



Deposition of:
Virtual Town Hall

May 11, 2021

In the Matter of:

Gas Hearing

[Veritext Legal Solutions](#)

888.777.6690 | cs-midatlantic@veritext.com | 215-241-1000

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

- - -
PHILADELPHIA GAS COMMISSION
- - -
VIRTUAL TOWN HALL
TO HEAR PUBLIC FEEDBACK
ON DRAFT MATERIALS
FOR THE PGW BUSINESS DIVERSIFICATION STUDY

- - -
May 11, 2021

10:00 A.M.

- - -
VIA ZOOM VIDEOCONFERENCE
- - -

BEFORE: DEREK GREEN, Chairman
ROYAL E. BROWN
REBECCA RHYNHART
Commissioners

- - -
VERITEXT LEGAL SOLUTIONS
MID-ATLANTIC DIVISION
1801 Market Street - Suite 1800
Philadelphia, Pennsylvania 19103

1 PRESENT ON BEHALF OF PGC:

2

GEMELA N. McCLENDON, ESQ.

3 Executive Director

4 ERIN BAGLEY LAI, ESQ.

Hearing Examiner

5

HEIDI L. WUSHINSKE, ESQ.

6 Hearing Examiner

7

PRESENT ON BEHALF OF THE OFFICE OF SUSTAINABILITY:

8

9 CHRISTINE KNAPP

Director

10

11 PRESENT ON BEHALF OF AMERICAN CITIES CLIMATE
12 CHALLENGE:

13

14 ARIELLA MARONE

15

PRESENT ON BEHALF OF E3:

16

DANIEL AAS

17

AMBER MAHONE

18

NIKI LINTMEIJER

ANTHONY FRATTO

19

PRESENT ON BEHALF OF PORTFOLIO ASSOCIATES:

20

BEVERLY HARPER

21

22

23

24

1 CHAIRMAN GREEN: Good morning,
2 everyone. This is a town hall meeting being
3 held by the Philadelphia Gas Commission
4 regarding PGW's Diversification Study.

5 I will let you know that this meeting
6 is being recorded and, by you being on this
7 call, you consent to being recorded for the
8 purposes of this conversation.

9 Also, due to the current public
10 health emergency, we at the Gas Commission
11 are having this town hall meeting remotely
12 and we are using Zoom to make this remote
13 town hall meeting possible and instructions
14 for how the public can participate in this
15 town hall meeting were included in the
16 information provided prior to this meeting.

17 For the purpose of this conversation,
18 we will have representatives from E3 and
19 Portfolio Associates to do an overview of
20 their work to date regarding the PGW
21 Diversification Study.

22 Also, we are joined today by members
23 of the Gas Commission as well as Christine
24 Knapp from the Office of Sustainability and

1 the American Cities Climate Challenge which
2 made this study possible.

3 For those who are testifying, you
4 received a list of all those who are
5 testifying. You will testify in that order.
6 We're asking individuals to keep their
7 remarks to two minutes because we have a
8 long number of people who are here to
9 testify. And before you testify, please
10 state your name for the record before the
11 testimony.

12 In addition, I will let you know that
13 for those who would like to submit written
14 testimony, you have the ability to do so up
15 until May 28th at 5:00 p.m. That written
16 testimony can be sent to
17 sustainability@phila.gov.

18 I'll ask Ms. McClendon if she can put
19 that information into the chat feature.

20 But you will have until May 28th to
21 be able to submit that information in
22 writing to be a part of this town hall
23 conversation.

24 With that, I'm now going to also

1 state that any issues beyond the scope of
2 the Diversification Study, that is beyond
3 the scope of this conversation. Those
4 comments should be provided to PGW directly.
5 So we want to make sure that we are keeping
6 the focus of this town hall on the PGW
7 Diversification Study.

8 With that, I will turn over the
9 presentation to representatives from E3 and
10 Portfolio Associates to provide a quick
11 overview of the work they have provided up
12 to this point and then we'll go into the
13 actual conversation and town hall with those
14 who are scheduled to testify this morning.

15 EXEC. DIR. McCLENDON: One thing
16 before we begin, again, as a reminder: If
17 it is not your turn to speak, please make
18 sure that your device is on mute at this
19 point. Again, if it is not your turn to
20 speak, we need you to be on mute until it is
21 your turn.

22 Then give me one moment.

23 Okay. Dan, you should be ready to
24 go.

1 MR. AAS: Great. Thank you. It
2 looks like I have the ability to share.

3 Can someone please confirm that my
4 screen is displaying?

5 MS. KNAPP: It looks like it.

6 MR. AAS: All right, Christine. I'll
7 hand it over to you.

8 MS. KNAPP: Thanks.

9 Good morning. I'm Christine Knapp,
10 the Director of the Office of
11 Sustainability, here to give you a little
12 bit of context about how we decided to
13 undertake this Business Diversification
14 Study for PGW.

15 Hopefully most of us know already
16 that climate change is already having an
17 impact on Philadelphia and is projected to
18 continue to have worsening impacts, both in
19 terms of heat and in terms of more frequent
20 and more severe storms, combined with
21 sea-level rise, resulting in the types of
22 flooding that is shown in the picture on the
23 right, which was in Eastwick this past
24 August during Tropical Storm Isaias.

1 Next slide, please.

2 So in order to stave off the worst
3 impacts of climate change, Mayor Kenney and
4 the City have committed to achieve carbon
5 neutrality by 2050. This is an increase
6 over the Mayor's previous goal of reducing
7 emissions 80% by 2050 and that is because
8 this is what science is telling us is
9 necessary to do in order to stave off the
10 severe impacts of climate change.

11 Fortunately, it is also the goal of
12 our Federal Government and the Biden-Harris
13 Administration, also moving in the direction
14 of what science is indicating to us is
15 necessary.

16 You can see there's other sort of
17 goals along the way of how we achieve carbon
18 neutrality. We have a lot of work to do.
19 And if you haven't looked at the Climate
20 Action Playbook in detail, I encourage you
21 to do so.

22 Next slide, please.

23 So in thinking about how we achieve
24 carbon neutrality, we have to look at what

1 the sources of emissions are in
2 Philadelphia, and buildings and industry are
3 our largest source at 72%.

4 And when we look at how buildings are
5 contributing, a big part of that is the way
6 that buildings are heated, which is often by
7 PGW through the use of natural gas, which is
8 a fossil fuel.

9 And so while PGW provides a critical
10 service, it is also contributing to this
11 issue of our not reaching our climate goals.

12 And so the City as the owner of PGW
13 is really intrigued in exploring the
14 question of how can PGW continue to thrive
15 in the future, retain its workforce, and be
16 economically viable, but while also helping
17 us achieve our carbon neutrality goal.

18 Next slide.

19 So the Bloomberg American Cities
20 Climate Challenge became an opportunity for
21 the City to apply for some technical
22 assistance and support to achieve carbon
23 emissions reduction in buildings and
24 transportation, the focus of the climate

1 challenge, and so we applied with PGW for a
2 variety of different activities, but
3 including the Business Diversification
4 Study.

5 The goal is really beginning to do
6 what is bulleted here:

7 A, reviewing the range of different
8 business pathways. We want to look at both
9 new energy sources that PGW could use to
10 deliver those services, but also new energy
11 services that they could take on to expand
12 their business portfolio and, again, have
13 some new sources of revenue.

14 We want to look at all of these
15 different pathways against different
16 criteria to understand what each option
17 would do for the carbon reduction or job
18 creation or the affordability of rates.

19 We want to look at the regulatory and
20 legal barriers that we know would circumvent
21 or create some challenges for PGW to take on
22 these options.

23 We want to incorporate comments from
24 public engagement, including today's session

1 and prior opportunities that we've had.

2 Developing a diversification tool,
3 which would be an ongoing tool that we could
4 use to keep looking at different business
5 practices to see how they would evaluate
6 those criteria beyond the deliverable study
7 that E3 will be delivering to us.

8 And then actually propose a set of
9 strategies and goals.

10 And, lastly, PGW has committed to
11 taking on a pilot project upon assessing
12 what was identified in the study as looking
13 promising to test out in the short term.

14 So this is what we have laid out here
15 for the goals of this study.

16 My last slide -- next, please -- is
17 focused of who has been guiding this work.
18 This is the working group of folks
19 representing the City; PGW itself; and then
20 the two regulatory bodies that oversee PGW,
21 the Gas Commission and the Public Facilities
22 Management Corporation; as well as the
23 energy authority; and Local 686, the union
24 that represents PGW workers.

1 So this group has helped us to
2 actually write the scope of the study and
3 has been meeting with the consulting team to
4 provide guidance and ask questions and give
5 input along the way.

6 With that, I'll turn it back to Dan
7 Aas from E3, who is our consultant team, to
8 walk you through the direct materials to
9 start us up and then we'll switch over for
10 public comment.

11 MR. AAS: Great. Thank you,
12 Christine.

13 And good morning, everyone. My name
14 is Dan Aas. I'm a director at E3 and E3 is
15 an energy consulting firm with offices in
16 Boston, New York, and San Francisco.

17 Our focus is really on the energy
18 transition, what does the world look like as
19 we shift from the current fossil fuel-based
20 energy paradigm to one that is consistent
21 with deep decarbonization and stabilization
22 of the earth's climate.

23 We're joined on the project today by
24 two partner firms: Portfolio Associates and

1 Econsult Solutions, both of which are
2 Philadelphia-based firms who have been
3 helping us with various aspects of the
4 project, including engagement and
5 understanding the economic impacts of the
6 diversification options on Philadelphia.

7 So the agenda for today is a brief
8 walkthrough of the study so far. I'll note
9 that there is a more detailed set of
10 materials available on the Office of
11 Sustainability's website. So given the
12 length of the presentation, this is
13 necessarily an abridged version, so I
14 encourage you to go look at those materials.

15 But, in short, what we'll be going
16 through today are decarbonization options
17 for PGW, the scope of this study in light of
18 those decarbonization options, preliminary
19 study findings, and next steps.

20 So I'll start by noting that there
21 are several different strategies that PGW
22 might explore to decarbonize the building
23 heating challenge that Christine mentioned
24 in her intro.

1 What we found across studies across
2 North America and elsewhere in the world is
3 that energy efficiency, including measures
4 like more efficient appliances or
5 weatherization, is a decarbonization
6 strategy that is required in any scenario
7 that achieves net zero.

8 And Philadelphians have been pursuing
9 energy efficiency for decades, as has PGW
10 via its programs. So this will likely be
11 something that will need to be expanded but
12 represents a continuation of what
13 Philadelphia has been doing.

14 But once we've done energy
15 efficiency, what we need to start thinking
16 about is how do we decarbonize the actual
17 supply of heating energy going into
18 buildings.

19 So as Christine mentioned, today that
20 supply is from natural gas, which is a
21 fossil fuel that produces greenhouse gas
22 emissions via combustion and via methane
23 leaks, and what we want to think about is
24 how we can replace that natural gas.

1 One option is to consider
2 decarbonized gases, meaning fuels that are
3 delivered via pipeline, much like natural
4 gas, but produce low or no GHG emissions.

5 The advantage of these fuels is that
6 they repurpose existing infrastructure and
7 thereby minimize customer disruption. So
8 essentially customers can continue to use
9 the same appliances in most cases in their
10 homes and it's delivered via the same
11 infrastructure as today.

12 But a key drawback of these fuels is
13 that they come at a substantial cost premium
14 over natural gas, costing many times more
15 than the cost of Marcellus shale gas that
16 currently is delivered today.

17 Electrification is a very different
18 decarbonization pathway. It involves
19 converting from appliances like furnaces to
20 electric heat pumps.

21 Electric heat pumps are a technology
22 that are in principle similar to an air
23 conditioner, but can both heat and cool a
24 home.

1 The advantage of this approach is
2 that heat pumps can use an increasingly
3 clean electric grid to efficiently heat
4 buildings. A drawback of this approach is
5 that it can lead to large impacts on
6 electricity systems during very cold hours,
7 especially if it's not accompanied by more
8 comprehensive weatherization measures.

9 Hybrid electrification refers to a
10 strategy that uses heat pumps, but backs
11 those heat pumps up with a gas furnace or
12 boiler for those really cold periods of the
13 year.

14 So we're essentially trying to take
15 advantage of the advantages of
16 electrification, meaning the ability to
17 provide efficient decarbonized heat for most
18 of the year, while avoiding some of the
19 drawbacks in the form of the great impacts.

20 So this is a scenario where
21 essentially you're using the heat pumps in a
22 gas furnace for backup, and one more
23 potential advantage of this solution from at
24 least a PGW workforce perspective is that it

1 provides an ongoing role for PGW's
2 infrastructure while still accommodating
3 electrification in the City.

4 And then there's a fourth option that
5 we considered in this analysis, which is
6 being explored in Massachusetts today,
7 called a geo microdistrict, which is a
8 shared ground source heat pump or geothermal
9 system that delivers heat via a network of
10 hot water pipes.

11 And what's interesting about this
12 option is that it is a form of
13 electrification, but the infrastructure to
14 deliver heat to the homes is very similar to
15 the system infrastructure that's used today
16 by PGW. Essentially it is pipes running
17 through trenches in streets. But instead of
18 delivering natural gas, it's delivering hot
19 water as a source for electricity.

20 So it offers an interesting form of
21 electrification that might bridge some of
22 the challenges of the electrification
23 scenario while still maintaining
24 infrastructure that can be served by PGW as

1 it's put forth.

2 So in each of these scenarios PGW is
3 going to face challenges that are sort of
4 cost-cutting and warrant consideration as we
5 evaluate diversification and
6 decarbonization.

7 So any successful diversification
8 strategy will need to address challenges
9 that include aging gas infrastructure. So
10 like many utilities, PGW is in the midst of
11 a long-term investment program to update its
12 system by removing cast iron pipes; and at
13 the same time ongoing investments are needed
14 in its system to ensure safety and
15 reliability, which I think we can all agree
16 cannot be allowed to degrade in any
17 decarbonization future.

18 There are also uncertain needs in gas
19 demands, meaning historical trends may no
20 longer be the best predictor of future gas
21 demands in Philadelphia.

22 So in addition to the impacts of
23 electrification, you know, if customers are
24 to choose an electric option, that would

1 lead to decreased demand. A warming climate
2 is also expected to decrease demand in the
3 City over the coming decades. And so
4 diversification strategies should be robust
5 against future uncertainties in gas demand.

6 There's also a very important
7 question of providing and retaining jobs.
8 So PGW employs well over 1,000 employees,
9 many of which are union jobs today, and any
10 transition to how energy is delivered to
11 Philadelphia's buildings requires careful
12 consideration of impacts on that labor
13 force.

14 And, finally, in terms of health,
15 safety, and equity challenges, Philadelphia
16 has a substantial low-income population for
17 whom paying their energy bills today is
18 already a burden and environmental justice
19 communities within the City are more likely
20 to be affected by the negative air quality
21 impacts of combustion of fossil fuels within
22 Philadelphia.

23 So this means that the City's energy
24 transformation carries meaningful equity

1 considerations, including equity in terms of
2 the sort of pocketbook bills that folks are
3 paying, as well as things like health and
4 safety that are more difficult to quantify
5 as pocketbook issues but are very, very
6 real.

7 So the scope of this analysis --
8 pardon me -- given the City's
9 decarbonization commitments and those
10 challenges I just outlined, E3 and our
11 partners have been tasked to develop an
12 assessment of diversification options for
13 PGW.

14 This includes an analysis phase,
15 which we're close to wrapping up now, where
16 we are working to identify things like
17 emissions, PGW's financial and customer
18 affordability implications, all these
19 different options.

20 It will culminate in a
21 diversification study that summarizes the
22 results of our quantitative analysis. So
23 we'll be describing what these different
24 energy futures look like and what different

1 diversification options look like under
2 them. And we will also be recommending a
3 sort of pilot program so it might offer a
4 near-term path forward for PGW to begin to
5 move towards decarbonization and
6 diversification.

7 So in developing the study, our team
8 has engaged in a variety of different forms
9 of stakeholders engagement, including a
10 workshop that included over 43 participants;
11 and this included the broader representation
12 from the environmental community, the
13 business community, social and equity
14 interest groups, and a wide variety of other
15 folks that had a perspective on PGW and
16 diversification options.

17 We followed that up with an online
18 survey that went to a broad group of folks
19 within Philadelphia that allowed folks to
20 provide both strong system multiple-choice
21 questions as well as more open-ended
22 responses. So as part of our study we will
23 be summarizing the feedback that we received
24 over the course of those two engagements.

1 And then the City also engaged, in
2 partnership with the Philadelphia
3 Association of Community Development
4 Corporations, in energy burden
5 conversations, which were smaller,
6 more-focused discussions in order to draw
7 out what are the key challenges facing
8 communities across Philadelphia today with
9 respect to their energy consumption and
10 costs.

11 I'll note that in addition to these,
12 today represents an important engagement
13 opportunity, where we will be looking to
14 share the initial work we've done on this
15 study and really looking forward to hearing
16 your feedback on work so far and
17 incorporating that into the final result.

18 Over the course of the engagement so
19 far, we have identified four key criteria
20 that sort of bubble to the top across all of
21 our different stakeholder engagements.

22 These include greenhouse gas
23 emissions: So do the different
24 diversification options and decarbonization

1 scenarios achieve GHG reductions that are
2 consistent with the City's policy on climate
3 emissions?

4 Impact on air quality: Do these
5 decarbonization and diversification
6 scenarios improve outdoor and indoor air
7 quality consistent with the City ambitions
8 and stakeholder interests and preferences?

9 Impact on rate affordability: Do
10 these scenarios decrease or stabilize bills
11 or reduce the energy burden facing
12 Philadelphians?

13 And, finally, impact on revenues and
14 workforce: Do these options maintain a
15 financially sound utility that can continue
16 to maintain safety and reliability and
17 sustain union jobs in Philadelphia?

18 So I'll note that we evaluate each of
19 these criteria using different metrics, some
20 of which are quantitative in nature, while
21 others are more of a qualitative assessment.

22 So I'm going to walk through a
23 high-level summary of the results so far,
24 and what we'll be looking at here are how

1 four different broad energy directions
2 compare against the four evaluation
3 criteria.

4 So this is by no means a
5 comprehensive list of the ways that PGW may
6 diversify or a comprehensive list of the
7 energy directions it might take, but I think
8 it offers a nice representative
9 cross-section of the different options.

10 So these scenarios include:

11 A decarbonized gas scenario, where
12 PGW's base remains similar to today, but
13 where their needs are served by fuels like
14 RNG and hydrogen.

15 An electrification scenario, where by
16 2050 most buildings in Philadelphia are
17 heated by electric heat pumps.

18 A hybrid electrification scenario
19 that also electrifies most buildings, but
20 those probably using systems with gas
21 backup.

22 And, finally, we have a hybrid
23 electrification with geo microdistricts
24 case, where instead of replacing cast iron

1 mains, as is sort of planned today, with
2 part ethylene or other sorts of conventional
3 pipefitting, PGW instead begins to convert
4 segments of its system in neighborhoods they
5 serve to shared ground source heat pump
6 systems that I described earlier in the
7 presentation.

8 So it's important to note that each
9 scenario has some both positive and negative
10 impacts, but at least on the dimension of
11 greenhouse gas emissions, each of the
12 scenarios has a positive impact.

13 So by construction we designed
14 scenarios that reduced GHG emissions to
15 levels consistent with a net-zero goal by
16 2050. That's a shared sort of constraint
17 applied across all of the scenarios, and the
18 question is how do they compare against the
19 rest of the criteria having accomplished
20 that goal.

21 So the first factor I'll discuss is
22 impact on air quality, which is one of our
23 factors that we addressed from a qualitative
24 perspective. But what I'll note is that

1 each of the electrification scenarios
2 substantially reduces combustion of natural
3 gas in Philadelphia. So we're essentially
4 moving the energy supply to a heat pump,
5 which involves no combustion; reducing the
6 amounts of things like Nox and PM 2.5 that
7 would be emitted within the City.

8 The decarbonized gas scenario has no
9 significant change in air equality.

10 Essentially you are continuing to combust
11 gases that produce similar air pollution as
12 current natural gas does, but you are not
13 essentially making the problem any worse in
14 that scenario.

15 The story gets a little more mixed
16 when we start thinking about impacts on
17 affordability, and I'll go through each of
18 those scenarios in turn.

19 At scale decarbonized gas, looking at
20 the first road, has clear affordability
21 challenges. So securing enough gas to
22 decarbonize PGW's system would require large
23 amounts of technologies, including a
24 technology called synthetic natural gas, and

1 these fuels are not yet commercialized
2 today. When they are commercialized at
3 scale, they are expected to cost
4 approximately five to ten times the current
5 commodity price of natural gas.

6 So you can imagine, customers who are
7 already constrained today by current natural
8 gas prices, if you were to increase those by
9 five to ten times the commodity portion of
10 the bills, you would start seeing some, you
11 know, challenging bills for those customers.

12 Electrification, I'll note again,
13 offers opportunities and challenges from an
14 affordability perspective. On the one hand,
15 customers may be eligible to experience fuel
16 savings when adopting electric heat pumps
17 today. However, those heat pumps come at a
18 cost premium over conventional gas
19 appliances.

20 More challenging in that scenario is
21 the distinction in costs between
22 participants and nonparticipants. So absent
23 mitigating measures, costs for
24 nonparticipants, meaning those who are not

1 electrifying, will rise as the costs of the
2 PGW gas system are spread over a shrinking
3 customer base.

4 And so given the higher up-front
5 costs of electrification, this raises the
6 concern that those who are less well-off may
7 be less likely to be among the folks who are
8 likely to electrify.

9 So you can imagine this sort of
10 bifurcated world where a group of customers
11 have moved over to relatively low-cost heat
12 pumps for their bills at least and other
13 customers are left paying very high gas
14 bills, and that's the situation that I think
15 the diversification options in the further
16 phases of this study are meant to consider
17 to address.

18 Hybrid electrification has the lowest
19 relative impact on participants and
20 nonparticipants of those who electrify and
21 those who don't and the reason for this is
22 that the cost of the gas system is still
23 being shared among a relatively large group
24 of customers.

1 So the exact split of those costs
2 depend upon policy, regulation, and rate
3 design. But in general the intuition is
4 that there's a sense that the costs are
5 being shared over a broader set of customers
6 which leads to sort of a more equal set of
7 cost impacts.

