfolios	Provided: ***Post-discussion* portfolio designs**

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Participant comprehension and satisfaction

- 24 true-or-false homework knowledge questions
  - *M*=90%, *SD*=11%, range: 46-100%
  - Scores significantly better than chance (t=28.2, p < 0.001)
- 13 computer knowledge questions
  - M = 93%, SD = 10%, range 62-100%

- Participants thought that using the computer tool was:
  - "an enjoyable experience" (*M*=6.5, *SD*=1.0, *t*=20.3, *p*<0.001) and "a valuable use of [their] time" (*M*=6.4, *SD*=1.2, *t*=17.9, *p*<0.001)
- They "learned a great deal about the different electricity options" (*M*=6.4, *SD*=1.2, *t*=16.3, *p*<0.001)

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Standardized Technology Distributions