8 And then, finally, the affordability
9 of geo microdistricts depends to a large
10 extent on how they're cost-allocated with
11 the key question of being whether the full
12 cost of the infrastructure is borne by the
13 consumers who receive services from the geo
14 microdistrict or whether those costs are
15 spread across the entire PGW customer base.

16 So it's really a question of to what
17 extent are those costs spread or to what
18 extent are they concentrated, which will
19 really affect the economics of them from
20 both the participant view, those who
21 electrify, and the nonparticipant view.

22 And our final criteria is impacts on
23 revenues and work force, and I'll note that
24 we directly modeled impact on revenues in

1 this analysis. We did not directly model
2 impacts on workforce. So those are
3 qualitatively assessed.

4 The decarbonized gas scenario could
5 lead to a future with stable revenues and
6 workforce if PGW decarbonizes, the reason
7 being that we are using the same system to
8 deliver gas which requires continued
9 maintenance and investment in that system.

10 However, in order for that outcome to
11 be realized, these fuels would have to be
12 cost-competitive with alternative
13 decarbonization strategies. Otherwise,
14 customers will face a powerful incentive to
15 electrify, putting the same pressures on the
16 economics of the utility that we discussed
17 on the previous slide.

18 So if you were to go with the
19 strategy and decarbonized gases turned out
20 to be more expensive than anticipated, you
21 might end up in a world where you're pushing
22 folks towards electrification, which will
23 lead you to a world in which you are seeing
24 declined utilization and the same sorts of

1 issues I mentioned before.

2 The high electrification scenario can
3 lead to a large reduction in revenues to
4 PGW. I think it's important to acknowledge
5 that, with both volumes of gas and number of
6 customers falling sharply over the coming
7 decades.

8 This will create a tension between
9 maintaining affordable rates and continuing
10 to make the safety and reliability-related
11 gas investments required for any gas
12 utility.

13 So, again, we didn't model the
14 impacts on PGW's workforce here, but we
15 believe they warrant further investigation.

16 I'll note that the transition to
17 electrification will take several decades
18 and along that transition the gas system
19 will need to be maintained in order to
20 ensure safety and reliability, so it's very
21 much an open question of, even under a high
22 electrification scenario, what the pace of
23 impacts on workforce would be.

24 Turning to the hybrid scenario, the

1 key difference here, as I noted before, is
2 the infrastructure that PGW continues to use
3 to deliver heat in Philadelphia,
4 particularly on those very cold, extreme
5 winter days.

6 This would mean that the footprint of
7 the system as set up today or near it would
8 be needed to be maintained. But in order
9 for those to be achieved, you would have to
10 believe that there is a relatively small
11 amount of cost-competitive decarbonized gas
12 available and that you're able to price the
13 system and earn revenues for PGW's system in
14 a way that reflects the value it's creating;
15 for instance, the value it's creating by
16 avoiding electric system infrastructure
17 upgrades.

18 And then, finally, from a revenue
19 perspective, the geo microdistricts would
20 spurn new investments in PGW's system that
21 go beyond those in its current cast iron
22 main replacement program or current revenue
23 forecasts.

24 And so it's likely that PGW would

1 need additional workers to install those
2 systems, potentially leading to an overall
3 increase in the workforce at PGW, with the
4 challenge here being whether these systems
5 can be installed in a way that is
6 affordable, in a way that is competitive
7 with other options.

8 And I'll note that sort of the costs
9 of the geo microdistricts are uncertain to a
10 large extent because their feasibility and
11 costs will depend to a large extent on a lot
12 of sort of local circumstances, things like
13 geology, the density of the buildings, and
14 the heating demands, and so that's something
15 that we think warrants additional study as
16 well.

17 So, in sum, I'll note that each of
18 the decarbonization scenarios includes
19 positives and negatives across the criteria
20 we evaluated with the exception of the
21 criteria that we constrained them all to
22 meet, and so it doesn't appear that there is
23 a single silver-bullet solution that
24 balances all of these criteria, you know,

1 just looking at it from an energy directions
2 perspective. So this raises the need for
3 creative thinking on the future of PGW,
4 including diversification and new business
5 models.

6 So right now the project team is
7 working on evaluating different
8 diversification options/different business
9 models for PGW and what we're trying to do
10 is think about different models that map to
11 the decarbonized energy directions that I
12 presented before: So what would a world
13 look like for PGW in the electrification
14 scenario? What would it look like for them
15 in the hybrid scenario? What would be their
16 role?

17 And so we're considering multiple
18 different options, including options that
19 are more similar to their current business
20 models, so those would be things like
21 procuring gas in the form of RNG; installing
22 pipes to deliver shared geothermal heat pump
23 energy to buildings; weatherization, which
24 is something PGW has already done; as well

1 as additional revenues that might be earned
2 from things like LNG or CNG supply.

3 But we're also exploring a set of
4 solutions that are a bit further afield from
5 what PGW currently does. A lot of these
6 trend more toward services rather than
7 infrastructure.

8 So, for instance, strategic
9 electrification or heat as a service are
10 scenarios where PGW might have a role in
11 financing the cost of a heat pump or a
12 hybrid heat pump installation in a home.

13 The load aggregator scenario is a
14 world in which PGW has a role in using a
15 system to manage the winter peak-time demand
16 through electrification.

17 And then there are other options that
18 we are looking at that are a bit more
19 transformational, a bit further afield from
20 the core business that PGW provides today,
21 and those would be things like microgrids or
22 community solar.

23 So, to conclude, I'm going to go
24 through a brief overview of the preliminary

1 findings from this analysis and discuss next
2 steps.

3 So the first preliminary finding is
4 that decarbonizing PGW is a priority to
5 achieve the City's climate goals but will
6 require innovation and likely new sources of
7 revenues to address energy affordability
8 challenges in Philadelphia.

9 Exclusive reliance on decarbonized
10 gas is risky and probably poses
11 unsustainable bill impacts to all PGW
12 customers in the long run, and does not
13 necessarily address other City and
14 stakeholder priorities; for instance,
15 improving air quality.

16 Exclusive reliance on electrification
17 can reduce energy bills for households that
18 electrify, but increases bills for customers
19 remaining on the gas system, posing equity
20 challenges unless mitigated.

21 Hybrid electrification options may
22 present a feasible decarbonization path that
23 balances impacts on customers who electrify
24 and customers who do not, those participant

1 and nonparticipant questions; but it comes
2 with its own questions about being able to
3 procure enough decarbonized gas and the sort
4 of carrying costs of the PGW system over
5 time.

6 And then geothermal microdistricts
7 will present a promising option for some
8 customer types, but the costs and
9 feasibility in Philadelphia are uncertain,
10 so more data are needed on the real-world
11 costs of these systems and the suitability
12 given Philadelphia's geology, housing
13 density, and infrastructure.

14 So what are our next steps?

15 Our next steps include research on
16 potential diversification options, as I just
17 outlined, for PGW and mapping those
18 diversification options to the different net
19 carbon-neutral energy directions PGW might
20 take.

21 Alongside that, there's research
22 being done on the legal and regulatory
23 feasibility of these new business models.

24 So PGW exists under a current legal

1 and regulatory model and not all of the
2 options we outlined above are currently
3 permitted under that model. There will be
4 an assessment of that.

5 We will be incorporating stakeholder
6 feedback, both feedback we received so far
7 and feedback from this town hall.

8 And then identifying and evaluating
9 potential pilot project opportunities that
10 can take these more long-term visions and
11 turn them into near-term opportunities.

12 And all of this will be summarized in
13 a final report that will be wrapping up by
14 the end of June.

15 So with that, I thank you again for
16 your time today, and we're looking forward
17 to hearing your feedback and input on the
18 study so far.

19 CHAIRMAN GREEN: Thank you, Dan, for
20 that presentation. I want to thank you all
21 for the work that's being done by E3,
22 Portfolio Associates, and Econsult putting
23 together next steps.

24 For the next step in today's town

1 hall, I will have Gemela McClendon, Esquire,
2 who is our Executive Director of the Gas
3 Commission, and other Staff from the Gas
4 Commission, now begin with those who have
5 signed up to testify to provide public
6 comments.

7 EXEC. DIR. McCLENDON: Thank you,
8 Councilman Green.

9 Before we get started, just a
10 reminder: At this moment right now we are
11 only taking comments from those who have
12 already signed up. We will be going
13 straight down the list that was provided to
14 us from the Office of Sustainability, who
15 managed the signup process.

16 Everyone will be allotted two minutes
17 to speak. We will call 30 seconds when
18 there's about 30 seconds left in your
19 allotted time. And once the two minutes has
20 lapsed, we will have to mute you because
21 there are a lot of people on the call who
22 wish to speak today.

23 As a reminder -- and I have already
24 put this information in the chat -- if you

1 have additional comments that need to be
2 made, if you have any sort of written
3 materials, including slides and things of
4 that nature, all of that information can be
5 submitted to the Office of Sustainability at
6 sustainability@phila.gov up until May 28th.

7 That will be your opportunity to make
8 sure that everything that you want to say
9 and get before the Office for consideration
10 in finalizing the report is received by them
11 at that time.

12 The final thing is, as Councilman
13 Green mentioned at the beginning of this
14 meeting, this is being recorded. We also
15 have a court reporter who is taking a full
16 transcript of the meeting, which will be
17 posted on the Gas Commission's website once
18 fully prepared and also, Christine, I
19 believe on Sustainability's website.

20 So please be mindful when you are
21 speaking to say your name -- we are going to
22 call your name, but please, once again,
23 state your name -- and speak clearly and not
24 too fast so that she can record everything

1 that you're saying without interrupting your
2 time.

3 You know, it is a limited amount of
4 time and we want to make sure that you are
5 able to use all of it with as few
6 interruptions as possible.

7 So, again, state your name for the
8 record; and also please make sure that you
9 are speaking clearly and not at too fast of
10 a pace so that she can capture everything
11 that you are saying.

12 With that, I am turning it over to
13 Heidi Wushinske, Hearing Examiner for the
14 Gas Commission.

15 HEARING EXAMINER WUSHINSKE: Okay.
16 First on the list of speakers we have Tammy
17 Murphy from Physicians for Social
18 Responsibility.

19 So, Tammy, I guess I will mute myself
20 when you're ready to speak and then start
21 your time then.

22 MS. MURPHY: Okay. My name is Tammy
23 Murphy. I just put part of my comments in
24 the chat. I wasn't sure if I was going to

1 be able to share my screen or share links,
2 so I put some of those in the chat.

3 To be honest with you, I'm a little
4 bit disappointed that the final report and
5 that the final plan seems to be set for June
6 and it's May and we're now having the town
7 hall. So a lot of what I have to say
8 basically seems like it's a little bit too
9 late to take into consideration.

10 But the first thing that I would
11 like, for anybody who is considering
12 continuing the use of unconventional gas
13 development industry in the future plans for
14 PGW, including toxic, expensive options such
15 as LNG, CNG, and RNG, the first thing that I
16 would have you consider -- and I'm happy to
17 come in person and explain this to you more
18 carefully, this is in the chat also -- this
19 is the PSR Compendium on the harms and the
20 health impacts of fracking.

21 There are about 1,700 different
22 studies that you can look at that talk about
23 the harms and health impacts of the industry
24 and what that does overall in Pennsylvania

1 and also throughout the country and
2 throughout the world.

3 More specifically to take into
4 consideration is the Environmental Health
5 News link that I did put into the chat.

6 HEARING EXAMINER WUSHINSKE: About 30
7 seconds.

8 MS. MURPHY: Wow. Okay. So that
9 talks specifically about the health impacts.

10 It should be taken into consideration
11 that there are cancers and other health
12 harms happening throughout the State that
13 other countries and other States have
14 considered human rights violations and that
15 our end-use product in Philadelphia should
16 consider the fact that other people are
17 harmed throughout the State.

18 There's 67 cases of rare cancer in
19 one small area in Southwest Pennsylvania, 13
20 children have already died, and that is
21 replicated throughout the State. There are
22 other scenarios similar throughout the
23 State. So those kinds of things need to be
24 taken into consideration.

1 I also think that you need to --

2 HEARING EXAMINER WUSHINSKE: Thank
3 you. That's your two minutes. Thank you.

4 MS. MURPHY: All right.

5 HEARING EXAMINER WUSHINSKE: Okay.

6 Next we have John DiEnna.

7 - - -

8 (No response.)

9 - - -

10 HEARING EXAMINER WUSHINSKE: Excuse
11 me if I said your name wrong. John, are you
12 here?

13 Jack? John also goes by Jack.

14 - - -

15 (No response.)

16 - - -

17 HEARING EXAMINER WUSHINSKE: Okay.

18 Let's move on to Peter Winslow.

19 MR. WINSLOW: Thank you, Heidi. My
20 name is Peter Winslow. I'm speaking today
21 as president of A SMART Collaboration, LLC.

22 Thank you, Chairman Green, and
23 members of the Gas Commission, for this
24 opportunity to participate in the public

1 discussion of PGW's Diversification Study.
2 I appreciate the opportunity and thank the
3 folks that brought this together, including
4 Bloomberg and others who provided the
5 funding.

6 I would like to comment that the
7 infographic format of the draft materials
8 helps to make the broad overview and major
9 points clear to a wide audience, so I
10 applaud the accessibility this format
11 provides for the general public.

12 However, in the absence of the more
13 detailed narrative, an explanation of
14 methodology, a sharing of analysis, and a
15 collegial discussion, interested parties,
16 essentially the people on this call, cannot
17 obtain the full benefit of the work that has
18 been performed by E3.

19 So I hope such explanatory
20 information will be forthcoming and shared
21 in the near future. As Tammy points out,
22 the time for concluding this work is short,
23 so I would hope that that information would
24 be coming to us fairly soon.

1 By the standards of the City's usual
2 practices, the public involvement provided
3 by the Diversification Study has really been
4 exemplary. Unfortunately, the usual
5 practices of the City set a really low bar.
6 Moreover, while the outreach has been
7 broader than usual, it has not been deep
8 enough.

9 So we're gratified that the study
10 confirms much of what the environmental
11 justice community has been saying for quite
12 some time and that this work has added more
13 rigor to the discussion and has been
14 comprehensive in its approach.

15 HEARING EXAMINER WUSHINSKE:

16 Mr. Winslow, about 30 seconds left.

17 MR. WINSLOW: Okay.

18 So let me say the next steps call for
19 a pilot project. Let's be bold. I suggest
20 we seize the opportunity provided by
21 redevelopment of the former refinery by
22 Hilco Redevelopment Partners adjacent to the
23 PGW Passyunk facilities. Within the
24 1,300-acre property and the surrounding

1 neighborhoods, extensive geothermal and
2 photovoltaic resources can be developed to
3 serve both industry and residences in a
4 community network. And as opposed to a
5 small pilot project, let's have a pilot
6 project that has significant impact on the
7 problem.

8 Thank you very much.

9 HEARING EXAMINER WUSHINSKE: Okay.
10 That's your time and thank you for your
11 testimony.

12 EXEC. DIR. McCLENDON: Heidi, one
13 second before you go on.

14 I just want to remind everybody
15 again, we know it's a limited amount of
16 time. We want to be able to get to everyone
17 who wants to speak.

18 So please, please, please try to
19 focus your comments within the time frame,
20 get out your most important points. You do
21 have the opportunity to submit additional
22 comments on additional areas after this
23 meeting.

24 Thank you, Heidi.

1 HEARING EXAMINER WUSHINSKE: Thank
2 you.

3 On our list of testimony next we have
4 Christina Coleman.

5 MS. COLEMAN: Thanks, Heidi.

6 My name is Christina Coleman. I am
7 speaking today on behalf of the Chamber of
8 Commerce of Philadelphia.

9 Our organization shares the same
10 priorities as many, that PGW's system must
11 safeguard ratepayers, maintain reliability,
12 retain workforce, and ensure the health and
13 safety of our residents. However, the
14 recommended strategies in the study fail to
15 feasibly meet those goals.

16 It is well-known that the resulting
17 increase in electricity demands and the
18 displacement of natural gas can actually
19 lead to increasing emissions from the power
20 generation sector. The study only accounts
21 for site energy, which does not include the
22 losses incurred in the production,
23 transmission, or delivery of energy.

24 The natural gas we all use in a year

1 in our homes to cook is more than 91%
2 efficient compared to what shifting produced
3 by natural gas, which is only 45% efficient.

4 To understand the net gains of
5 electrification scenarios is essential to
6 consider the generation mix. Currently
7 natural gas generation makes up 43% of PJM's
8 grid mix.

9 The Diversification Study anticipates
10 that over time emission benefits of
11 electrification will increase as PJM's
12 system decarbonizes. If all generation
13 resources were zero emitting, displacing
14 direct use natural gas and electricity would
15 result in net emission benefits.

16 But this does not reflect the current
17 reality or the realistic expectation of the
18 current mix for the foreseeable future.

19 We know that residential natural gas
20 only accounts for 4% of the U.S. emissions.
21 Even assuming 100% clean energy grid mix,
22 the emission reductions are marginal.

23 Put simply, the strategies outlined
24 in the study demonstrate a

1 least-cost-effective method for reducing
2 emissions. The study also does not provide
3 a full assessment of the costs. The costs
4 of both the electrification and hybrid
5 scenarios do not account for capital costs
6 and distribution system upgrades required to
7 meet the growth in electricity demand.
8 Natural gas is the lowest-cost energy today.

9 HEARING EXAMINER WUSHINSKE: 30
10 seconds.

11 MS. COLEMAN: Thank you.

12 2021 forecasts show that on an energy
13 equivalent basis electricity will cost 39
14 per million Btu while natural gas costs
15 about 11 dollars.

16 We urge the Commission to request a
17 more transparent evaluation of the total
18 costs associated with these strategies. As
19 we collectively work towards a recovery for
20 the City, we need to seek decision-making
21 that balances the economic and environmental
22 costs.

23 We hope these concerns will be
24 addressed in the next steps. Thank you.

1 HEARING EXAMINER WUSHINSKE: Thank
2 you.

3 Next we have Mitch Chanin.

4 MR. CHANIN: Great. If you can give
5 me just one second to pull up my comments.

6 HEARING EXAMINER WUSHINSKE: Sure.

7 MR. CHANIN: Okay. I'm switching
8 screens.

9 Okay. My name is Mitch Chanin. I'm
10 a member of POWER and Philly Thrive as well
11 as other local organizations and I have
12 lived in Northeast Philly for most of my
13 life.

14 The crises that we face here in
15 Philly are interconnected. The urgent
16 stress of climate catastrophe, deep poverty,
17 unaffordable energy bills, home disrepair,
18 and widespread asthma are all related and to
19 solve them we need to transform PGW and our
20 wider energy system as well as our
21 buildings.

22 The draft materials for the
23 Diversification Study are a good, though
24 very limited, first step towards figuring

1 out how to do that.

2 I'm encouraged to see the materials
3 confirm that building electrification is
4 essential and that they begin exploring
5 possibilities for network geothermal
6 systems, but much more is needed.

7 For example, the draft materials say
8 very little about options for repairing
9 buildings and making them highly
10 energy-efficient. I'd like to see the
11 completed report address those possibilities
12 in much greater depth.

13 A bold comprehensive repair and
14 retrofit program would improve residents'
15 health, make our homes more comfortable and
16 resilient, bring down energy bills, create
17 jobs, and reduce displacement. It would
18 also crucially greatly limit the cost of new
19 equipment and infrastructure that will be
20 needed for heating and cooling buildings as
21 we decarbonize.

22 I hope this study will kick off a
23 fully participatory community-based planning
24 process over the coming months so we can

1 create the bold plan that we need.

2 I urge PGW and the City to undertake
3 a pilot project that involves installing
4 networked geothermal systems as well as home
5 repairs and retrofits.

6 HEARING EXAMINER WUSHINSKE: 30
7 seconds.

8 MR. CHANIN: At the same time, while
9 we plan the future of PGW, I ask the Gas
10 Commissioners to take action to stop PGW
11 from lobbying against the policies that
12 we'll need to achieve the goals that the
13 study addresses. You will hear more about
14 that from colleagues this morning.

15 Thanks very much.

16 HEARING EXAMINER WUSHINSKE: Thank
17 you.

18 Next up we have Michael Heaney.

19 MR. HEANEY: My name is Michael
20 Heaney. I'm a resident of Philadelphia, a
21 certified energy manager, and a former
22 employee of Philadelphia's Office of
23 Sustainability as recently as 2015.

24 OOS has done a great job so far of

1 managing the Diversification Study, but
2 Philadelphia needs a strong, independent
3 manager for this process from here on out
4 because the Gas Commission can easily ignore
5 an internal city department.

6 This is exactly what happened in 2014
7 when the proposed sale of PGW was the
8 subject of a multimillion dollar report
9 prepared by city employees, including OOS
10 and the Law Department. City Council simply
11 ignored the report and did not hold hearings
12 on the sale.

13 A strong outside organization would
14 be harder to ignore and more likely to push
15 back if its recommendations were ignored or
16 delayed.

17 Secondly, climate-driven issues are
18 usually characterized by distrust from
19 opponents with opposing viewpoints. The Gas
20 Commission and the Mayor have lost the trust
21 of Philadelphians concerned about climate
22 change because of the recent approval of the
23 PGW LNG plant in Southwest Philadelphia.

24 OOS is subordinate to the Mayor and

1 City Council, as demonstrated by the
2 nontransparency of the 2014 sale of PGW.

3 One outside organization that's
4 well-positioned to manage this process would
5 be the Kleinman Center for Energy Policy at
6 Penn. Researchers at Kleinman have provided
7 unbiased insights into local energy issues,
8 such as the refinery and the LNG plant.

9 I commend OOS on the transparency of
10 the Diversification Study thus far, but as
11 studies transition into action, a strong,
12 independent manager is needed.

13 Thank you.

14 HEARING EXAMINER WUSHINSKE: 20
15 seconds left.

16 Oh, thank you.

17 Okay. Next we have Mike Ewall.

18 MR. EWALL: Hi. Mike Ewall with
19 Energy Justice Network.

20 It's nice to see any move away from
21 natural gas and I'd like to know if the
22 transition services being made available to
23 residents will be available to those on oil
24 heating systems and not just those currently

1 on gas.

2 I was not happy, though, to see the
3 litany of false solutions included in this
4 study. It was weak on conservation and
5 efficiency. Conservation is not even
6 mentioned.

7 It talks in just two places about
8 nuclear and it mentions nuclear retention as
9 a good thing and fails to recognize that
10 nuclear power is not zero carbon and
11 definitely not zero emissions and the
12 environmental racism aspect of where the
13 uranium comes from or where the waste
14 disposal ends up is huge and looms large in
15 the nuclear issue.

16 So I don't think it's reasonable to
17 expect these aging nuclear reactors to last
18 or to be part of a so-called zero-carbon
19 strategy with electrification.

20 The report also selectively looks
21 beyond the smoke stack to benefit both the
22 gas and bio energy and treat them
23 differently. It assumes that the grid shift
24 from coal and natural gas means lower

1 greenhouse gases even though it's actually
2 higher if you include the extensive methane
3 leakage in the system.

4 On the other hand, they do look at
5 the larger picture on biogenic carbons, but
6 do so with outdated science assuming that
7 carbon neutral, even though it's been
8 scientifically debunked repeatedly for over
9 a decade, that biomass and biofuels, RNF,
10 and renewable natural gas, so-called, are
11 actually worse than their fossil fuel
12 counterparts for the climate, and yet those
13 emissions are zeroed out based on outdated
14 science and double counting.

15 On Page 15 the report mentions
16 gasified biomass and that has no place in a
17 study when gasification is horribly
18 expensive and tends not to work. It is
19 quite --

20 HEARING EXAMINER WUSHINSKE: Excuse
21 me. This is your 30-second warning.

22 MR. EWALL: Thank you.

23 And there's no way a community will
24 allow this to be built at scale, and I

1 promise to lead the fight against any effort
2 to build this.

3 Finally, it mentions zero waste by
4 2035 as a goal, which the City does have in
5 other documents that are referenced here,
6 yet the waste factor is probably a lot more
7 than 3% of the greenhouse gases in the City
8 that this report attributes to it if you
9 account for it correctly. It relies on
10 continual use of trash incineration, which
11 is about twice as bad as landfilling, for
12 the climate --

13 HEARING EXAMINER WUSHINSKE: Excuse
14 me. That's your time.

15 MR. EWALL: -- and doesn't address
16 this problem.

17 And just the last thing is it doesn't
18 mention unit-based pricing or savings
19 control at all. In waste reduction that's
20 the most effective and cost-efficient way to
21 quickly reduce waste that needs
22 consideration there.

23 Thank you.

24 HEARING EXAMINER WUSHINSKE: Thank

1 you, Mr. Ewall.

2 Just a reminder to everyone: If you
3 don't get to finish what you want to say,
4 please submit the rest of your comments in
5 the form of written testimony.

6 Okay. Next up we have Zeyneb Magavi.
7 MS. MAGAVI: Hello. Yes. I am
8 Co-Executive Director of HEET. Thank you
9 for the opportunity.

10 I wish to comment on the potential of
11 the geo microdistrict, which can be
12 interconnected like Lego blocks to grow a
13 utility-scale geo grid, allowing for an
14 incremental evolution of a gas grid into a
15 non-emitting thermal utility.

16 Specifically, nearly every street can
17 be served by such a geo grid utility.
18 However, some need deeper bore holes, more
19 advanced drilling, or other adaptations to
20 meet the total demand.

21 So HEET likes to propose the
22 potential be evaluated as follows: The gas
23 system transition divided into three
24 categories based on cost/benefit thresholds.

1 First, strategic abandonment by the
2 gas utility, whether it's because there is
3 low-energy-use density. Think of a
4 farmhouse every 2 miles, which doesn't make
5 sense to pipe together. We have very little
6 of this in Boston and I suspect the same is
7 true for Philadelphia.

8 Second, where the geology is entirely
9 incompatible; likely rare given the three
10 general types of bedrock in Philadelphia.

11 There's another segment of the gas
12 system that you don't abandon. It's called
13 strategic maintenance, those industries that
14 rely on high-intensity combustion. And it
15 is pretty straightforward to determine a
16 longer-term evolution path to RNG or
17 hydrogen for these customers.

18 The third category is the rest of the
19 gas system, the vast majority, and it is
20 appropriate for consideration for strategic
21 evolution from gas to non-emitting thermal
22 delivery by geo grid.

23 Doing so has additional system scale
24 benefits beyond those mentioned, including

1 cutting peaks and reducing the total power
2 grid load of full electrification.

3 HEARING EXAMINER WUSHINSKE: Excuse
4 me. This is your 30-second warning.

5 MS. MAGAVI: I would like to invite
6 Philadelphia to join our growing geo grid
7 consortium at HEET. We're working very hard
8 to create an open source and collaborative
9 approach to the development of this new path
10 and join us in boldly reimagining our energy
11 system for a safer, better world for all.

12 HEARING EXAMINER WUSHINSKE: Thank
13 you.

14 Next we have Audrey Schulman.

15 MS. SCHULMAN: Great. Thank you.
16 I'm the other Co-Executive Director of HEET
17 that came up with the geo microdistrict. I
18 wanted to make one or two corrections.

19 It's a system of networked ground
20 source heat pumps. The pipes are filled
21 with just plain water which absorb
22 temperature of the ground. They do not have
23 piped hot water, which was stated in the
24 study. I wanted to make sure there was no

1 basic misunderstanding here.

2 Networked heat pumps provide both
3 heating and cooling and can provide load
4 canceling because of that. For instance,
5 supermarket fridges might use a lot of
6 cooling and thus return the water into the
7 shared loop hotter. That heat can then be
8 used by homes down the street.

9 The system does not serve only nearby
10 homes, which was also in the presentation.
11 It would be most efficient when serving many
12 different buildings with different heating
13 and cooling needs.

14 In terms of energy bills, with gas
15 the cost of the fuel is about 60% of your
16 current gas bill. With the geothermal
17 system, there would be no gas; thus, that
18 cost would be gone.

19 Applied Economics Clinic here
20 projected average annual heating bills of
21 gas versus networked geothermal, calculating
22 geothermal to cost around half of that of
23 gas.

24 The geothermal system would last just

1 as long as the gas system and, thus, the
2 installation costs can and should be
3 amortized over decades, the same as the gas
4 system. The gas can provide --

5 HEARING EXAMINER WUSHINSKE: Excuse
6 me. That's your 30-second warning.

7 MS. SCHULMAN: -- backup supplemental
8 heat, which would be rarely used, unless the
9 whole gas geo system can be considered one
10 hybrid system in terms of regulation and
11 customer amortization.

12 There's a variety of installations
13 going into the ground in Massachusetts and
14 New York. Mayor de Blasio announced
15 potential legislation in New York to allow
16 the future installations to scale. There's
17 a lot of interest nationally.

18 Networked geothermal meets your
19 evaluation criteria. It can result in
20 low-cost, safer, renewable energy for all.

21 Thank you.

22 HEARING EXAMINER WUSHINSKE: Thank
23 you.

24 Okay. Walter Tsou.

1 DR. TSOU: Yes. Thank you for the
2 opportunity to speak today about the PGW
3 diversification plan. My name is Dr. Walter
4 Tsou and I'm speaking on behalf of
5 Physicians for Social Responsibility in
6 Pennsylvania, although we are based here in
7 Philadelphia.

8 I'll begin by noting that there are
9 significant health impacts of burning of gas
10 indoors, especially when used as a
11 substitute for heating one's house in the
12 winter. But even regular indoor use,
13 particularly with baking in the oven or
14 cooking with all four burners, all release
15 criteria air pollutants, including nitrogen
16 oxide, VOC, carbon monoxide, and ultrafine
17 particles.

18 All of these can adversely impact the
19 respiratory status of the household
20 residents. Of particular concern are young
21 children whose lungs are still developing
22 and will breathe in twice the indoor air
23 relative to the size of their lungs compared
24 to adults.

1 The result, of course, is that poor
2 indoor air quality adversely impacts some
3 children triggering asthma and bronchitis.
4 In older people with borderline respiratory
5 status these odorless and colorless
6 pollutants can trigger difficulty breathing.

7 It's worth noting that gas stoves are
8 required to be vented outdoors, but somehow
9 indoor stoves are frequently used without
10 the use of a hood or in many cases a
11 microwave hood, which simply recirculates
12 the bad air.

13 Finally, in my remaining time I want
14 to say that of the four choices given for
15 PGW, we need to move to geothermal
16 microgrids, as just mentioned, and
17 electrification.

18 Decarbonized gas, whether from biogas
19 or synthetic natural gas, still puts carbon
20 dioxide in the atmosphere; and hydrogen,
21 unless it's from the electrolysis of water
22 by renewables, comes from burning natural
23 gas, which just simply greenwashes the
24 problem. If we are going to spend the

1 money to address the problem --

2 HEARING EXAMINER WUSHINSKE: Excuse
3 me. Just about 20 seconds left.

4 DR. TSOU: -- let's do it right.

5 Thank you for this opportunity to
6 speak.

7 HEARING EXAMINER WUSHINSKE: Thank
8 you for your testimony.

9 HEARING EXAMINER LAI: Next we have
10 Thomas Schuster.

11 MR. SCHUSTER: Good morning. My name
12 is Tom Schuster. I am the Clean Energy
13 Program Director for the Sierra Club
14 Pennsylvania Chapter.

15 We fully support the goal of full
16 decarbonization by 2050. This study clearly
17 shows that all realistic options for
18 decarbonization involves significant
19 electrification of buildings. This
20 electrification must begin in earnest
21 immediately.

22 All scenarios also require
23 alternative revenue sources for PGW. Given
24 the number of options available, we

1 recommend that multiple pilots be pursued
2 following this initial study.

3 The Sierra Club recommends one pilot
4 to test the feasibility of networked
5 geothermal systems. The concept is very
6 promising in terms of energy efficiency, the
7 retention of workers, and alternative
8 revenues for PGW.

9 These systems require utility
10 coordination, many stakeholders, and will
11 not be driven by the market alone, making
12 them an appropriate candidate for a pilot.

13 That said, networked geothermal will
14 not be the best solution everywhere and the
15 complexity of the first project may mean the
16 pilot takes years to complete. Therefore,
17 additional pilots to assist low-income
18 customers to electrify should be undertaken
19 immediately as well.

20 It's clear that the high
21 electrification scenario offers the lowest
22 cost to participants by a wide margin. We
23 share the concerns about the costs for the
24 last nonparticipants in this scenario who

1 could be mostly low income.

2 Upgrading and electrifying low-income
3 customers first has to be the goal and the
4 Philadelphia Energy Authority Build to Last
5 Program offers a promising solution with its
6 holistic approach to home rehabilitation,
7 weatherization, and electrification.

8 PGW should partner with Build to Last
9 during its two-year pilot to determine how
10 it can provide heat as a service while
11 reducing capital outlay for customers.

12 Strategic targeting of whole
13 neighborhoods for retrofits, allowing for
14 decommissioning sections of the gas system,
15 could also be a goal of the pilot.

16 Thank you for the opportunity to
17 comment and we look forward to submitting
18 more details in writing.

19 HEARING EXAMINER LAI: Thank you,
20 Tom.

21 Next we have Julie Greenberg.

22 MS. GREENBERG: Thank you,
23 Commissioners. I am Julie Greenberg,
24 Director of POWER's Climate Justice and Jobs

1 Team.

2 We are counting on you as
3 democratically elected representatives to
4 guide PGW into a just transition away from
5 fossil fuel and towards a sustainable
6 business model.

7 Climate crisis and extreme inequality
8 are the greatest moral issues of the day.
9 We cannot defer to business as usual to
10 solve these problems. That's why we are
11 contesting in the public forum of democracy
12 for new innovative solutions.

13 From our research we have learned
14 that electrification is essential to a
15 sustainable future for our city and our
16 planet. From the Business Diversification
17 Study materials, we see that networked
18 geothermal energy may be the best way to
19 meet our goals of affordability,
20 renewability, fair labor, and health and
21 safety.

22 We also think networked geothermal
23 built and operated by PGW is the best way to
24 protect the institution of PGW and the

1 workforce.

2 PGW should focus on creating new
3 energy infrastructure, home efficiency
4 investment, and heat as a service rather
5 than collapsing in a death spiral as people
6 who can afford to switch to electrification
7 do so while those who are energy-burdened
8 remain in the sinking ship of PGW.

9 We would like to see the pilot
10 project done on networked geothermal energy.
11 We recommend the standard best practice of
12 having third-party expert evaluation of the
13 design, implementation, and evaluation of
14 the pilot. With a well-designed pilot all
15 parties will learn together --

16 HEARING EXAMINER LAI: 30 seconds.

17 MS. GREENBERG: -- that we can find
18 mutually acceptable solutions.

19 In the meantime, we ask that you, our
20 elected leaders, direct PGW to stop paying
21 trade association fees to groups that lobby
22 against electrification. This undermines
23 democracy and needs to end.

24 We will be offering further written

1 comments and look forward to seeing
2 responses in the final report.

3 Thank you all very much.

4 HEARING EXAMINER LAI: Thank you,
5 Julie.

6 Next, Dwayne Royster.

7 BISHOP ROYSTER: Hi. Good
8 afternoon -- or good morning, excuse me.
9 I'm Bishop Dwayne Royster, Executive
10 Director of POWER Interfaith. We are a
11 multi-faith, multi-racial organizing force
12 deeply rooted in Philadelphia working for
13 racial and economic justice on a livable
14 planet.

15 Thank you for responding to our
16 request for meaningful public participation
17 in relation to the Business Diversification
18 Study and overall for a just transition for
19 PGW. We will be submitting detailed written
20 comments soon.

21 POWER supports a bold pilot project
22 on networked geothermal, which we see as the
23 most promising options for good jobs in a
24 just transition.

1 But the shocking fact is that PGW's
2 lobbying activities are undermining the
3 City's goals. The Business Diversification
4 Study shows a powerful and essential role
5 for building electrification in the
6 sustainable future for PGW.

7 However, PGW funds and participates
8 actively in lobbying campaigns by the gas
9 industry trade associations, such as the
10 American Gas Association and the American
11 Public Gas Association, that seek to block
12 and oppose building electrification.

13 We have also received very concerning
14 reports that PGW is currently lobbying and
15 working in support for Senator Yaw's bill
16 that seeks to preempt municipalities from
17 adopting policies advancing building
18 electrification. We understand that there
19 is a Senate hearing about the bill underway
20 this morning.

21 This lobbying is directly opposed to
22 the City's interests. City Council
23 unanimously passed a resolution opposing
24 Senator Yaw's preemption bill a couple of

1 weeks ago. The City should --

2 HEARING EXAMINER LAI: 30 seconds.

3 BISHOP ROYSTER: -- require PGW to
4 provide a comprehensive public accounting of
5 its lobbying activities relating to the Yaw
6 bill and to building electrification
7 generally and PGW must be directed in no
8 uncertain terms to cease such activities.

9 Such strong action is necessary to
10 ensure that the Business Diversification
11 Study has a meaningful future. Why spend so
12 many public resources on the study if PGW is
13 allowed to work behind the scenes to
14 undermine the study's recommendations?

15 Thank you, and we look forward to
16 seeing our concerns and recommendations
17 reflected in the final draft of the study.

18 HEARING EXAMINER LAI: Thank you,
19 Bishop Royster.

20 Next we have Mr. Steven Greenspan.

21 DR. GREENSPAN: Thank you for this
22 opportunity to speak. My name is Dr. Steven
23 Greenspan. I'm a member of POWER's Climate
24 Justice and Jobs Team.

1 As a retired vice president of
2 research and innovation at a Fortune 500 IT
3 company, I wish to focus my remarks on two
4 areas that are not well-examined in the
5 report: innovative business models, such
6 as heat as a service, and the focus of a
7 pilot program.

8 The traditional business model for
9 most gas utilities involves selling more and
10 more gas to generate revenue. The
11 devastating consequences of this business
12 model for our planet, our health, and
13 environmental justice are well-documented.

14 In contrast, the goal of a heat as a
15 service business model is to maintain
16 well-heated homes; but heat as a service,
17 weatherization, and networked geothermal
18 solutions are in the company's bottom-line
19 interest because they reduce the need for
20 additional energy. I'll provide further
21 details in writing.

22 Regarding the pilot, we will learn
23 little from piloting RNG, simple
24 electrification, or hybrid scenarios.

1 Pilots should encourage innovation while
2 promoting health and safety, energy
3 renewability, affordability, and sustainable
4 union jobs.

5 I ask the Commission to use this
6 opportunity to examine networked geothermal
7 and concurrently heat as a service or
8 similar business models.

9 It is also vital that the pilot's
10 design and analysis be subject to
11 transparency, community participation, and
12 third-party verification.

13 In closing, I ask the Commissioners
14 to encourage climate justice and innovation
15 and to prohibit PGW from any efforts to
16 weaken the City's electrification and
17 environmental justice efforts. Ratepayer
18 revenue should never be used to undermine
19 ratepayer values.

20 Thank you for your time and
21 attention. I hope these comments will be
22 considered in the final report.

23 HEARING EXAMINER LAI: Thank you,
24 Dr. Greenspan.

1 Next we have Ms. Elisa McCool.

2 MS. KNAPP: Elisa actually emailed me
3 that she is unable to make it today, so we
4 can skip to the next person.

5 HEARING EXAMINER LAI: Thank you.

6 Nancy Boxer.

7 MS. BOXER: Good morning. Nancy
8 Boxer with the Association for Climate
9 Health.

10 We are opposed to your first option.
11 Substituting decarbonized gas and piping it
12 around the same leaky pipes will continue to
13 pour carbon into the atmosphere. It also
14 shares the safety and health risks of
15 natural gas, so there is no improvement to
16 public health.

17 We are uncomfortable about the cost
18 of a hybrid system, which requires buildings
19 to maintain two HVAC systems even if one is
20 rarely used. This is costly and burdens
21 low-income residents the most. Possible
22 exception, inexpensive electric space
23 heaters for residential users.

24 But a geothermal microdistrict has

1 many advantages, saves jobs and money, is
2 safer, helps achieve climate goals,
3 repurposes potentially stranded assets,
4 provides cooling for those who otherwise
5 can't afford it.

6 Ground source heat pumps had the most
7 support and the least opposition in your
8 survey and can satisfy the top concerns of
9 survey respondents.

10 Your own staff at Bartram's Gardens,
11 the Police Tactical Training Site, and
12 Kensington High School all say their
13 geothermal systems run quieter, smoother,
14 and cheaper than traditional HVAC systems.
15 And for projects with a long time horizon
16 geothermal is cheaper with a smaller carbon
17 footprint and a better safety record.

18 So why not let PGW try the most
19 exciting future available to gas utilities
20 today? Potential pilot sites include the
21 Community College, City health centers,
22 municipal buildings, schools, housing
23 projects, museums. Some could be networked
24 together. Why not test-drive a geothermal

1 microdistrict? We say go for it.

2 Thank you for your time.

3 HEARING EXAMINER LAI: Thank you,
4 Nancy.

5 John DiEnna?

6 - - -

7 (No response.)

8 - - -

9 HEARING EXAMINER LAI: John DiEnna?

10 - - -

11 (No response.)

12 - - -

13 HEARING EXAMINER LAI: If not, we'll
14 move along to Alexandra Kroger.

15 MS. KROGER: Thank you to the
16 Philadelphia Gas Commission for holding this
17 meeting today. My name is Alexandra Kroger
18 and I'm the Energy Program Director of The
19 Energy Co-op, Philadelphia's only renewable
20 energy nonprofit cooperative.

21 We were the first supplier to offer a
22 renewable electricity alternative to
23 Philadelphians in the newly deregulated
24 electricity market in the late 1990s and

1 since 2015 we have been offering renewable
2 natural gas or RNG, a more sustainable
3 alternative, recovered from organic waste
4 facilities without drilling or fracking, for
5 people who use natural gas to heat their
6 homes and businesses.

7 We began supplying RNG in the PGW
8 territory in late 2019. The environmental
9 value of RNG in energy production is in its
10 conversion of methane to carbon dioxide. As
11 a greenhouse gas methane is by some measures
12 80 times more potent than carbon dioxide.

13 RNG also offers a more sustainable
14 alternative to conventional gas because its
15 production does not involve drilling or
16 hydraulic fracture.

17 The environmental advantages of RNG
18 over conventional natural gas are clear and
19 we see it in the popularity of our RNG
20 product. However, the question of whether
21 RNG should be part of a long-term policy to
22 decarbonize our energy infrastructure is a
23 different matter.

24 At The Energy Co-op we continue to

1 innovate in order to ensure the availability
2 of RNG supply to Philadelphians, but we also
3 recognize that RNG is more than likely a
4 very significant but interim step on the
5 path to decarbonization.

6 The future of heat generation for
7 homes and businesses will require a further
8 leap to justify the considerable investment
9 that will be needed.

10 The PGW study has identified several
11 challenges for the future of the natural gas
12 economy in Philadelphia.

13 HEARING EXAMINER LAI: 30 seconds.

14 MS. KROGER: We believe that all the
15 challenges will be best met by a carbon-free
16 electrification strategy that relies on
17 renewable electricity and energy storage
18 technology.

19 This strategy will generate new jobs
20 for construction, maintenance, and operation
21 of entirely new infrastructure, including
22 the existing workforce.

23 Lastly, and most indisputably, the
24 use of clean renewable energy to provide

1 heating for all is the healthiest, safest,
2 and most equitable option for Philadelphia.

3 Thank you for your time.

4 HEARING EXAMINER LAI: Thank you,
5 Alexandra.

6 Next, Katie Bartolotta.

7 MS. BARTOLOTTA: Good morning. My
8 name is Katie Bartolotta and I'm the Policy
9 and Program Director at Green Building
10 United, a mission-based member organization
11 of industry professionals, including
12 architects, engineers, contractors,
13 developers, building owners and managers,
14 and more.

15 Our members play a critical role in
16 the building environment, including
17 decision-making around equipment in new and
18 existing buildings and homes.

19 In this study the viable models
20 options for decarbonizing gas end usage
21 feature electrification as a strategy.

22 We know that electrification is
23 comparable, even cheaper in terms of
24 up-front and long-term utility costs, in

1 newly built homes.

2 We know that electrification in
3 existing homes is more affordable when
4 paired with energy efficiencies and
5 weatherization measures.

6 We know that electrification improves
7 indoor air quality, which impacts health.

8 With electrification as a potential
9 path forward for PGW, we need to fully vet
10 the technical and financial feasibility of
11 scaling electrification in existing homes,
12 especially those in need of repair, through
13 a pilot program. This is a critical need to
14 ensure that low-income Philadelphians are
15 not left behind in this transition.

16 This study also makes clear that
17 consumer decisions on how to heat their
18 homes are largely outside of PGW's control.
19 So how do consumers make decisions on what
20 to install in their homes?

21 The vast majority of home HVAC
22 replacements are happening on an emergency
23 basis. The decision that consumers are
24 making in a moment of need is locked in to

1 the long lifespan of the replacement they're
2 choosing.

3 To support electrification as a
4 viable option, we need to ensure that all
5 points in the process are equipped to make a
6 supportive decision. Consumers need
7 assurance that electrification meets their
8 affordability, comfort, and health needs.
9 Contractors need familiarity and experience
10 with equipment installation and high-impact
11 efficiency measures that paradox with
12 electrification.

13 HEARING EXAMINER LAI: 30 seconds.

14 MS. BARTOLOTTA: Grant, loan, and
15 rebate program implementers need evidence of
16 electrification improving cost, comfort, and
17 indoor air quality; a robust existing home's
18 electrification program as the next phase in
19 this process; and help answer these critical
20 questions and help PGW assess the viability
21 of some of the diversification options that
22 were briefly presented in this draft.

23 Thank you for your time today.

24 HEARING EXAMINER LAI: Thank you,

1 Katie.

2 Next we have Alex Bomstein or
3 Bomstein.

4 MR. BOMSTEIN: Hi. My name is Alex
5 Bomstein and I live at 9th and Dickinson in
6 South Philly. Thanks for holding this
7 today.

8 My wife and I were customers of PGW
9 through December 2019. On December 17th,
10 2019, we finally got our house free of
11 fracked gas completely, closing our PGW
12 account and removing our boilers, radiators,
13 and water heater. We went completely
14 electric. Our electricity is now sourced
15 from rooftop solar and grid source wind
16 power.

17 Two days later, on December 19th,
18 2019, a gas explosion killed two people and
19 destroyed five houses just a block from my
20 house.

21 Since then we have had PGW trucks
22 doing work of some sort or another outside
23 our house at least every few months.
24 There's actually one outside right now.

1 A block away neighbors walk their
2 dogs on the grass where five houses stood
3 for a century. A block in another direction
4 from our house is a parking lot where a half
5 a century ago another gas explosion took
6 down three other houses in our neighborhood.

7 We don't need this and we don't want
8 it. I have been telling everyone I can to
9 get off gas. It's killing the planet and
10 it's killing my neighbors and it will keep
11 killing my neighbors as long as we keep
12 piping it into our neighborhoods.

13 And gas is finite. There's only so
14 much in the ground. It's going to run out
15 sooner or later. PGW will stop selling gas
16 sooner or later. The only question is how
17 many more people need to die first, how much
18 more wrecking of the planet is going to
19 happen first.

20 I don't want PGW to be part of any of
21 that. PGW needs to move into new business
22 lines and transition out of gas as soon as
23 humanly possible.

24 Thank you.

1 HEARING EXAMINER LAI: Thank you,
2 Alex.

3 Mehdi Entezari or Mehdi Entezari.

4 MR. ENTEZARI: It's Mehdi.

5 HEARING EXAMINER LAI: Sorry for the
6 mispronunciation.

7 MR. ENTEZARI: That's okay.

8 Good morning. My name is Mehdi
9 Entezari, a resident of Philadelphia and a
10 member of the Geodelphia Group. Thank you
11 for the opportunity.

12 My focus today is on the geothermal
13 microdistrict option mentioned on Slides 34
14 and 35. As is stated on the two slides, a
15 viable diversification option for PGW is to
16 be a provider of cooling and heating as a
17 service by investing in, owning, and
18 maintaining the system's infrastructure.

19 I recommend looking into the business
20 model of Dandelion Energy in the State of
21 New York and Connecticut to learn more about
22 how that is done.

23 As mentioned on Slide 35 of the
24 report, the characteristics of the local

1 geology and building typology are the major
2 focus on the initial cost.

3 My recommendation is for PGW to use
4 the geology data from the many buildings
5 within the perimeter of the City that have
6 already switched to a geothermal heating and
7 cooling system.

8 This approach will enable PGW to
9 build a more accurate cost model and,
10 consequently, it will enable to skip the
11 piloting phase and start the new line of
12 business by installing the systems in
13 municipal buildings and public schools.

14 This approach also puts the City on
15 the right path to meet its 2030 net-zero
16 target, which is reducing energy use by 20%
17 and municipal carbon emission by 50%.

18 With respect to school buildings,
19 every year students in the vast majority of
20 the 200-plus Philadelphia public schools are
21 held hostage by the heat in the classroom
22 during the hot weather. It is understood
23 that some of the buildings are old, but that
24 is only suitable and fair for --

1 HEARING EXAMINER LAI: 30 seconds.

2 MR. ENTEZARI: -- that is not
3 suitable for our kids. Any investment made
4 reduces the operating costs and allows the
5 City and PGW to fully recover their
6 investment in a reasonable time.

7 However, regarding the nonpublic
8 buildings, for quick rollout and better
9 return on investment, my recommendation is
10 based on Massachusetts put a major focus on
11 multi-tenant, single-owner buildings and
12 multi-building campuses owned by colleges,
13 hospitals, and businesses.

14 And, finally, the diversification of
15 PGW will necessitate removing the word "gas"
16 from the current name of the company.

17 Thank you very much.

18 HEARING EXAMINER LAI: Thank you.

19 Next we have Mr. Russell Hicks.

20 MR. HICKS: Thank you for the
21 opportunity to testify and present my public
22 statement. I appreciate the Commission --

23 THE COURT REPORTER: Erin, I'm having
24 trouble understanding.

1 MR. HICKS: I am Russell Hicks
2 representing POWER Climate Justice and Jobs
3 Team.

4 I wish to state my support for PGW
5 pursuing a pilot program on networked
6 geothermal, which POWER believes has a great
7 promise, including creating local green jobs
8 to support a just transition to renewable
9 energy and having living-wage jobs for labor
10 and community in terms of green jobs
11 creation.

12 Although the networked geothermal
13 pilot will involve up-front costs, we
14 believe that it will have a robust return on
15 investment with the right financing models
16 and cost/benefit analysis as part of a
17 sustainable program for PGW.

18 The Diversification Study is a good
19 start, but it's for the benefit of PGW's
20 stakeholders and the City needs a just
21 transition to renewable energy study for all
22 stakeholders who are involved; i.e.,
23 customers, businesses, taxpayers, and
24 citizens of a public utility.

1 In order for PGW to make equitable
2 and responsible use of ratepayers' funds, it
3 must be informed by up-to-date data and
4 modeling.

5 HEARING EXAMINER LAI: 30 seconds.

6 MR. HICKS: We support the networked
7 geothermal project as the next step in any
8 process that includes a strong role for
9 environmental organizations to shape a just
10 transition for PGW.

11 Thank you.

12 HEARING EXAMINER LAI: Thank you.

13 Next we have Mr. Robert Ballenger.

14 MR. BALLENGER: Good morning. My
15 name is Robert Ballenger and I'm the
16 Co-Director of the Energy Unit at Community
17 Legal Services, where I represent low-income
18 Philadelphians who maintain essential home
19 utility service.

20 I also serve as Public Advocate
21 representing the broad interests of PGW's
22 residential customers as a group in matters
23 before the Philadelphia Gas Commission.

24 The draft Diversification Study

1 examined some possible options PGW has to
2 move its business away from fossil fuels.
3 PGW currently faces a myriad of challenges
4 including, but not limited to, the climate
5 crisis.

6 As the study recognizes, it's vital
7 that PGW's future is planned with the
8 objective of protecting the safety and
9 health of all Philadelphians, most
10 particularly those Philadelphians who are
11 struggling to get by.

12 Even prior to the COVID-19 pandemic a
13 large portion of PGW's residential customers
14 were low and moderate income. In 2019 a
15 third of PGW's nearly 500,000 residential
16 customers were confirmed to be low income.
17 Many more are suspected to be.

18 Over the last year even more PGW
19 customers have struggled to pay their gas
20 bills. In March PGW reported that nearly
21 170,000 households were at risk for
22 termination and those households held over
23 \$85 million in debt as of the end of
24 February.

1 All Philadelphians must be able to
2 continue to heat their homes. The City of
3 Philadelphia and PGW must examine options to
4 decarbonize with the affordability of
5 heating at the forefront. I appreciate that
6 the draft study incorporates some of this
7 analysis, but look forward to further and
8 deeper analysis in the future.

9 As households with the ability to
10 move away from gas do so, both PGW and the
11 City need to commit to ensuring that
12 those --

13 HEARING EXAMINER LAI: 30 seconds.

14 MR. BALLENGER: -- who are currently
15 unable to afford their utility bills will
16 have options to maintain heat in their
17 homes.

18 I appreciate the comments that have
19 been provided by others this morning and
20 look forward to continuing to work with
21 these stakeholders as PGW transitions to a
22 low-carbon future.

23 Thank you.

24 HEARING EXAMINER LAI: Thank you.

1 Todd Baylson.

2 MR. BAYLSON: Good morning. Good
3 morning, Councilman Green and everyone.
4 It's great to see so many old friends.

5 My name is Todd Baylson. I'm a
6 resident of Philadelphia and I work for
7 Solar States, which is a Philadelphia-based
8 solar installation and education company and
9 I wanted to bring a few comments to the
10 discussion from the solar energy business
11 view.

12 The first is that we have come to
13 find that we need to change our discussions
14 as it relates to public policy in
15 Pennsylvania a bit.

16 This state is an energy power house
17 and we produce more energy than we consume,
18 which very few places do. But culturally,
19 when you spend time in Harrisburg, where a
20 lot of the energy public policy is decided,
21 it's really important to understand this
22 kind of history and a proud legacy as a
23 power house. And people refer to it as an
24 all-of-the-above energy strategy.

1 The reality, though, is that coal is
2 disappearing as part of the energy mix;
3 nuclear will also continue to step down,
4 although both will have baseline; and
5 there's very little renewable energy
6 generated in Pennsylvania.

7 The changes have really been as a
8 result of natural gas, which has benefited
9 businesses and consumers by lowering prices,
10 but has all these other impacts.

11 Meanwhile, the way to kind of start
12 to get to an all-of-the-above strategy is by
13 increasing the amount of renewables, and we
14 can also do the side benefits of saving the
15 family farm and creating so many jobs.

16 This is also the solar decade
17 nationally. Our trade association has
18 pointed out that with the Biden
19 Administration we have an opportunity over
20 the next four years, and these least two
21 with the Congress as it sits, whichever side
22 of the aisle you're on, this is very
23 important --

24 HEARING EXAMINER LAI: 30 seconds.

1 MR. BAYLSON: -- number of years for
2 generating momentum in building out solar
3 across the country.

4 As we know, rooftop solar is a great
5 job creator and it's a good match for
6 workforce development in Philadelphia, where
7 you can get a family-sustaining job without
8 necessarily going to college, you can move
9 up the occupational ladder, and it's safe
10 for the 21st Century.

11 And last, but most importantly,
12 especially in light of news this week,
13 resiliency is going to be very important;
14 and solar and storage are going to be a key
15 way that we support the grid by allowing
16 people to be resilient.

17 Thank you again for allowing us to
18 participate. Have a great morning.

19 HEARING EXAMINER LAI: Thank you.
20 Matt Walker.

21 MR. WALKER: Hi, everyone. My name
22 is Matt Walker and I'm the Advocacy Director
23 with Clean Air Council. We are a nonprofit
24 environmental health organization

1 headquartered in Philly and we have been
2 working to protect everyone's right to a
3 healthy environment for over 50 years.

4 So in order to meet the City's
5 climate goals, PGW, we know they must
6 transition to a sustainable energy utility
7 that no longer uses or provides fossil fuel
8 or fossil fuel-derived gas and contributes
9 zero greenhouse gas emissions. Anything
10 less will not adequately address the climate
11 crisis.

12 Figuring out how to transition PGW
13 into an environmentally sustainable utility
14 is a complex topic and requires a robust
15 conversation and engagement process.

16 The Council is happy to see the
17 strong stakeholder and public engagement in
18 this process, especially the most
19 energy-burdened communities, as well as a
20 level of transparency before a final report
21 is included. This process includes many
22 elements that the Council has advocated for
23 many years ago, so it's promising to see
24 this process. Thank you.

1 The Council is glad to see that
2 public health, safety, and equity was a
3 guiding principle of the analysis.

4 We are also happy to see the serious
5 consideration of how PGW could transition to
6 renewable energy while exploring how this
7 publicly owned utility can reduce climate
8 impacts and air pollution while providing
9 ongoing energy needs and job opportunities.

10 We offer the following suggestions on
11 the report:

12 Under the hybrid electrification
13 model, the report envisions customers
14 adopting heat pumps paired with a gas
15 furnace to meet peak heat demands during the
16 coldest periods of winter. If it hasn't
17 already been completed, the report
18 consultants should estimate how much backup
19 gas, if any, would actually be needed.
20 That's actually --

21 HEARING EXAMINER LAI: 30 seconds.

22 MR. WALKER: Oh, well, we're glad to
23 see the analysis recognized decarbonized gas
24 as risky. We understand the analysis --

1 let's see, I'll skip over this part.

2 We're happy to see all the
3 diversification options you're looking at on
4 Page 45 that are under consideration.

5 We recommend modeling how much
6 revenue PGW can make from some of these
7 diversification options suggested in the
8 report.

9 And the Council understands PGW is
10 involved with liquified natural gas, but
11 this should be removed from any
12 consideration.

13 And we think that more analysis must
14 be done with the cost of the hybrid
15 electrification, with the geothermal
16 microdistricts --

17 HEARING EXAMINER LAI: Thank you.
18 That's your time.

19 MR. WALKER: We will be submitting
20 further comments, written comments. Thank
21 you.

22 HEARING EXAMINER LAI: Thank you,
23 Matt.

24 Alex Dews.

1 MR. DEWS: Good morning. I'm the
2 Executive Director at Green Building United.
3 Thank you, Chairman, for the opportunity to
4 provide comments on the draft version of the
5 report and for the work to date on this
6 critical and very complex challenge.

7 We look forward to seeing the final
8 version of the report and will continue to
9 work with our member experts to submit a
10 more detailed written version of these
11 comments.

12 We hope we can complement the
13 research done to date to ensure the best
14 possible accuracy and modeling assumptions
15 of this study to further strengthen the case
16 that the high electrification and heat as a
17 service options are most viable.

18 We'd like to review details on the
19 assumptions for building shell upgrades for
20 new and existing buildings on Slide 64 and
21 offer to provide comparable cost information
22 from built projects in this region.

23 For the heat pump and hybrid
24 scenarios, we have significant concerns with

1 the cost estimates provided, which range in
2 rigor and credibility from detailed Federal
3 Government survey data to the contractor
4 lead generation website Home Advisor.

5 While precision may be difficult to
6 achieve, accurate cost ranges are possible
7 to establish and important in considering
8 that they're extrapolated and long-term cost
9 models.

10 We would like to see more detail on
11 the air source heat pump cost assumptions on
12 Slide 68 and, in particular, want to
13 understand why the hybrid scenario, which
14 includes both a heat pump and furnace
15 equipment, is assumed to cost \$3,000 less
16 than a heat pump on its own.

17 We would like to know what is
18 included in the price point for a heat pump
19 and how the heat pump tonnage was
20 established as it's almost twice the size of
21 what we would expect for a typical-sized
22 Philadelphia row house.

23 For geothermal microdistricts, we
24 understand this was a late addition based on

1 stakeholder input and could not be fully
2 explored, but we would like to understand
3 how the process will proceed in evaluating
4 the viability of this and other nascent
5 technology options.

6 Finally, in terms of PGW's
7 new business models --

8 HEARING EXAMINER LAI: 30 seconds.

9 MR. DEWS: -- we would like to have
10 the opportunity to review the full details
11 and provide feedback on the proposed
12 diversification strategies as that was the
13 main goal of the study.

14 Thank you.

15 HEARING EXAMINER LAI: Thank you.

16 Next, Emily Davis?

17 - - -

18 (No response.)

19 - - -

20 HEARING EXAMINER LAI: Emily Davis?

21 - - -

22 (No response.)

23 - - -

24 HEARING EXAMINER LAI: Emily Davis?

1 MS. DAVIS: Sorry. I'm here.

2 HEARING EXAMINER LAI: Okay.

3 MS. DAVIS: My name is Emily Davis.

4 I live in Center City Philadelphia.

5 First, thanks go to the Office of
6 Sustainability for conducting this study and
7 for looking out for the future of the
8 workers at PGW. There is much work that an
9 organization like PGW can do to support a
10 clean energy future for Philadelphia.

11 But it seems that PGW and its
12 managing board, the Philadelphia Facilities
13 Management Corporation, are not looking out
14 for the future of their workers or trying to
15 help our City meet its carbon reduction and
16 clean energy goals.

17 I was particularly appalled to learn
18 that PGW pays over \$400,000 in annual dues
19 to a trade association called the American
20 Gas Association. While I understand
21 membership in AGA can be important in
22 staying informed about best practices in the
23 industry, this group is also writing and
24 lobbying bills that are not in the City's

1 interest.

2 It seems that the leadership of PGW
3 is looking out for gas producers more than
4 the safety of their end users or
5 distributors like PGW.

6 AGA is the group that's promoting the
7 Bill 275 that Senator Gene Yaw has
8 introduced in Pennsylvania. This bill would
9 prohibit local governments like Philadelphia
10 from adapting requirements that new
11 buildings use energy-friendly sources. AGA
12 is also discouraging new construction codes
13 that increase energy efficiency. Both of
14 these actions are counter to Philadelphia's
15 climate goals.

16 I understand that representatives of
17 Philadelphian's leadership --

18 HEARING EXAMINER LAI: 30 seconds.

19 MR. DEWS: -- excuse me, PGW's
20 leadership at AGA supported both these
21 actions. It's time that the leadership of
22 PGW considers the goals of the City and the
23 future of its workers in its decisions.

24 Thank you.

1 HEARING EXAMINER LAI: Thank you,
2 Emily.

3 Lisa Hastings?

4 - - -

5 (No response.)

6 - - -

7 HEARING EXAMINER LAI: Lisa Hastings?

8 - - -

9 (No response.)

10 - - -

11 MS. HASTINGS: Hello. Am I on?

12 HEARING EXAMINER LAI: Yes, thank
13 you.

14 MS. HASTINGS: Hi. I'm Lisa
15 Hastings.

16 First, I wanted to say that I agree
17 with everyone, we must stop allowing the
18 expansion of all natural gas use in the City
19 and we need to move to a diverse portfolio
20 of clean renewable energy options, including
21 geothermal, solar, and hydrogen. We can use
22 a grid electric renewable hybrid, but we
23 don't need to use a gas hybrid.

24 I agree we need renewable pilot

1 programs and financial support for
2 electrification and renewable energy for
3 low-income households.

4 Although this study provided some
5 interesting information, including that
6 natural gas usage in the City creates more
7 pollution than using grid energy, for the
8 most part the study was presented without
9 data and was too negative about
10 diversification and conversion to renewable
11 energy and limited in many other ways.

12 It also seemed to assume that all
13 participants in alternative energy -- i.e.,
14 not natural gas -- would no longer be PGW
15 customers, but that is not a given if PGW
16 provides other significant energy options to
17 its customers.

18 It, without backing it up, states
19 that geothermal microgrids will cost a
20 fortune to maintain. It's more expensive
21 than our, quote/unquote, current
22 infrastructure.

23 HEARING EXAMINER LAI: 30 seconds.

24 MS. HASTINGS: Also, current hydrogen

1 and synthetic hydrogen gas manufacturing are
2 much better and cleaner options than
3 presented and the conventional gasification
4 that everyone's concerned about is not even
5 necessary anymore to provide hydrogen and
6 hydrogen synthetic gas.

7 So PGW can either invest in the
8 future or get lost in the past. Thank you.

9 HEARING EXAMINER LAI: Thank you,
10 Lisa.

11 Frances Upshaw?

12 - - -

13 (No response.)

14 - - -

15 HEARING EXAMINER LAI: Frances
16 Upshaw?

17 MS. UPSHAW: Good morning. My name
18 is Frances Upshaw, a board member of POWER
19 Interfaith and a founder of our Climate
20 Justice and Jobs Team.

21 We at POWER are very concerned about
22 the collision of racism, economic
23 inequality, and climate crisis. As people
24 of faith, we are called to be part of the

1 solution, and we call on each of you to also
2 be a part of that solution. We want to see
3 responsive, creative, new ideas.

4 Our climate team members have studied
5 the options for PGW in the study. We
6 recommend a pilot project on geothermal
7 energy. From a good pilot we can learn how
8 to make this work in a city with high
9 poverty.

10 One way to make energy more
11 affordable is through energy efficiency,
12 home repair, and weatherization. That
13 definitely keeps energy bills lower.

14 PGW should manage the jobs in energy
15 efficiency, home repair, and weatherization.
16 These are good union jobs and they help our
17 low-income communities afford energy and not
18 lose their homes to gentrification.

19 We need PGW to truly diversify its
20 business model and to think big about new
21 ideas. We are learning about heat as a
22 service. This approach creates incentives
23 for PGW to sell less energy --

24 HEARING EXAMINER LAI: 30 seconds.

1 MS. UPSHAW: -- and remain stable.
2 This addresses energy bills and climate
3 crisis.

4 I am a busy church person, not an
5 energy expert, but when we left it to the
6 experts, we got into the mess we are in
7 today. Regular people like me have to raise
8 our voices and call on our elected leaders
9 to listen.

10 And you, our elected leaders, need to
11 tell PGW what direction to take. You need
12 to align the lobbying, the fee structures,
13 everything, in a sane way so that the
14 people, the City, and PGW are working
15 together for a vision of clean energy and
16 equity.

17 Thank you very much.

18 HEARING EXAMINER LAI: Thank you.

19 Next, Lynn Robinson.

20 MS. ROBINSON: Good morning. My name
21 is Lynn Robinson. I'm the founder/director
22 of Neighbors Against the Gas Plants, an
23 active member of several organizations, and
24 a retired Philadelphia public school

1 teacher.

2 I'm disappointed that the Office of
3 Sustainability allowed industry consultants
4 to participate in writing the Business
5 Diversification Study for PGW, but I'd like
6 to credit them for soliciting significant
7 public input.

8 And there's two tangible slides to
9 prove it. Networked geothermal energy was
10 given mention on Slides 34 and 35. However,
11 Slide 44, about customer decisions
12 determining the future, leaves out
13 geothermal from the chart.

14 There is some transparency in this
15 draft. Slides 31 and 32 look at
16 electrification and hybrid electrification
17 without PGW diversification. Yes, the
18 option of no diversification is given two
19 slides. So PGW not diversifying beyond gas
20 is the exact underlying subtext of this
21 study.

22 The economic predictions dealing with
23 electrification models assume that
24 nonparticipants are the PGW gas customers

1 and that participants would be randomly
2 scattered throughout the City. Gas mains
3 would still be maintained all over the
4 place. Participants who electrify would pay
5 for installation of their electric
6 infrastructure. Low-income people would all
7 be PGW customers and their bills would go up
8 as PGW shrinks and less gas is sold.

9 HEARING EXAMINER LAI: 30 seconds.

10 MS. ROBINSON: I hear you.

11 To make up for the revenues lost,
12 they say sell LNG and CNG. None of it makes
13 any sense.

14 Slides 32 and 47 say hybrid
15 electrification is more equitable
16 economically between participants and
17 nonparticipants. But how many homeowners
18 are going to crowd two heating systems into
19 one home?

20 Anyway, I'll skip to the end. As an
21 educator, I give the study draft that I had
22 access to an F for content and a C for
23 presentation. The presentation graphics are
24 easy to read, but since there's no

1 supporting evidence --

2 HEARING EXAMINER LAI: That's your
3 time.

4 MS. ROBINSON: -- provided for any
5 economic...

6 HEARING EXAMINER LAI: I think that
7 concludes our list. I'm going to pass it
8 over to either our Executive Director or
9 Chairman Green.

10 CHAIRMAN GREEN: Thank you, Ms. Lai.

11 I want to thank everyone that
12 participated in this morning's town hall.
13 Also, I want to remind people that if you
14 would like to provide additional written
15 testimony, please do so by Friday, May 28th.
16 You can submit that information to
17 sustainability@phila.gov.

18 In addition, it is my intention to
19 have City Council hearings on this study and
20 we hope to introduce that resolution for
21 hearings sometime in the coming weeks so
22 that way we can continue to have this
23 conversation and also continue to educate
24 other individuals in the City of

1 Philadelphia, including members of City
2 Council and other stakeholders and
3 constituents within the City of
4 Philadelphia, regarding this conversation
5 regarding the Diversification Study being
6 conducted by PGW with resources from the
7 American Cities Climate Change Challenge.

8 I want to thank all of you for being
9 here.

10 I also will continue this
11 conversation, especially as we go into the
12 fall, with the potential passage of the
13 American Jobs Plan, which will provide
14 dollars regarding infrastructure. I think a
15 number of the things that were raised this
16 morning as well as in the study provide
17 additional conversation regarding those
18 issues.

19 So I want to thank all of you for
20 being with us this morning and we'll look
21 forward to continuing this conversation
22 through hearings in City Council.

23 - - -

24 (Whereupon the town hall meeting

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

adjourned at 11:50 a.m.)

- - -

Reported By: Susan Marie Migatz, RMR, CRR

- - -

1	3	8	
<p>1,000 18:8 1,300 45:24 1,700 41:21 100 48:21 10:00 1:8 11 1:7 49:15 11:50 112:1 13 42:19 15 56:15 170,000 90:21 17th 83:9 1800 1:23 1801 1:23 19 90:12 19103 1:24 1990s 77:24 19th 83:17</p>	<p>3 57:7 3,000 99:15 30 38:17,18 42:6 45:16 49:9 52:6 56:21 60:4 62:6 69:16 72:2 79:13 82:13 87:1 89:5 91:13 93:24 96:21 100:8 102:18 104:23 106:24 109:9 31 108:15 32 108:15 109:14 34 85:13 108:10 35 85:14,23 108:10 39 49:13</p>	<p>80 7:7 78:12 85 90:23</p> <p>9</p> <p>91 48:1 9th 83:5</p> <p>a</p> <p>a.m. 1:8 112:1 aas 2:16 6:1,6 11:7 11:11,14 abandon 59:12 abandonment 59:1 ability 4:14 6:2 15:16 91:9 able 4:21 31:12 36:2 40:5 41:1 46:16 91:1 abridged 12:13 absence 44:12 absent 26:22 absorb 60:21 acceptable 69:18 access 109:22 accessibility 44:10 accommodating 16:2 accompanied 15:7 accomplished 24:19 account 49:5 57:9 83:12 accounting 72:4 accounts 47:20 48:20 accuracy 98:14 accurate 86:9 99:6 achieve 7:4,17,23 8:17,22 22:1 35:5 52:12 76:2 99:6</p>	<p>achieved 31:9 achieves 13:7 acknowledge 30:4 acre 45:24 action 7:20 52:10 54:11 72:9 actions 102:14,21 active 107:23 actively 71:8 activities 9:2 71:2 72:5,8 actual 5:13 13:16 adaptations 58:19 adapting 102:10 added 45:12 addition 4:12 17:22 21:11 99:24 110:18 additional 32:1,15 34:1 39:1 46:21 46:22 59:23 66:17 73:20 110:14 111:17 address 17:8 27:17 35:7,13 51:11 57:15 65:1 95:10 addressed 24:23 49:24 addresses 52:13 107:2 adequately 95:10 adjacent 45:22 adjourned 112:1 administration 7:13 93:19 adopting 26:16 71:17 96:14 adults 63:24 advanced 58:19</p>
<p>2</p>	<p>4 48:20 400,000 101:18 43 20:10 48:7 44 108:11 45 48:3 97:4 47 109:14</p>		
<p>2 59:4 2.5 25:6 20 54:14 65:3 86:16 200 86:20 2014 53:6 54:2 2015 52:23 78:1 2019 78:8 83:9,10 83:18 90:14 2021 1:7 49:12 2030 86:15 2035 57:4 2050 7:5,7 23:16 24:16 65:16 21st 94:10 275 102:7 28th 4:15,20 39:6 110:15</p>	<p>5</p> <p>50 86:17 95:3 500 73:2 500,000 90:15 5:00 4:15</p> <p>6</p> <p>60 61:15 64 98:20 67 42:18 68 99:12 686 10:23</p>		
	<p>7</p> <p>72 8:3</p>		

<p>advancing 71:17 advantage 14:5 15:1,15,23 advantages 15:15 76:1 78:17 adversely 63:18 64:2 advisor 99:4 advocacy 94:22 advocate 89:20 advocated 95:22 affect 28:19 afford 69:6 76:5 91:15 106:17 affordability 9:18 19:18 22:9 25:17 25:20 26:14 28:8 35:7 68:19 74:3 82:8 91:4 affordable 30:9 32:6 81:3 106:11 afield 34:4,19 afternoon 70:8 aga 101:21 102:6 102:11,20 agenda 12:7 aggregator 34:13 aging 17:9 55:17 ago 72:1 84:5 95:23 agree 17:15 103:16,24 air 14:22 18:20 22:4,6 24:22 25:9 25:11 35:15 63:15 63:22 64:2,12 81:7 82:17 94:23 96:8 99:11 aisle 93:22 alex 83:2,4 85:2 97:24</p>	<p>alexandra 77:14 77:17 80:5 align 107:12 allocated 28:10 allotted 38:16,19 allow 56:24 62:15 allowed 17:16 20:19 72:13 108:3 allowing 58:13 67:13 94:15,17 103:17 allows 87:4 alongside 36:21 alternative 29:12 65:23 66:7 77:22 78:3,14 104:13 amber 2:16 ambitions 22:7 america 13:2 american 2:11 4:1 8:19 71:10,10 101:19 111:7,13 amortization 62:11 amortized 62:3 amount 31:11 40:3 46:15 93:13 amounts 25:6,23 analysis 16:5 19:7 19:14,22 29:1 35:1 44:14 74:10 88:16 91:7,8 96:3 96:23,24 97:13 announced 62:14 annual 61:20 101:18 answer 82:19 anthony 2:17 anticipated 29:20 anticipates 48:9</p>	<p>anybody 41:11 anymore 105:5 anyway 109:20 appalled 101:17 appear 32:22 applaud 44:10 appliances 13:4 14:9,19 26:19 applied 9:1 24:17 61:19 apply 8:21 appreciate 44:2 87:22 91:5,18 approach 15:1,4 45:14 60:9 67:6 86:8,14 106:22 appropriate 59:20 66:12 approval 53:22 approximately 26:4 architects 80:12 area 42:19 areas 46:22 73:4 ariella 2:13 asking 4:6 aspect 55:12 aspects 12:3 assess 82:20 assessed 29:3 assessing 10:11 assessment 19:12 22:21 37:4 49:3 assets 76:3 assist 66:17 assistance 8:22 associated 49:18 associates 2:19 3:19 5:10 11:24 37:22</p>	<p>association 21:3 69:21 71:10,11 75:8 93:17 101:19 101:20 associations 71:9 assume 104:12 108:23 assumed 99:15 assumes 55:23 assuming 48:21 56:6 assumptions 98:14 98:19 99:11 assurance 82:7 asthma 50:18 64:3 atlantic 1:23 atmosphere 64:20 75:13 attention 74:21 attributes 57:8 audience 44:9 audrey 60:14 august 6:24 authority 10:23 67:4 availability 79:1 available 12:10 31:12 54:22,23 65:24 76:19 average 61:20 avoiding 15:18 31:16</p> <hr/> <p style="text-align: center;">b</p> <hr/> <p>back 11:6 53:15 backing 104:18 backs 15:10 backup 15:22 23:21 62:7 96:18 bad 57:11 64:12 bagley 2:4</p>
--	--	---	---

<p>baking 63:13 balances 32:24 35:23 49:21 ballenger 89:13,14 89:15 91:14 bar 45:5 barriers 9:20 bartolotta 80:6,7,8 82:14 bartram's 76:10 base 23:12 27:3 28:15 based 11:19 12:2 51:23 56:13 57:18 58:24 63:6 80:10 87:10 92:7 99:24 baseline 93:4 basic 61:1 basically 41:8 basis 49:13 81:23 baylson 92:1,2,5 94:1 bedrock 59:10 began 78:7 beginning 9:5 39:13 begins 24:3 behalf 2:1,7,11,14 2:19 47:7 63:4 believe 30:15 31:10 39:19 79:14 88:14 believes 88:6 benefit 44:17 55:21 58:24 88:16 88:19 benefited 93:8 benefits 48:10,15 59:24 93:14 best 17:20 66:14 68:18,23 69:11</p>	<p>79:15 98:13 101:22 better 60:11 76:17 87:8 105:2 beverly 2:20 beyond 5:1,2 10:6 31:21 55:21 59:24 108:19 biden 7:12 93:18 bifurcated 27:10 big 8:5 106:20 bill 35:11 61:16 71:15,19,24 72:6 102:7,8 bills 18:17 19:2 22:10 26:10,11 27:12,14 35:17,18 50:17 51:16 61:14 61:20 90:20 91:15 101:24 106:13 107:2 109:7 bio 55:22 biofuels 56:9 biogas 64:18 biogenic 56:5 biomass 56:9,16 bishop 70:7,9 72:3 72:19 bit 6:12 34:4,18,19 41:4,8 92:15 blasio 62:14 block 71:11 83:19 84:1,3 blocks 58:12 bloomberg 8:19 44:4 board 101:12 105:18 bodies 10:20 boiler 15:12</p>	<p>boilers 83:12 bold 45:19 51:13 52:1 70:21 boldly 60:10 bomstein 83:2,3,4 83:5 borderline 64:4 bore 58:18 borne 28:12 boston 11:16 59:6 bottom 73:18 boxer 75:6,7,8 breathe 63:22 breathing 64:6 bridge 16:21 brief 12:7 34:24 briefly 82:22 bring 51:16 92:9 broad 20:18 23:1 44:8 89:21 broader 20:11 28:5 45:7 bronchitis 64:3 brought 44:3 brown 1:12 btu 49:14 bubble 21:20 build 57:2 67:4,8 86:9 building 12:22 51:3 71:5,12,17 72:6 80:9,13,16 86:1 87:12 94:2 98:2,19 buildings 8:2,4,6 8:23 13:18 15:4 18:11 23:16,19 32:13 33:23 50:21 51:9,20 61:12 65:19 75:18 76:22 80:18 86:4,13,18</p>	<p>86:23 87:8,11 98:20 102:11 built 56:24 68:23 81:1 98:22 bullet 32:23 bulleted 9:6 burden 18:18 21:4 22:11 burdened 69:7 95:19 burdens 75:20 burners 63:14 burning 63:9 64:22 business 1:5 6:13 9:3,8,12 10:4 20:13 33:4,8,19 34:20 36:23 68:6 68:9,16 70:17 71:3 72:10 73:5,8 73:11,15 74:8 84:21 85:19 86:12 90:2 92:10 100:7 106:20 108:4 businesses 78:6 79:7 87:13 88:23 93:9 busy 107:4</p> <hr/> <p style="text-align: center;">c</p> <hr/> <p>c 109:22 calculating 61:21 call 3:7 38:17,21 39:22 44:16 45:18 106:1 107:8 called 16:7 25:24 55:18 56:10 59:12 101:19 105:24 campaigns 71:8 campuses 87:12 canceling 61:4</p>
--	---	--	---

cancer 42:18 cancers 42:11 candidate 66:12 capital 49:5 67:11 capture 40:10 carbon 7:4,17,24 8:17,22 9:17 36:19 55:10,18 56:7 63:16 64:19 75:13 76:16 78:10 78:12 79:15 86:17 91:22 101:15 carbons 56:5 careful 18:11 carefully 41:18 carries 18:24 carrying 36:4 case 23:24 98:15 cases 14:9 42:18 64:10 cast 17:12 23:24 31:21 catastrophe 50:16 categories 58:24 category 59:18 cease 72:8 center 54:5 101:4 centers 76:21 century 84:3,5 94:10 certified 52:21 chairman 1:12 3:1 37:19 43:22 98:3 110:9,10 challenge 2:11 4:1 8:20 9:1 12:23 32:4 98:6 111:7 challenges 9:21 16:22 17:3,8 18:15 19:10 21:7 25:21 26:13 35:8	35:20 79:11,15 90:3 challenging 26:11 26:20 chamber 47:7 change 6:16 7:3,10 25:9 53:22 92:13 111:7 changes 93:7 chanin 50:3,4,7,9 52:8 chapter 65:14 characteristics 85:24 characterized 53:18 chart 108:13 chat 4:19 38:24 40:24 41:2,18 42:5 cheaper 76:14,16 80:23 children 42:20 63:21 64:3 choice 20:20 choices 64:14 choose 17:24 choosing 82:2 christina 47:4,6 christine 2:9 3:23 6:6,9 11:12 12:23 13:19 39:18 church 107:4 circumstances 32:12 circumvent 9:20 cities 2:11 4:1 8:19 111:7 citizens 88:24 city 7:4 8:12,21 10:19 16:3 18:3	18:19 21:1 22:7 25:7 35:13 45:5 49:20 52:2 53:5,9 53:10 54:1 57:4,7 68:15 71:22 72:1 76:21 86:5,14 87:5 88:20 91:2 91:11 101:4,15 102:22 103:18 104:6 106:8 107:14 109:2 110:19,24 111:1,3 111:22 city's 18:23 19:8 22:2 35:5 45:1 71:3,22 74:16 95:4 101:24 classroom 86:21 clean 15:3 48:21 65:12 79:24 94:23 101:10,16 103:20 107:15 cleaner 105:2 clear 25:20 44:9 66:20 78:18 81:16 clearly 39:23 40:9 65:16 climate 2:11 4:1 6:16 7:3,10,19 8:11,20,24 11:22 18:1 22:2 35:5 50:16 53:17,21 56:12 57:12 67:24 68:7 72:23 74:14 75:8 76:2 88:2 90:4 95:5,10 96:7 102:15 105:19,23 106:4 107:2 111:7 clinic 61:19 close 19:15	closing 74:13 83:11 club 65:13 66:3 cng 34:2 41:15 109:12 coal 55:24 93:1 codes 102:12 cold 15:6,12 31:4 coldest 96:16 coleman 47:4,5,6 49:11 collaboration 43:21 collaborative 60:8 collapsing 69:5 colleagues 52:14 collectively 49:19 college 76:21 94:8 colleges 87:12 collegial 44:15 collision 105:22 colorless 64:5 combined 6:20 combust 25:10 combustion 13:22 18:21 25:2,5 59:14 come 14:13 26:17 41:17 92:12 comes 36:1 55:13 64:22 comfort 82:8,16 comfortable 51:15 coming 18:3 30:6 44:24 51:24 110:21 commend 54:9 comment 11:10 44:6 58:10 67:17 comments 5:4 9:23 38:6,11 39:1
--	---	--	--

<p>40:23 46:19,22 50:5 58:4 70:1,20 74:21 91:18 92:9 97:20,20 98:4,11</p> <p>commerce 47:8</p> <p>commercialized 26:1,2</p> <p>commission 1:2 3:3,10,23 10:21 38:3,4 40:14 43:23 49:16 53:4 53:20 74:5 77:16 87:22 89:23</p> <p>commission's 39:17</p> <p>commissioners 1:13 52:10 67:23 74:13</p> <p>commit 91:11</p> <p>commitments 19:9</p> <p>committed 7:4 10:10</p> <p>commodity 26:5,9</p> <p>communities 18:19 21:8 95:19 106:17</p> <p>community 20:12 20:13 21:3 34:22 45:11 46:4 51:23 56:23 74:11 76:21 88:10 89:16</p> <p>company 73:3 87:16 92:8</p> <p>company's 73:18</p> <p>comparable 80:23 98:21</p> <p>compare 23:2 24:18</p> <p>compared 48:2 63:23</p>	<p>compendium 41:19</p> <p>competitive 29:12 31:11 32:6</p> <p>complement 98:12</p> <p>complete 66:16</p> <p>completed 51:11 96:17</p> <p>completely 83:11 83:13</p> <p>complex 95:14 98:6</p> <p>complexity 66:15</p> <p>comprehensive 15:8 23:5,6 45:14 51:13 72:4</p> <p>concentrated 28:18</p> <p>concept 66:5</p> <p>concern 27:6 63:20</p> <p>concerned 53:21 105:4,21</p> <p>concerning 71:13</p> <p>concerns 49:23 66:23 72:16 76:8 98:24</p> <p>conclude 34:23</p> <p>concludes 110:7</p> <p>concluding 44:22</p> <p>concurrently 74:7</p> <p>conditioner 14:23</p> <p>conducted 111:6</p> <p>conducting 101:6</p> <p>confirm 6:3 51:3</p> <p>confirmed 90:16</p> <p>confirms 45:10</p> <p>congress 93:21</p> <p>connecticut 85:21</p> <p>consent 3:7</p>	<p>consequences 73:11</p> <p>consequently 86:10</p> <p>conservation 55:4 55:5</p> <p>consider 14:1 27:16 41:16 42:16 48:6</p> <p>considerable 79:8</p> <p>consideration 17:4 18:12 39:9 41:9 42:4,10,24 57:22 59:20 96:5 97:4 97:12</p> <p>considerations 19:1</p> <p>considered 16:5 42:14 62:9 74:22</p> <p>considering 33:17 41:11 99:7</p> <p>considers 102:22</p> <p>consistent 11:20 22:2,7 24:15</p> <p>consortium 60:7</p> <p>constituents 111:3</p> <p>constrained 26:7 32:21</p> <p>constraint 24:16</p> <p>construction 24:13 79:20 102:12</p> <p>consultant 11:7</p> <p>consultants 96:18 108:3</p> <p>consulting 11:3,15</p> <p>consume 92:17</p> <p>consumer 81:17</p> <p>consumers 28:13 81:19,23 82:6 93:9</p>	<p>consumption 21:9</p> <p>content 109:22</p> <p>contesting 68:11</p> <p>context 6:12</p> <p>continual 57:10</p> <p>continuation 13:12</p> <p>continue 6:18 8:14 14:8 22:15 75:12 78:24 91:2 93:3 98:8 110:22,23 111:10</p> <p>continued 29:8</p> <p>continues 31:2</p> <p>continuing 25:10 30:9 41:12 91:20 111:21</p> <p>contractor 99:3</p> <p>contractors 80:12 82:9</p> <p>contrast 73:14</p> <p>contributes 95:8</p> <p>contributing 8:5 8:10</p> <p>control 57:19 81:18</p> <p>conventional 24:2 26:18 78:14,18 105:3</p> <p>conversation 3:8 3:17 4:23 5:3,13 95:15 110:23 111:4,11,17,21</p> <p>conversations 21:5</p> <p>conversion 78:10 104:10</p> <p>convert 24:3</p> <p>converting 14:19</p> <p>cook 48:1</p>
--	--	--	--

<p>cooking 63:14 cool 14:23 cooling 51:20 61:3 61:6,13 76:4 85:16 86:7 cooperative 77:20 coordination 66:10 core 34:20 corporation 10:22 101:13 corporations 21:4 corrections 60:18 correctly 57:9 cost 14:13,15 17:4 26:3,18 27:11,22 28:7,10,12 29:12 31:11 34:11 49:1 49:8,13 51:18 57:20 58:24 61:15 61:18,22 62:20 66:22 75:17 82:16 86:2,9 88:16 97:14 98:21 99:1 99:6,8,11,15 104:19 costing 14:14 costly 75:20 costs 21:10 26:21 26:23 27:1,5 28:1 28:4,14,17 32:8,11 36:4,8,11 49:3,3,5 49:14,18,22 62:2 66:23 80:24 87:4 88:13 council 53:10 54:1 71:22 94:23 95:16 95:22 96:1 97:9 110:19 111:2,22 councilman 38:8 39:12 92:3</p>	<p>counter 102:14 counterparts 56:12 counting 56:14 68:2 countries 42:13 country 42:1 94:3 couple 71:24 course 20:24 21:18 64:1 court 39:15 87:23 court 39:15 87:23 covid 90:12 create 9:21 30:8 51:16 52:1 60:8 creates 104:6 106:22 creating 31:14,15 69:2 88:7 93:15 creation 9:18 88:11 creative 33:3 106:3 creator 94:5 credibility 99:2 credit 108:6 crises 50:14 crisis 68:7 90:5 95:11 105:23 107:3 criteria 9:16 10:6 21:19 22:19 23:3 24:19 28:22 32:19 32:21,24 62:19 63:15 critical 8:9 80:15 81:13 82:19 98:6 cross 23:9 crowd 109:18 crr 112:3 crucially 51:18</p>	<p>culminate 19:20 culturally 92:18 current 3:9 11:19 25:12 26:4,7 31:21,22 33:19 36:24 48:16,18 61:16 87:16 104:21,24 currently 14:16 34:5 37:2 48:6 54:24 71:14 90:3 91:14 customer 14:7 19:17 27:3 28:15 36:8 62:11 108:11 customers 14:8 17:23 26:6,11,15 27:10,13,24 28:5 29:14 30:6 35:12 35:18,23,24 59:17 66:18 67:3,11 83:8 88:23 89:22 90:13,16,19 96:13 104:15,17 108:24 109:7 cutting 17:4 60:1</p> <p style="text-align: center;">d</p> <p>dan 5:23 11:6,14 37:19 dandelion 85:20 daniel 2:16 data 36:10 86:4 89:3 99:3 104:9 date 3:20 89:3 98:5,13 davis 100:16,20,24 101:1,3,3 day 68:8 days 31:5 83:17 de 62:14</p>	<p>dealing 108:22 death 69:5 debt 90:23 debunked 56:8 decade 56:9 93:16 decades 13:9 18:3 30:7,17 62:3 decarbonization 11:21 12:16,18 13:5 14:18 17:6 17:17 19:9 20:5 21:24 22:5 29:13 32:18 35:22 65:16 65:18 79:5 decarbonize 12:22 13:16 25:22 51:21 78:22 91:4 decarbonized 14:2 15:17 23:11 25:8 25:19 29:4,19 31:11 33:11 35:9 36:3 64:18 75:11 96:23 decarbonizes 29:6 48:12 decarbonizing 35:4 80:20 december 83:9,9 83:17 decided 6:12 92:20 decision 49:20 80:17 81:23 82:6 decisions 81:17,19 102:23 108:11 declined 29:24 decommissioning 67:14 decrease 18:2 22:10</p>
--	--	--	--

<p>decreased 18:1 deep 11:21 45:7 50:16 deeper 58:18 91:8 deeply 70:12 defer 68:9 definitely 55:11 106:13 degrade 17:16 delayed 53:16 deliver 9:10 16:14 29:8 31:3 33:22 deliverable 10:6 delivered 14:3,10 14:16 18:10 delivering 10:7 16:18,18 delivers 16:9 delivery 47:23 59:22 demand 18:1,2,5 34:15 49:7 58:20 demands 17:19,21 32:14 47:17 96:15 democracy 68:11 69:23 democratically 68:3 demonstrate 48:24 demonstrated 54:1 density 32:13 36:13 59:3 department 53:5 53:10 depend 28:2 32:11 depends 28:9 depth 51:12 deregulated 77:23</p>	<p>derek 1:12 derived 95:8 described 24:6 describing 19:23 design 28:3 69:13 74:10 designed 24:13 69:14 destroyed 83:19 detail 7:20 99:10 detailed 12:9 44:13 70:19 98:10 99:2 details 67:18 73:21 98:18 100:10 determine 59:15 67:9 determining 108:12 devastating 73:11 develop 19:11 developed 46:2 developers 80:13 developing 10:2 20:7 63:21 development 21:3 41:13 60:9 94:6 device 5:18 dews 97:24 98:1 100:9 102:19 dickinson 83:5 die 84:17 died 42:20 dienna 43:6 77:5,9 difference 31:1 different 9:2,7,15 9:15 10:4 12:21 14:17 19:19,23,24 20:8 21:21,23 22:19 23:1,9 33:7</p>	<p>33:8,10,18 36:18 41:21 61:12,12 78:23 differently 55:23 difficult 19:4 99:5 difficulty 64:6 dimension 24:10 dioxide 64:20 78:10,12 dir 5:15 38:7 46:12 direct 11:8 48:14 69:20 directed 72:7 direction 7:13 84:3 107:11 directions 23:1,7 33:1,11 36:19 directly 5:4 28:24 29:1 71:21 director 2:3,9 6:10 11:14 38:2 58:8 60:16 65:13 67:24 70:10 77:18 80:9 89:16 94:22 98:2 107:21 110:8 disappearing 93:2 disappointed 41:4 108:2 discouraging 102:12 discuss 24:21 35:1 discussed 29:16 discussion 44:1,15 45:13 92:10 discussions 21:6 92:13 displacement 47:18 51:17 displacing 48:13</p>	<p>displaying 6:4 disposal 55:14 disrepair 50:17 disruption 14:7 distinction 26:21 distribution 49:6 distributors 102:5 distrust 53:18 diverse 103:19 diversification 1:5 3:4,21 5:2,7 6:13 9:3 10:2 12:6 17:5 17:7 18:4 19:12 19:21 20:1,6,16 21:24 22:5 27:15 33:4,8 36:16,18 44:1 45:3 48:9 50:23 53:1 54:10 63:3 68:16 70:17 71:3 72:10 82:21 85:15 87:14 88:18 89:24 97:3,7 100:12 104:10 108:5,17,18 111:5 diversify 23:6 106:19 diversifying 108:19 divided 58:23 division 1:23 documented 73:13 documents 57:5 dogs 84:2 doing 13:13 59:23 83:22 dollar 53:8 dollars 49:15 111:14 double 56:14 dr 63:1,3 65:4 72:21,22 74:24</p>
--	--	--	--

<p>draft 1:5 44:7 50:22 51:7 72:17 82:22 89:24 91:6 98:4 108:15 109:21</p> <p>draw 21:6</p> <p>drawback 14:12 15:4</p> <p>drawbacks 15:19</p> <p>drilling 58:19 78:4 78:15</p> <p>drive 76:24</p> <p>driven 53:17 66:11</p> <p>due 3:9</p> <p>dues 101:18</p> <p>dwayne 70:6,9</p>	<p>educate 110:23</p> <p>education 92:8</p> <p>educator 109:21</p> <p>effective 49:1 57:20</p> <p>efficiencies 81:4</p> <p>efficiency 13:3,9 13:15 55:5 66:6 69:3 82:11 102:13 106:11,15</p> <p>efficient 13:4 15:17 48:2,3 51:10 57:20 61:11</p> <p>efficiently 15:3</p> <p>effort 57:1</p> <p>efforts 74:15,17</p> <p>either 105:7 110:8</p> <p>elected 68:3 69:20 107:8,10</p> <p>electric 14:20,21 15:3 17:24 23:17 26:16 31:16 75:22 83:14 103:22 109:5</p> <p>electricity 15:6 16:19 47:17 48:14 49:7,13 77:22,24 79:17 83:14</p> <p>electrification 14:17 15:9,16 16:3,13,21,22 17:23 23:15,18,23 25:1 26:12 27:5 27:18 29:22 30:2 30:17,22 33:13 34:9,16 35:16,21 48:5,11 49:4 51:3 55:19 60:2 64:17 65:19,20 66:21 67:7 68:14 69:6 69:22 71:5,12,18</p>	<p>72:6 73:24 74:16 79:16 80:21,22 81:2,6,8,11 82:3,7 82:12,16,18 96:12 97:15 98:16 104:2 108:16,16,23 109:15</p> <p>electrifies 23:19</p> <p>electrify 27:8,20 28:21 29:15 35:18 35:23 66:18 109:4</p> <p>electrifying 27:1 67:2</p> <p>electrolysis 64:21</p> <p>elements 95:22</p> <p>eligible 26:15</p> <p>elisa 75:1,2</p> <p>emailed 75:2</p> <p>emergency 3:10 81:22</p> <p>emily 100:16,20 100:24 101:3 103:2</p> <p>emission 48:10,15 48:22 86:17</p> <p>emissions 7:7 8:1 8:23 13:22 14:4 19:17 21:23 22:3 24:11,14 47:19 48:20 49:2 55:11 56:13 95:9</p> <p>emitted 25:7</p> <p>emitting 48:13 58:15 59:21</p> <p>employee 52:22</p> <p>employees 18:8 53:9</p> <p>employs 18:8</p> <p>enable 86:8,10</p> <p>encourage 7:20 12:14 74:1,14</p>	<p>encouraged 51:2</p> <p>ended 20:21</p> <p>ends 55:14</p> <p>energy 9:9,10 10:23 11:15,17,20 13:3,9,14,17 18:10 18:17,23 19:24 21:4,9 22:11 23:1 23:7 25:4 33:1,11 33:23 35:7,17 36:19 47:21,23 48:21 49:8,12 50:17,20 51:10,16 52:21 54:5,7,19 55:22 59:3 60:10 61:14 62:20 65:12 66:6 67:4 68:18 69:3,7,10 73:20 74:2 77:18,19,20 78:9,22,24 79:17 79:24 81:4 85:20 86:16 88:9,21 89:16 92:10,16,17 92:20,24 93:2,5 95:6,19 96:6,9 101:10,16 102:11 102:13 103:20 104:2,7,11,13,16 106:7,10,11,13,14 106:17,23 107:2,5 107:15 108:9</p> <p>engaged 20:8 21:1</p> <p>engagement 9:24 12:4 20:9 21:12 21:18 95:15,17</p> <p>engagements 20:24 21:21</p> <p>engineers 80:12</p> <p>ensure 17:14 30:20 47:12 72:10 79:1 81:14 82:4</p>
e			
<p>e 1:12</p> <p>e3 2:14 3:18 5:9 10:7 11:7,14,14 19:10 37:21 44:18</p> <p>earlier 24:6</p> <p>earn 31:13</p> <p>earned 34:1</p> <p>earnest 65:20</p> <p>earth's 11:22</p> <p>easily 53:4</p> <p>eastwick 6:23</p> <p>easy 109:24</p> <p>economic 12:5 49:21 70:13 105:22 108:22 110:5</p> <p>economically 8:16 109:16</p> <p>economics 28:19 29:16 61:19</p> <p>economy 79:12</p> <p>econsult 12:1 37:22</p>			

<p>98:13 ensuring 91:11 entezari 85:3,3,4,7 85:9 87:2 entire 28:15 entirely 59:8 79:21 environment 80:16 95:3 environmental 18:18 20:12 42:4 45:10 49:21 55:12 73:13 74:17 78:8 78:17 89:9 94:24 environmentally 95:13 envisions 96:13 equal 28:6 equality 25:9 equipment 51:19 80:17 82:10 99:15 equipped 82:5 equitable 80:2 89:1 109:15 equity 18:15,24 19:1 20:13 35:19 96:2 107:16 equivalent 49:13 erin 2:4 87:23 especially 15:7 63:10 81:12 94:12 95:18 111:11 esq 2:2,4,5 esquire 38:1 essential 48:5 51:4 68:14 71:4 89:18 essentially 14:8 15:14,21 16:16 25:3,10,13 44:16 establish 99:7</p>	<p>established 99:20 estimate 96:18 estimates 99:1 ethylene 24:2 evaluate 10:5 17:5 22:18 evaluated 32:20 58:22 evaluating 33:7 37:8 100:3 evaluation 23:2 49:17 62:19 69:12 69:13 everybody 46:14 everyone's 95:2 105:4 evidence 82:15 110:1 evolution 58:14 59:16,21 ewall 54:17,18,18 56:22 57:15 58:1 exact 28:1 108:20 exactly 53:6 examine 74:6 91:3 examined 73:4 90:1 examiner 2:4,6 40:13,15 42:6 43:2,5,10,17 45:15 46:9 47:1 49:9 50:1,6 52:6,16 54:14 56:20 57:13 57:24 60:3,12 62:5,22 65:2,7,9 67:19 69:16 70:4 72:2,18 74:23 75:5 77:3,9,13 79:13 80:4 82:13 82:24 85:1,5 87:1 87:18 89:5,12</p>	<p>91:13,24 93:24 94:19 96:21 97:17 97:22 100:8,15,20 100:24 101:2 102:18 103:1,7,12 104:23 105:9,15 106:24 107:18 109:9 110:2,6 example 51:7 exception 32:20 75:22 exciting 76:19 exclusive 35:9,16 excuse 43:10 56:20 57:13 60:3 62:5 65:2 70:8 102:19 exec 5:15 38:7 46:12 executive 2:3 38:2 58:8 60:16 70:9 98:2 110:8 exemplary 45:4 existing 14:6 79:22 80:18 81:3 81:11 82:17 98:20 exists 36:24 expand 9:11 expanded 13:11 expansion 103:18 expect 55:17 99:21 expectation 48:17 expected 18:2 26:3 expensive 29:20 41:14 56:18 104:20 experience 26:15 82:9 expert 69:12 107:5 experts 98:9 107:6</p>	<p>explain 41:17 explanation 44:13 explanatory 44:19 explore 12:22 explored 16:6 100:2 exploring 8:13 34:3 51:4 96:6 explosion 83:18 84:5 extensive 46:1 56:2 extent 28:10,17,18 32:10,11 extrapolated 99:8 extreme 31:4 68:7</p> <p style="text-align: center;">f</p> <p>f 109:22 face 17:3 29:14 50:14 faces 90:3 facilities 10:21 45:23 78:4 101:12 facing 21:7 22:11 fact 42:16 71:1 factor 24:21 57:6 factors 24:23 fail 47:14 fails 55:9 fair 68:20 86:24 fairly 44:24 faith 70:11 105:24 fall 111:12 falling 30:6 false 55:3 familiarity 82:9 family 93:15 94:7 far 12:8 21:16,19 22:23 37:6,18 52:24 54:10</p>
---	---	--	--

<p>farm 93:15 farmhouse 59:4 fast 39:24 40:9 feasibility 32:10 36:9,23 66:4 81:10 feasible 35:22 feasibly 47:15 feature 4:19 80:21 february 90:24 federal 7:12 99:2 fee 107:12 feedback 1:4 20:23 21:16 37:6 37:6,7,17 100:11 fees 69:21 fight 57:1 figuring 50:24 95:12 filled 60:20 final 21:17 28:22 37:13 39:12 41:4 41:5 70:2 72:17 74:22 95:20 98:7 finalizing 39:10 finally 18:14 22:13 23:22 28:8 31:18 57:3 64:13 83:10 87:14 100:6 financial 19:17 81:10 104:1 financially 22:15 financing 34:11 88:15 find 69:17 92:13 finding 35:3 findings 12:19 35:1 finish 58:3 finite 84:13</p>	<p>firm 11:15 firms 11:24 12:2 first 24:21 25:20 35:3 40:16 41:10 41:15 50:24 59:1 66:15 67:3 75:10 77:21 84:17,19 92:12 101:5 103:16 five 26:4,9 83:19 84:2 flooding 6:22 focus 5:6 8:24 11:17 46:19 69:2 73:3,6 85:12 86:2 87:10 focused 10:17 21:6 folks 10:18 19:2 20:15,18,19 27:7 29:22 44:3 followed 20:17 following 66:2 96:10 follows 58:22 footprint 31:6 76:17 force 18:13 28:23 70:11 forecasts 31:23 49:12 forefront 91:5 foreseeable 48:18 form 15:19 16:12 16:20 33:21 58:5 format 44:7,10 former 45:21 52:21 forms 20:8 forth 17:1 forthcoming 44:20</p>	<p>fortunately 7:11 fortune 73:2 104:20 forum 68:11 forward 20:4 21:15 37:16 67:17 70:1 72:15 81:9 91:7,20 98:7 111:21 fossil 8:8 11:19 13:21 18:21 56:11 68:5 90:2 95:7,8 found 13:1 founder 105:19 107:21 four 21:19 23:1,2 63:14 64:14 93:20 fourth 16:4 fracked 83:11 fracking 41:20 78:4 fracture 78:16 frame 46:19 frances 105:11,15 105:18 francisco 11:16 fratto 2:17 free 79:15 83:10 frequent 6:19 frequently 64:9 friday 110:15 fridges 61:5 friendly 102:11 friends 92:4 front 27:4 80:24 88:13 fuel 8:8 11:19 13:21 26:15 56:11 61:15 68:5 95:7,8 fuels 14:2,5,12 18:21 23:13 26:1</p>	<p>29:11 90:2 full 28:11 39:15 44:17 49:3 60:2 65:15 100:10 fully 39:18 51:23 65:15 81:9 87:5 100:1 funding 44:5 funds 71:7 89:2 furnace 15:11,22 96:15 99:14 furnaces 14:19 further 27:15 30:15 34:4,19 69:24 73:20 79:7 91:7 97:20 98:15 future 8:15 17:17 17:20 18:5 29:5 33:3 41:13 44:21 48:18 52:9 62:16 68:15 71:6 72:11 76:19 79:6,11 90:7 91:8,22 101:7,10,14 102:23 105:8 108:12 futures 19:24</p> <hr/> <p style="text-align: center;">g</p> <hr/> <p>gains 48:4 gardens 76:10 gas 1:2 3:3,10,23 8:7 10:21 13:20 13:21,24 14:4,14 14:15 15:11,22 16:18 17:9,18,20 18:5 21:22 23:11 23:20 24:11 25:3 25:8,12,19,21,24 26:5,8,18 27:2,13 27:22 29:4,8 30:5 30:11,11,18 31:11</p>
--	---	---	--

<p>33:21 35:10,19 36:3 38:2,3 39:17 40:14 41:12 43:23 47:18,24 48:3,7,14 48:19 49:8,14 52:9 53:4,19 54:21 55:1,22,24 56:10 58:14,22 59:2,11,19,21 61:14,16,17,21,23 62:1,3,4,9 63:9 64:7,18,19,23 67:14 71:8,10,11 73:9,10 75:11,15 76:19 77:16 78:2 78:5,11,14,18 79:11 80:20 83:11 83:18 84:5,9,13,15 84:22 87:15 89:23 90:19 91:10 93:8 95:8,9 96:14,19,23 97:10 101:20 102:3 103:18,23 104:6,14 105:1,6 107:22 108:19,24 109:2,8 gases 14:2 25:11 29:19 56:1 57:7 gasification 56:17 105:3 gasified 56:16 gemela 2:2 38:1 gene 102:7 general 28:3 44:11 59:10 generally 72:7 generate 73:10 79:19 generated 93:6 generating 94:2</p>	<p>generation 47:20 48:6,7,12 79:6 99:4 gentrification 106:18 geo 16:7 23:23 28:9,13 31:19 32:9 58:11,13,17 59:22 60:6,17 62:9 geodelphia 85:10 geology 32:13 36:12 59:8 86:1,4 geothermal 16:8 33:22 36:6 46:1 51:5 52:4 61:16 61:21,22,24 62:18 64:15 66:5,13 68:18,22 69:10 70:22 73:17 74:6 75:24 76:13,16,24 85:12 86:6 88:6 88:12 89:7 97:15 99:23 103:21 104:19 106:6 108:9,13 ghg 14:4 22:1 24:14 give 5:22 6:11 11:4 50:4 109:21 given 12:11 19:8 27:4 36:12 59:9 64:14 65:23 104:15 108:10,18 glad 96:1,22 go 5:12,24 12:14 25:17 29:18 31:21 34:23 46:13 77:1 101:5 109:7 111:11</p>	<p>goal 7:6,11 8:17 9:5 24:15,20 57:4 65:15 67:3,15 73:14 100:13 goals 7:17 8:11 10:9,15 35:5 47:15 52:12 68:19 71:3 76:2 95:5 101:16 102:15,22 goes 43:13 going 4:24 12:15 13:17 17:3 22:22 34:23 38:12 39:21 40:24 62:13 64:24 84:14,18 94:8,13 94:14 109:18 110:7 good 3:1 6:9 11:13 50:23 55:9 65:11 70:7,8,23 75:7 80:7 85:8 88:18 89:14 92:2,2 94:5 98:1 105:17 106:7 106:16 107:20 government 7:12 99:3 governments 102:9 grant 82:14 graphics 109:23 grass 84:2 gratified 45:9 great 6:1 11:11 15:19 50:4 52:24 60:15 88:6 92:4 94:4,18 greater 51:12 greatest 68:8 greatly 51:18 green 1:12 3:1 37:19 38:8 39:13</p>	<p>43:22 80:9 88:7 88:10 92:3 98:2 110:9,10 greenberg 67:21 67:22,23 69:17 greenhouse 13:21 21:22 24:11 56:1 57:7 78:11 95:9 greenspan 72:20 72:21,23 74:24 greenwashes 64:23 grid 15:3 48:8,21 55:23 58:13,14,17 59:22 60:2,6 83:15 94:15 103:22 104:7 ground 16:8 24:5 60:19,22 62:13 76:6 84:14 group 10:18 11:1 20:18 27:10,23 85:10 89:22 101:23 102:6 groups 20:14 69:21 grow 58:12 growing 60:6 growth 49:7 guess 40:19 guidance 11:4 guide 68:4 guiding 10:17 96:3</p>
h			
<p>half 61:22 84:4 hall 1:4 3:2,11,13 3:15 4:22 5:6,13 37:7 38:1 41:7 110:12 111:24 hand 6:7 26:14 56:4</p>			

<p>happen 84:19 happened 53:6 happening 42:12 81:22 happy 41:16 55:2 95:16 96:4 97:2 hard 60:7 harder 53:14 harmed 42:17 harms 41:19,23 42:12 harper 2:20 harris 7:12 harrisburg 92:19 hastings 103:3,7 103:11,14,15 104:24 headquartered 95:1 health 3:10 18:14 19:3 41:20,23 42:4,9,11 47:12 51:15 63:9 68:20 73:12 74:2 75:9 75:14,16 76:21 81:7 82:8 90:9 94:24 96:2 healthiest 80:1 healthy 95:3 heaney 52:18,19 52:20 hear 1:4 52:13 109:10 hearing 2:4,6 21:15 37:17 40:13 40:15 42:6 43:2,5 43:10,17 45:15 46:9 47:1 49:9 50:1,6 52:6,16 54:14 56:20 57:13 57:24 60:3,12</p>	<p>62:5,22 65:2,7,9 67:19 69:16 70:4 71:19 72:2,18 74:23 75:5 77:3,9 77:13 79:13 80:4 82:13,24 85:1,5 87:1,18 89:5,12 91:13,24 93:24 94:19 96:21 97:17 97:22 100:8,15,20 100:24 101:2 102:18 103:1,7,12 104:23 105:9,15 106:24 107:18 109:9 110:2,6 hearings 53:11 110:19,21 111:22 heat 6:19 14:20,21 14:23 15:2,3,10,11 15:17,21 16:8,9,14 23:17 24:5 25:4 26:16,17 27:11 31:3 33:22 34:9 34:11,12 60:20 61:2,7 62:8 67:10 69:4 73:6,14,16 74:7 76:6 78:5 79:6 81:17 86:21 91:2,16 96:14,15 98:16,23 99:11,14 99:16,18,19 106:21 heated 8:6 23:17 73:16 heater 83:13 heaters 75:23 heating 12:23 13:17 32:14 51:20 54:24 61:3,12,20 63:11 80:1 85:16 86:6 91:5 109:18</p>	<p>heet 58:8,21 60:7 60:16 heidi 2:5 40:13 43:19 46:12,24 47:5 held 3:3 86:21 90:22 hello 58:7 103:11 help 82:19,20 101:15 106:16 helped 11:1 helping 8:16 12:3 helps 44:8 76:2 hi 54:18 70:7 83:4 94:21 103:14 hicks 87:19,20 88:1,1 89:6 high 22:23 27:13 30:2,21 59:14 66:20 76:12 82:10 98:16 106:8 higher 27:4 56:2 highly 51:9 hilco 45:22 historical 17:19 history 92:22 hold 53:11 holding 77:16 83:6 holes 58:18 holistic 67:6 home 14:24 34:12 50:17 52:4 67:6 69:3 81:21 89:18 99:4 106:12,15 109:19 home's 82:17 homeowners 109:17 homes 14:10 16:14 48:1 51:15 61:8 61:10 73:16 78:6</p>	<p>79:7 80:18 81:1,3 81:11,18,20 91:2 91:17 106:18 honest 41:3 hood 64:10,11 hope 44:19,23 49:23 51:22 74:21 98:12 110:20 hopefully 6:15 horizon 76:15 horribly 56:17 hospitals 87:13 hostage 86:21 hot 16:10,18 60:23 86:22 hotter 61:7 hours 15:6 house 63:11 83:10 83:20,23 84:4 92:16,23 99:22 household 63:19 households 35:17 90:21,22 91:9 104:3 houses 83:19 84:2 84:6 housing 36:12 76:22 huge 55:14 human 42:14 humanly 84:23 hvac 75:19 76:14 81:21 hybrid 15:9 23:18 23:22 27:18 30:24 33:15 34:12 35:21 49:4 62:10 73:24 75:18 96:12 97:14 98:23 99:13 103:22,23 108:16 109:14</p>
---	---	---	--

<p>hydraulic 78:16 hydrogen 23:14 59:17 64:20 103:21 104:24 105:1,5,6</p>	<p>improve 22:6 51:14 improvement 75:15 improves 81:6 improving 35:15 82:16 incentive 29:14 incentives 106:22 incineration 57:10 include 17:9 21:22 23:10 36:15 47:21 56:2 76:20 included 3:15 20:10,11 55:3 95:21 99:18 includes 19:14 32:18 89:8 95:21 99:14 including 9:3,24 12:4 13:3 19:1 20:9 25:23 33:4 33:18 39:3 41:14 44:3 53:9 59:24 63:15 79:21 80:11 80:16 88:7 90:4 103:20 104:5 111:1 income 18:16 66:17 67:1,2 75:21 81:14 89:17 90:14,16 104:3 106:17 109:6 incompatible 59:9 incorporate 9:23 incorporates 91:6 incorporating 21:17 37:5 increase 7:5 26:8 32:3 47:17 48:11 102:13</p>	<p>increases 35:18 increasing 47:19 93:13 increasingly 15:2 incremental 58:14 incurred 47:22 independent 53:2 54:12 indicating 7:14 indisputably 79:23 individuals 4:6 110:24 indoor 22:6 63:12 63:22 64:2,9 81:7 82:17 indoors 63:10 industries 59:13 industry 8:2 41:13 41:23 46:3 71:9 80:11 101:23 108:3 inequality 68:7 105:23 inexpensive 75:22 infographic 44:7 information 3:16 4:19,21 38:24 39:4 44:20,23 98:21 104:5 110:16 informed 89:3 101:22 infrastructure 14:6,11 16:2,13,15 16:24 17:9 28:12 31:2,16 34:7 36:13 51:19 69:3 78:22 79:21 85:18 104:22 109:6 111:14</p>	<p>initial 21:14 66:2 86:2 innovate 79:1 innovation 35:6 73:2 74:1,14 innovative 68:12 73:5 input 11:5 37:17 100:1 108:7 insights 54:7 install 32:1 81:20 installation 34:12 62:2 82:10 92:8 109:5 installations 62:12 62:16 installed 32:5 installing 33:21 52:3 86:12 instance 31:15 34:8 35:14 61:4 institution 68:24 instructions 3:13 intensity 59:14 intention 110:18 interconnected 50:15 58:12 interest 20:14 62:17 73:19 102:1 interested 44:15 interesting 16:11 16:20 104:5 interests 22:8 71:22 89:21 interfaith 70:10 105:19 interim 79:4 internal 53:5 interrupting 40:1 interruptions 40:6</p>
<p>i</p>			
<p>i.e. 88:22 104:13 ideas 106:3,21 identified 10:12 21:19 79:10 identify 19:16 identifying 37:8 ignore 53:4,14 ignored 53:11,15 imagine 26:6 27:9 immediately 65:21 66:19 impact 6:17 22:4,9 22:13 24:12,22 27:19 28:24 46:6 63:18 82:10 impacts 6:18 7:3 7:10 12:5 15:5,19 17:22 18:12,21 24:10 25:16 28:7 28:22 29:2 30:14 30:23 35:11,23 41:20,23 42:9 63:9 64:2 81:7 93:10 96:8 implementation 69:13 implementers 82:15 implications 19:18 important 18:6 21:12 24:8 30:4 46:20 92:21 93:23 94:13 99:7 101:21 importantly 94:11</p>			

<p>intrigued 8:13 intro 12:24 introduce 110:20 introduced 102:8 intuition 28:3 invest 105:7 investigation 30:15 investing 85:17 investment 17:11 29:9 69:4 79:8 87:3,6,9 88:15 investments 17:13 30:11 31:20 invite 60:5 involve 78:15 88:13 involved 88:22 97:10 involvement 45:2 involves 14:18 25:5 52:3 65:18 73:9 iron 17:12 23:24 31:21 isaias 6:24 issue 8:11 55:15 issues 5:1 19:5 30:1 53:17 54:7 68:8 111:18</p>	<p>john 43:6,11,13 77:5,9 join 60:6,10 joined 3:22 11:23 julie 67:21,23 70:5 june 37:14 41:5 justice 18:18 45:11 54:19 67:24 70:13 72:24 73:13 74:14,17 88:2 justify 79:8</p>	<p>l</p> <p>l 2:5 labor 18:12 68:20 88:9 ladder 94:9 lai 2:4 65:9 67:19 69:16 70:4 72:2 72:18 74:23 75:5 77:3,9,13 79:13 80:4 82:13,24 85:1,5 87:1,18 89:5,12 91:13,24 93:24 94:19 96:21 97:17,22 100:8,15 100:20,24 101:2 102:18 103:1,7,12 104:23 105:9,15 106:24 107:18 109:9 110:2,6,10 laid 10:14 landfilling 57:11 lapsed 38:20 large 15:5 25:22 27:23 28:9 30:3 32:10,11 55:14 90:13 largely 81:18 larger 56:5 largest 8:3 lastly 10:10 79:23 late 41:9 77:24 78:8 99:24 law 53:10 lead 15:5 18:1 29:5,23 30:3 47:19 57:1 99:4 leaders 69:20 107:8,10 leadership 102:2 102:17,20,21</p>	<p>leading 32:2 leads 28:6 leakage 56:3 leaks 13:23 leaky 75:12 leap 79:8 learn 69:15 73:22 85:21 101:17 106:7 learned 68:13 learning 106:21 leaves 108:12 left 27:13 38:18 45:16 54:15 65:3 81:15 107:5 legacy 92:22 legal 1:22 9:20 36:22,24 89:17 legislation 62:15 lego 58:12 length 12:12 level 6:21 22:23 95:20 levels 24:15 life 50:13 lifespan 82:1 light 12:17 94:12 likes 58:21 limit 51:18 limited 40:3 46:15 50:24 90:4 104:11 line 73:18 86:11 lines 84:22 link 42:5 links 41:1 lintmeijer 2:17 liquified 97:10 lisa 103:3,7,14 105:10 list 4:4 23:5,6 38:13 40:16 47:3</p>
<p>j</p>	<p>k</p> <p>katie 80:6,8 83:1 keep 4:6 10:4 84:10,11 keeping 5:5 keeps 106:13 kenney 7:3 kensington 76:12 key 14:12 21:7,19 28:11 31:1 94:14 kick 51:22 kids 87:3 killed 83:18 killing 84:9,10,11 kind 92:22 93:11 kinds 42:23 kleinman 54:5,6 knapp 2:9 3:24 6:5 6:8,9 75:2 know 3:5 4:12 6:15 9:20 17:23 26:11 32:24 40:3 46:15 48:19 54:21 80:22 81:2,6 94:4 95:5 99:17 known 47:16 kroger 77:14,15 77:17 79:14</p>		

<p>110:7 listen 107:9 litany 55:3 little 6:11 25:15 41:3,8 51:8 59:5 73:23 93:5 livable 70:13 live 83:5 101:4 lived 50:12 living 88:9 llc 43:21 lng 34:2 41:15 53:23 54:8 109:12 load 34:13 60:2 61:3 loan 82:14 lobby 69:21 lobbying 52:11 71:2,8,14,21 72:5 101:24 107:12 local 10:23 32:12 50:11 54:7 85:24 88:7 102:9 locked 81:24 long 4:8 17:11 35:12 37:10 62:1 76:15 78:21 80:24 82:1 84:11 99:8 longer 17:20 59:16 95:7 104:14 look 7:24 8:4 9:8 9:14,19 11:18 12:14 19:24 20:1 33:13,14 41:22 56:4 67:17 70:1 72:15 91:7,20 98:7 108:15 111:20 looked 7:19 looking 10:4,12 21:13,15 22:24</p>	<p>25:19 33:1 34:18 37:16 85:19 97:3 101:7,13 102:3 looks 6:2,5 55:20 looms 55:14 loop 61:7 lose 106:18 losses 47:22 lost 53:20 105:8 109:11 lot 7:18 32:11 34:5 38:21 41:7 57:6 61:5 62:17 84:4 92:20 low 14:4 18:16 27:11 45:5 59:3 62:20 66:17 67:1 67:2 75:21 81:14 89:17 90:14,16 91:22 104:3 106:17 109:6 lower 55:24 106:13 lowering 93:9 lowest 27:18 49:8 66:21 lungs 63:21,23 lynn 107:19,21</p>	<p>maintaining 16:23 30:9 85:18 maintenance 29:9 59:13 79:20 major 44:8 86:1 87:10 majority 59:19 81:21 86:19 making 25:13 49:20 51:9 66:11 80:17 81:24 manage 34:15 54:4 106:14 managed 38:15 management 10:22 101:13 manager 52:21 53:3 54:12 managers 80:13 managing 53:1 101:12 manufacturing 105:1 map 33:10 mapping 36:17 marcellus 14:15 march 90:20 margin 66:22 marginal 48:22 marie 112:3 market 1:23 66:11 77:24 marone 2:13 massachusetts 16:6 62:13 87:10 match 94:5 materials 1:5 11:8 12:10,14 39:3 44:7 50:22 51:2,7 68:17</p>	<p>matt 94:20,22 97:23 matter 78:23 matters 89:22 mayor 7:3 53:20 53:24 62:14 mayor's 7:6 mcclendon 2:2 4:18 5:15 38:1,7 46:12 mccool 75:1 mean 31:6 66:15 meaning 14:2 15:16 17:19 26:24 meaningful 18:24 70:16 72:11 means 18:23 23:4 55:24 meant 27:16 measures 13:3 15:8 26:23 78:11 81:5 82:11 meet 32:22 47:15 49:7 58:20 68:19 86:15 95:4 96:15 101:15 meeting 3:2,5,11 3:13,15,16 11:3 39:14,16 46:23 77:17 111:24 meets 62:18 82:7 mehdi 85:3,3,4,8 member 50:10 72:23 80:10 85:10 98:9 105:18 107:23 members 3:22 43:23 80:15 106:4 111:1 membership 101:21</p>
	<p>m</p>		
	<p>magavi 58:6,7 60:5 mahone 2:16 main 31:22 100:13 mains 24:1 109:2 maintain 22:14,16 47:11 73:15 75:19 89:18 91:16 104:20 maintained 30:19 31:8 109:3</p>		

<p>mention 57:18 108:10</p> <p>mentioned 12:23 13:19 30:1 39:13 55:6 59:24 64:16 85:13,23</p> <p>mentions 55:8 56:15 57:3</p> <p>mess 107:6</p> <p>met 79:15</p> <p>methane 13:22 56:2 78:10,11</p> <p>method 49:1</p> <p>methodology 44:14</p> <p>metrics 22:19</p> <p>michael 52:18,19</p> <p>microdistrict 16:7 28:14 58:11 60:17 75:24 77:1 85:13</p> <p>microdistricts 23:23 28:9 31:19 32:9 36:6 97:16 99:23</p> <p>microgrids 34:21 64:16 104:19</p> <p>microwave 64:11</p> <p>mid 1:23</p> <p>midst 17:10</p> <p>migatz 112:3</p> <p>mike 54:17,18</p> <p>miles 59:4</p> <p>million 49:14 90:23</p> <p>mindful 39:20</p> <p>minimize 14:7</p> <p>minutes 4:7 38:16 38:19 43:3</p> <p>mispronunciation 85:6</p>	<p>mission 80:10</p> <p>misunderstanding 61:1</p> <p>mitch 50:3,9</p> <p>mitigated 35:20</p> <p>mitigating 26:23</p> <p>mix 48:6,8,18,21 93:2</p> <p>mixed 25:15</p> <p>model 29:1 30:13 37:1,3 68:6 73:8 73:12,15 85:20 86:9 96:13 106:20</p> <p>modeled 28:24</p> <p>modeling 89:4 97:5 98:14</p> <p>models 33:5,9,10 33:20 36:23 73:5 74:8 80:19 88:15 99:9 100:7 108:23</p> <p>moderate 90:14</p> <p>moment 5:22 38:10 81:24</p> <p>momentum 94:2</p> <p>money 65:1 76:1</p> <p>monoxide 63:16</p> <p>months 51:24 83:23</p> <p>moral 68:8</p> <p>morning 3:1 5:14 6:9 11:13 52:14 65:11 70:8 71:20 75:7 80:7 85:8 89:14 91:19 92:2 92:3 94:18 98:1 105:17 107:20 111:16,20</p> <p>morning's 110:12</p> <p>move 20:5 43:18 54:20 64:15 77:14 84:21 90:2 91:10</p>	<p>94:8 103:19</p> <p>moved 27:11</p> <p>moving 7:13 25:4</p> <p>multi 70:11,11 87:11,12</p> <p>multimillion 53:8</p> <p>multiple 20:20 33:17 66:1</p> <p>municipal 76:22 86:13,17</p> <p>municipalities 71:16</p> <p>murphy 40:17,22 40:23 42:8 43:4</p> <p>museums 76:23</p> <p>mute 5:18,20 38:20 40:19</p> <p>mutually 69:18</p> <p>myriad 90:3</p> <hr/> <p style="text-align: center;">n</p> <hr/> <p>n 2:2</p> <p>name 4:10 11:13 39:21,22,23 40:7 40:22 43:11,20 47:6 50:9 52:19 63:3 65:11 72:22 77:17 80:8 83:4 85:8 87:16 89:15 92:5 94:21 101:3 105:17 107:20</p> <p>nancy 75:6,7 77:4</p> <p>narrative 44:13</p> <p>nascent 100:4</p> <p>nationally 62:17 93:17</p> <p>natural 8:7 13:20 13:24 14:3,14 16:18 25:2,12,24 26:5,7 47:18,24 48:3,7,14,19 49:8 49:14 54:21 55:24</p>	<p>56:10 64:19,22 75:15 78:2,5,18 79:11 93:8 97:10 103:18 104:6,14</p> <p>nature 22:20 39:4</p> <p>near 20:4 31:7 37:11 44:21</p> <p>nearby 61:9</p> <p>nearly 58:16 90:15 90:20</p> <p>necessarily 12:13 35:13 94:8</p> <p>necessary 7:9,15 72:9 105:5</p> <p>necessitate 87:15</p> <p>need 5:20 13:11,15 17:8 30:19 32:1 33:2 39:1 42:23 43:1 49:20 50:19 52:1,12 58:18 64:15 73:19 81:9 81:12,13,24 82:4,6 82:9,15 84:7,17 91:11 92:13 103:19,23,24 106:19 107:10,11</p> <p>needed 17:13 31:8 36:10 51:6,20 54:12 79:9 96:19</p> <p>needs 17:18 23:13 53:2 57:21 61:13 69:23 82:8 84:21 88:20 96:9</p> <p>negative 18:20 24:9 104:9</p> <p>negatives 32:19</p> <p>neighborhood 84:6</p> <p>neighborhoods 24:4 46:1 67:13 84:12</p>
--	--	--	---

<p>neighbors 84:1,10 84:11 107:22 net 13:7 24:15 36:18 48:4,15 86:15 network 16:9 46:4 51:5 54:19 networked 52:4 60:19 61:2,21 62:18 66:4,13 68:17,22 69:10 70:22 73:17 74:6 76:23 88:5,12 89:6 108:9 neutral 36:19 56:7 neutrality 7:5,18 7:24 8:17 never 74:18 new 9:9,10,13 11:16 31:20 33:4 35:6 36:23 51:18 60:9 62:14,15 68:12 69:2 79:19 79:21 80:17 84:21 85:21 86:11 98:20 100:7 102:10,12 106:3,20 newly 77:23 81:1 news 42:5 94:12 nice 23:8 54:20 niki 2:17 nitrogen 63:15 non 58:15 59:21 nonparticipant 28:21 36:1 nonparticipants 26:22,24 27:20 66:24 108:24 109:17 nonprofit 77:20 94:23</p>	<p>nonpublic 87:7 nontransparency 54:2 north 13:2 northeast 50:12 note 12:8 21:11 22:18 24:8,24 26:12 28:23 30:16 32:8,17 noted 31:1 noting 12:20 63:8 64:7 nox 25:6 nuclear 55:8,8,10 55:15,17 93:3 number 4:8 30:5 65:24 94:1 111:15</p> <hr/> <p style="text-align: center;">o</p> <hr/> <p>objective 90:8 obtain 44:17 occupational 94:9 odorless 64:5 offer 20:3 77:21 96:10 98:21 offering 69:24 78:1 offers 16:20 23:8 26:13 66:21 67:5 78:13 office 2:7 3:24 6:10 12:10 38:14 39:5,9 52:22 101:5 108:2 offices 11:15 oh 54:16 96:22 oil 54:23 okay 5:23 40:15 40:22 42:8 43:5 43:17 45:17 46:9 50:7,9 54:17 58:6 62:24 85:7 101:2</p>	<p>old 86:23 92:4 older 64:4 once 13:14 38:19 39:17,22 one's 63:11 ongoing 10:3 16:1 17:13 96:9 online 20:17 oos 52:24 53:9,24 54:9 op 77:19 78:24 open 20:21 30:21 60:8 operated 68:23 operating 87:4 operation 79:20 opponents 53:19 opportunities 10:1 26:13 37:9,11 96:9 opportunity 8:20 21:13 39:7 43:24 44:2 45:20 46:21 58:9 63:2 65:5 67:16 72:22 74:6 85:11 87:21 93:19 98:3 100:10 oppose 71:12 opposed 46:4 71:21 75:10 opposing 53:19 71:23 opposition 76:7 option 9:16 14:1 16:4,12 17:24 36:7 75:10 80:2 82:4 85:13,15 108:18 options 9:22 12:6 12:16,18 19:12,19 20:1,16 21:24</p>	<p>22:14 23:9 27:15 32:7 33:8,18,18 34:17 35:21 36:16 36:18 37:2 41:14 51:8 65:17,24 70:23 80:20 82:21 90:1 91:3,16 97:3 97:7 98:17 100:5 103:20 104:16 105:2 106:5 order 4:5 7:2,9 21:6 29:10 30:19 31:8 79:1 89:1 95:4 organic 78:3 organization 47:9 53:13 54:3 80:10 94:24 101:9 organizations 50:11 89:9 107:23 organizing 70:11 outcome 29:10 outdated 56:6,13 outdoor 22:6 outdoors 64:8 outlay 67:11 outlined 19:10 36:17 37:2 48:23 outreach 45:6 outside 53:13 54:3 81:18 83:22,24 oven 63:13 overall 32:2 41:24 70:18 oversee 10:20 overview 3:19 5:11 34:24 44:8 owned 87:12 96:7 owner 8:12 87:11 owners 80:13</p>
--	--	---	---

<p>owning 85:17 oxide 63:16</p>	<p>partner 11:24 67:8</p>	<p>31:19 33:2</p>	<p>30:14 31:13,20 44:1 47:10 71:1 81:18 88:19 89:21 90:7,13,15 100:6 102:19</p>
<p>p</p>	<p>partners 19:11 45:22</p>	<p>peter 43:18,20</p>	<p>phase 19:14 82:18 86:11</p>
<p>p.m. 4:15 pace 30:22 40:10 page 56:15 97:4 paired 81:4 96:14 pandemic 90:12 paradigm 11:20 paradox 82:11 pardon 19:8 parking 84:4 part 4:22 8:5 20:22 24:2 40:23 55:18 78:21 84:20 88:16 93:2 97:1 104:8 105:24 106:2 participant 28:20 35:24 participants 20:10 26:22 27:19 66:22 104:13 109:1,4,16 participate 3:14 43:24 94:18 108:4 participated 110:12 participates 71:7 participation 70:16 74:11 participatory 51:23 particles 63:17 particular 63:20 99:12 particularly 31:4 63:13 90:10 101:17 parties 44:15 69:15</p>	<p>partnership 21:2 party 69:12 74:12 pass 110:7 passage 111:12 passed 71:23 passyunk 45:23 path 20:4 35:22 59:16 60:9 79:5 81:9 86:15 pathway 14:18 pathways 9:8,15 pay 90:19 109:4 paying 18:17 19:3 27:13 69:20 pays 101:18 peak 34:15 96:15 peaks 60:1 penn 54:6 pennsylvania 1:24 41:24 42:19 63:6 65:14 92:15 93:6 102:8 people 4:8 38:21 42:16 44:16 64:4 69:5 78:5 83:18 84:17 92:23 94:16 105:23 107:7,14 109:6 110:13 performed 44:18 perimeter 86:5 periods 15:12 96:16 permitted 37:3 person 41:17 75:4 107:4 perspective 15:24 20:15 24:24 26:14</p>	<p>pgc 2:1 pgw 1:5 3:20 5:4,6 6:14 8:7,9,12,14 9:1,9,21 10:10,19 10:20,24 12:17,21 13:9 15:24 16:16 16:24 17:2,10 18:8 19:13 20:4 20:15 23:5 24:3 27:2 28:15 29:6 30:4 31:2,24 32:3 33:3,9,13,24 34:5 34:10,14,20 35:4 35:11 36:4,17,19 36:24 41:14 45:23 50:19 52:2,9,10 53:7,23 54:2 63:2 64:15 65:23 66:8 67:8 68:4,23,24 69:2,8,20 70:19 71:6,7,14 72:3,7 72:12 74:15 76:18 78:7 79:10 81:9 82:20 83:8,11,21 84:15,20,21 85:15 86:3,8 87:5,15 88:4,17 89:1,10 90:1,3,18,20 91:3 91:10,21 95:5,12 96:5 97:6,9 101:8 101:9,11,18 102:2 102:5,22 104:14 104:15 105:7 106:5,14,19,23 107:11,14 108:5 108:17,19,24 109:7,8 111:6 pgw's 3:4 16:1 19:17 23:12 25:22</p>	<p>phila.gov 39:6 phila.gov. 4:17 110:17 philadelphia 1:2 1:24 3:3 6:17 8:2 12:2,6 13:13 17:21 18:15,22 20:19 21:2,8 22:17 23:16 25:3 31:3 35:8 36:9 42:15 47:8 52:20 53:2,23 59:7,10 60:6 63:7 67:4 70:12 77:16 79:12 80:2 85:9 86:20 89:23 91:3 92:6,7 94:6 99:22 101:4 101:10,12 102:9 107:24 111:1,4 philadelphia's 18:11 36:12 52:22 77:19 102:14 philadelphian's 102:17 philadelphians 13:8 22:12 53:21 77:23 79:2 81:14 89:18 90:9,10 91:1 philly 50:10,12,15 83:6 95:1 photovoltaic 46:2</p>

<p>physicians 40:17 63:5</p> <p>picture 6:22 56:5</p> <p>pilot 10:11 20:3 37:9 45:19 46:5,5 52:3 66:3,12,16 67:9,15 69:9,14,14 70:21 73:7,22 76:20 81:13 88:5 88:13 103:24 106:6,7</p> <p>pilot's 74:9</p> <p>piloting 73:23 86:11</p> <p>pilots 66:1,17 74:1</p> <p>pipe 59:5</p> <p>piped 60:23</p> <p>pipefitting 24:3</p> <p>pipeline 14:3</p> <p>pipes 16:10,16 17:12 33:22 60:20 75:12</p> <p>piping 75:11 84:12</p> <p>pjm's 48:7,11</p> <p>place 56:16 109:4</p> <p>places 55:7 92:18</p> <p>plain 60:21</p> <p>plan 41:5 52:1,9 63:3 111:13</p> <p>planet 68:16 70:14 73:12 84:9,18</p> <p>planned 24:1 90:7</p> <p>planning 51:23</p> <p>plans 41:13</p> <p>plant 53:23 54:8</p> <p>plants 107:22</p> <p>play 80:15</p> <p>playbook 7:20</p> <p>please 4:9 5:17 6:3 7:1,22 10:16 39:20,22 40:8</p>	<p>46:18,18,18 58:4 110:15</p> <p>plus 86:20</p> <p>pm 25:6</p> <p>pocketbook 19:2,5</p> <p>point 5:12,19 99:18</p> <p>pointed 93:18</p> <p>points 44:9,21 46:20 82:5</p> <p>police 76:11</p> <p>policies 52:11 71:17</p> <p>policy 22:2 28:2 54:5 78:21 80:8 92:14,20</p> <p>pollutants 63:15 64:6</p> <p>pollution 25:11 96:8 104:7</p> <p>poor 64:1</p> <p>popularity 78:19</p> <p>population 18:16</p> <p>portfolio 2:19 3:19 5:10 9:12 11:24 37:22 103:19</p> <p>portion 26:9 90:13</p> <p>poses 35:10</p> <p>posing 35:19</p> <p>positioned 54:4</p> <p>positive 24:9,12</p> <p>positives 32:19</p> <p>possibilities 51:5 51:11</p> <p>possible 3:13 4:2 40:6 75:21 84:23 90:1 98:14 99:6</p> <p>posted 39:17</p> <p>potent 78:12</p> <p>potential 15:23 36:16 37:9 58:10</p>	<p>58:22 62:15 76:20 81:8 111:12</p> <p>potentially 32:2 76:3</p> <p>pour 75:13</p> <p>poverty 50:16 106:9</p> <p>power 47:19 50:10 55:10 60:1 70:10 70:21 83:16 88:2 88:6 92:16,23 105:18,21</p> <p>power's 67:24 72:23</p> <p>powerful 29:14 71:4</p> <p>practice 69:11</p> <p>practices 10:5 45:2,5 101:22</p> <p>precision 99:5</p> <p>predictions 108:22</p> <p>predictor 17:20</p> <p>preempt 71:16</p> <p>preemption 71:24</p> <p>preferences 22:8</p> <p>preliminary 12:18 34:24 35:3</p> <p>premium 14:13 26:18</p> <p>prepared 39:18 53:9</p> <p>present 2:1,7,11 2:14,19 35:22 36:7 87:21</p> <p>presentation 5:9 12:12 24:7 37:20 61:10 109:23,23</p> <p>presented 33:12 82:22 104:8 105:3</p> <p>president 43:21 73:1</p>	<p>pressures 29:15</p> <p>pretty 59:15</p> <p>previous 7:6 29:17</p> <p>price 26:5 31:12 99:18</p> <p>prices 26:8 93:9</p> <p>pricing 57:18</p> <p>principle 14:22 96:3</p> <p>prior 3:16 10:1 90:12</p> <p>priorities 35:14 47:10</p> <p>priority 35:4</p> <p>probably 23:20 35:10 57:6</p> <p>problem 25:13 46:7 57:16 64:24 65:1</p> <p>problems 68:10</p> <p>proceed 100:3</p> <p>process 38:15 51:24 53:3 54:4 82:5,19 89:8 95:15,18,21,24 100:3</p> <p>procure 36:3</p> <p>procuring 33:21</p> <p>produce 14:4 25:11 92:17</p> <p>produced 48:2</p> <p>producers 102:3</p> <p>produces 13:21</p> <p>product 42:15 78:20</p> <p>production 47:22 78:9,15</p> <p>professionals 80:11</p> <p>program 17:11 20:3 31:22 51:14</p>
--	---	---	---

<p>65:13 67:5 73:7 77:18 80:9 81:13 82:15,18 88:5,17 programs 13:10 104:1 prohibit 74:15 102:9 project 10:11 11:23 12:4 33:6 37:9 45:19 46:5,6 52:3 66:15 69:10 70:21 89:7 106:6 projected 6:17 61:20 projects 76:15,23 98:22 promise 57:1 88:7 promising 10:13 36:7 66:6 67:5 70:23 95:23 promoting 74:2 102:6 property 45:24 propose 10:8 58:21 proposed 53:7 100:11 protect 68:24 95:2 protecting 90:8 proud 92:22 prove 108:9 provide 5:10 11:4 15:17 20:20 38:5 49:2 61:2,3 62:4 67:10 72:4 73:20 79:24 98:4,21 100:11 105:5 110:14 111:13,16 provided 3:16 5:4 5:11 38:13 44:4 45:2,20 54:6</p>	<p>91:19 99:1 104:4 110:4 provider 85:16 provides 8:9 16:1 34:20 44:11 76:4 95:7 104:16 providing 18:7 96:8 psr 41:19 public 1:4 3:9,14 9:24 10:21 11:10 38:5 43:24 44:11 45:2 68:11 70:16 71:11 72:4,12 75:16 86:13,20 87:21 88:24 89:20 92:14,20 95:17 96:2 107:24 108:7 publicly 96:7 pull 50:5 pump 16:8 24:5 25:4 33:22 34:11 34:12 98:23 99:11 99:14,16,18,19 pumps 14:20,21 15:2,10,11,21 23:17 26:16,17 27:12 60:20 61:2 76:6 96:14 purpose 3:17 purposes 3:8 pursued 66:1 pursuing 13:8 88:5 push 53:14 pushing 29:21 put 4:18 17:1 38:24 40:23 41:2 42:5 48:23 87:10 puts 64:19 86:14</p>	<p>putting 29:15 37:22</p> <hr/> <p style="text-align: center;">q</p> <hr/> <p>qualitative 22:21 24:23 qualitatively 29:3 quality 18:20 22:4 22:7 24:22 35:15 64:2 81:7 82:17 quantify 19:4 quantitative 19:22 22:20 question 8:14 18:7 24:18 28:11,16 30:21 78:20 84:16 questions 11:4 20:21 36:1,2 82:20 quick 5:10 87:8 quickly 57:21 quieter 76:13 quite 45:11 56:19 quote 104:21</p> <hr/> <p style="text-align: center;">r</p> <hr/> <p>racial 70:11,13 racism 55:12 105:22 radiators 83:12 raise 107:7 raised 111:15 raises 27:5 33:2 randomly 109:1 range 9:7 99:1 ranges 99:6 rare 42:18 59:9 rarely 62:8 75:20 rate 22:9 28:2 ratepayer 74:17 74:19</p>	<p>ratepayers 47:11 89:2 rates 9:18 30:9 reaching 8:11 reactors 55:17 read 109:24 ready 5:23 40:20 real 19:6 36:10 realistic 48:17 65:17 reality 48:17 93:1 realized 29:11 really 8:13 9:5 11:17 15:12 21:15 28:16,19 45:3,5 92:21 93:7 reason 27:21 29:6 reasonable 55:16 87:6 rebate 82:15 rebecca 1:13 receive 28:13 received 4:4 20:23 37:6 39:10 71:13 recirculates 64:11 recognize 55:9 79:3 recognized 96:23 recognizes 90:6 recommend 66:1 69:11 85:19 97:5 106:6 recommendation 86:3 87:9 recommendations 53:15 72:14,16 recommended 47:14 recommending 20:2</p>
--	--	---	---

recommends 66:3 record 4:10 39:24 40:8 76:17 recorded 3:6,7 39:14 recover 87:5 recovered 78:3 recovery 49:19 redevelopment 45:21,22 reduce 22:11 35:17 51:17 57:21 73:19 96:7 reduced 24:14 reduces 25:2 87:4 reducing 7:6 25:5 49:1 60:1 67:11 86:16 reduction 8:23 9:17 30:3 57:19 101:15 reductions 22:1 48:22 refer 92:23 referenced 57:5 refers 15:9 refinery 45:21 54:8 reflect 48:16 reflected 72:17 reflects 31:14 regarding 3:4,20 73:22 87:7 111:4 111:5,14,17 region 98:22 regular 63:12 107:7 regulation 28:2 62:10 regulatory 9:19 10:20 36:22 37:1	rehabilitation 67:6 reimagining 60:10 related 30:10 50:18 relates 92:14 relating 72:5 relation 70:17 relative 27:19 63:23 relatively 27:11,23 31:10 release 63:14 reliability 17:15 22:16 30:10,20 47:11 reliance 35:9,16 relies 57:9 79:16 rely 59:14 remain 69:8 107:1 remaining 35:19 64:13 remains 23:12 remarks 4:7 73:3 remind 46:14 110:13 reminder 5:16 38:10,23 58:2 remote 3:12 remotely 3:11 removed 97:11 removing 17:12 83:12 87:15 renewability 68:20 74:3 renewable 56:10 62:20 77:19,22 78:1 79:17,24 88:8,21 93:5 96:6 103:20,22,24 104:2,10	renewables 64:22 93:13 repair 51:13 81:12 106:12,15 repairing 51:8 repairs 52:5 repeatedly 56:8 replace 13:24 replacement 31:22 82:1 replacements 81:22 replacing 23:24 replicated 42:21 report 37:13 39:10 41:4 51:11 53:8 53:11 55:20 56:15 57:8 70:2 73:5 74:22 85:24 95:20 96:11,13,17 97:8 98:5,8 reported 90:20 112:3 reporter 39:15 87:23 reports 71:14 represent 89:17 representation 20:11 representative 23:8 representatives 3:18 5:9 68:3 102:16 representing 10:19 88:2 89:21 represents 10:24 13:12 21:12 repurpose 14:6 repurposes 76:3	request 49:16 70:16 require 25:22 35:6 65:22 66:9 72:3 79:7 required 13:6 30:11 49:6 64:8 requirements 102:10 requires 18:11 29:8 75:18 95:14 research 36:15,21 68:13 73:2 98:13 researchers 54:6 residences 46:3 resident 52:20 85:9 92:6 residential 48:19 75:23 89:22 90:13 90:15 residents 47:13 51:14 54:23 63:20 75:21 resiliency 94:13 resilient 51:16 94:16 resolution 71:23 110:20 resources 46:2 48:13 72:12 111:6 respect 21:9 86:18 respiratory 63:19 64:4 respondents 76:9 responding 70:15 response 43:8,15 77:7,11 100:18,22 103:5,9 105:13 responses 20:22 70:2
---	--	---	---

<p>responsibility 40:18 63:5 responsible 89:2 responsive 106:3 rest 24:19 58:4 59:18 result 21:17 48:15 62:19 64:1 93:8 resulting 6:21 47:16 results 19:22 22:23 retain 8:15 47:12 retaining 18:7 retention 55:8 66:7 retired 73:1 107:24 retrofit 51:14 retrofits 52:5 67:13 return 61:6 87:9 88:14 revenue 9:13 31:18,22 65:23 73:10 74:18 97:6 revenues 22:13 28:23,24 29:5 30:3 31:13 34:1 35:7 66:8 109:11 review 98:18 100:10 reviewing 9:7 rhynhart 1:13 right 6:6,23 33:6 38:10 43:4 65:4 83:24 86:15 88:15 95:2 rights 42:14 rigor 45:13 99:2</p>	<p>rise 6:21 27:1 risk 90:21 risks 75:14 risky 35:10 96:24 rmr 112:3 rnf 56:9 rng 23:14 33:21 41:15 59:16 73:23 78:2,7,9,13,17,19 78:21 79:2,3 road 25:20 robert 89:13,15 robinson 107:19 107:20,21 109:10 110:4 robust 18:4 82:17 88:14 95:14 role 16:1 33:16 34:10,14 71:4 80:15 89:8 rollout 87:8 rooftop 83:15 94:4 rooted 70:12 row 99:22 royal 1:12 royster 70:6,7,9 72:3,19 run 35:12 76:13 84:14 running 16:16 russell 87:19 88:1</p>	<p>90:8 96:2 102:4 sale 53:7,12 54:2 san 11:16 sane 107:13 satisfy 76:8 saves 76:1 saving 93:14 savings 26:16 57:18 saying 40:1,11 45:11 scale 25:19 26:3 56:24 58:13 59:23 62:16 scaling 81:11 scattered 109:2 scenario 13:6 15:20 16:23 23:11 23:15,18 24:9 25:8,14 26:20 29:4 30:2,22,24 33:14,15 34:13 66:21,24 99:13 scenarios 17:2 22:1,6,10 23:10 24:12,14,17 25:1 25:18 32:18 34:10 42:22 48:5 49:5 65:22 73:24 98:24 scenes 72:13 scheduled 5:14 school 76:12 86:18 107:24 schools 76:22 86:13,20 schulman 60:14 60:15 62:7 schuster 65:10,11 65:12 science 7:8,14 56:6 56:14</p>	<p>scientifically 56:8 scope 5:1,3 11:2 12:17 19:7 screen 6:4 41:1 screens 50:8 sea 6:21 second 46:13 50:5 56:21 59:8 60:4 62:6 secondly 53:17 seconds 38:17,18 42:7 45:16 49:10 52:7 54:15 65:3 69:16 72:2 79:13 82:13 87:1 89:5 91:13 93:24 96:21 100:8 102:18 104:23 106:24 109:9 section 23:9 sections 67:14 sector 47:20 securing 25:21 see 7:16 10:5 51:2 51:10 54:20 55:2 68:17 69:9 70:22 78:19 92:4 95:16 95:23 96:1,4,23 97:1,2 99:10 106:2 seeing 26:10 29:23 70:1 72:16 98:7 seek 49:20 71:11 seeks 71:16 segment 59:11 segments 24:4 seize 45:20 selectively 55:20 sell 106:23 109:12 selling 73:9 84:15</p>
	<p>s</p>		
	<p>safe 94:9 safeguard 47:11 safer 60:11 62:20 76:2 safest 80:1 safety 17:14 18:15 19:4 22:16 30:10 30:20 47:13 68:21 74:2 75:14 76:17</p>		

senate 71:19 senator 71:15,24 102:7 sense 28:4 59:5 109:13 sent 4:16 serious 96:4 serve 24:5 46:3 61:9 89:20 served 16:24 23:13 58:17 service 8:10 34:9 67:10 69:4 73:6 73:15,16 74:7 85:17 89:19 98:17 106:22 services 9:10,11 28:13 34:6 54:22 89:17 serving 61:11 session 9:24 set 10:8 12:9 28:5 28:6 31:7 34:3 41:5 45:5 severe 6:20 7:10 shale 14:15 shape 89:9 share 6:2 21:14 41:1,1 66:23 shared 16:8 24:5 24:16 27:23 28:5 33:22 44:20 61:7 shares 47:9 75:14 sharing 44:14 sharply 30:6 shell 98:19 shift 11:19 55:23 shifting 48:2 ship 69:8 shocking 71:1	short 10:13 12:15 44:22 show 49:12 shown 6:22 shows 65:17 71:4 shrinking 27:2 shrinks 109:8 side 93:14,21 sierra 65:13 66:3 signed 38:5,12 significant 25:9 46:6 63:9 65:18 79:4 98:24 104:16 108:6 signup 38:15 silver 32:23 similar 14:22 16:14 23:12 25:11 33:19 42:22 74:8 simple 73:23 simply 48:23 53:10 64:11,23 single 32:23 87:11 sinking 69:8 site 47:21 76:11 sites 76:20 sits 93:21 situation 27:14 size 63:23 99:20 sized 99:21 skip 75:4 86:10 97:1 109:20 slide 7:1,22 8:18 10:16 29:17 85:23 98:20 99:12 108:11 slides 39:3 85:13 85:14 108:8,10,15 108:19 109:14 small 31:10 42:19 46:5	smaller 21:5 76:16 smart 43:21 smoke 55:21 smoother 76:13 social 20:13 40:17 63:5 solar 34:22 83:15 92:7,8,10 93:16 94:2,4,14 103:21 sold 109:8 soliciting 108:6 solution 15:23 32:23 66:14 67:5 106:1,2 solutions 1:22 12:1 34:4 55:3 68:12 69:18 73:18 solve 50:19 68:10 soon 44:24 70:20 84:22 sooner 84:15,16 sorry 85:5 101:1 sort 7:16 17:3 19:2 20:3 21:20 24:1 24:16 27:9 28:6 32:8,12 36:3 39:2 83:22 sorts 24:2 29:24 sound 22:15 source 8:3 16:8,19 24:5 60:8,20 76:6 83:15 99:11 sourced 83:14 sources 8:1 9:9,13 35:6 65:23 102:11 south 83:6 southwest 42:19 53:23 space 75:22 speak 5:17,20 38:17,22 39:23	40:20 46:17 63:2 65:6 72:22 speakers 40:16 speaking 39:21 40:9 43:20 47:7 63:4 specifically 42:3,9 58:16 spend 64:24 72:11 92:19 spiral 69:5 split 28:1 spread 27:2 28:15 28:17 spurn 31:20 stabilization 11:21 stabilize 22:10 stable 29:5 107:1 stack 55:21 staff 38:3 76:10 stakeholder 21:21 22:8 35:14 37:5 95:17 100:1 stakeholders 20:9 66:10 88:20,22 91:21 111:2 standard 69:11 standards 45:1 start 11:9 12:20 13:15 25:16 26:10 40:20 86:11 88:19 93:11 started 38:9 state 4:10 5:1 39:23 40:7 42:12 42:17,21,23 85:20 88:4 92:16 stated 60:23 85:14 statement 87:22 states 42:13 92:7 104:18
--	---	---	---

<p>status 63:19 64:5 stave 7:2,9 staying 101:22 step 37:24 50:24 79:4 89:7 93:3 steps 12:19 35:2 36:14,15 37:23 45:18 49:24 steven 72:20,22 stood 84:2 stop 52:10 69:20 84:15 103:17 storage 79:17 94:14 storm 6:24 storms 6:20 story 25:15 stoves 64:7,9 straight 38:13 straightforward 59:15 stranded 76:3 strategic 34:8 59:1 59:13,20 67:12 strategies 10:9 12:21 18:4 29:13 47:14 48:23 49:18 100:12 strategy 13:6 15:10 17:8 29:19 55:19 79:16,19 80:21 92:24 93:12 street 1:23 58:16 61:8 streets 16:17 strengthen 98:15 stress 50:16 strong 20:20 53:2 53:13 54:11 72:9 89:8 95:17</p>	<p>structures 107:12 struggled 90:19 struggling 90:11 students 86:19 studied 106:4 studies 13:1 41:22 54:11 study 1:5 3:4,21 4:2 5:2,7 6:14 9:4 10:6,12,15 11:2 12:8,17,19 19:21 20:7,22 21:15 27:16 32:15 37:18 44:1 45:3,9 47:14 47:20 48:9,24 49:2 50:23 51:22 52:13 53:1 54:10 55:4 56:17 60:24 65:16 66:2 68:17 70:18 71:4 72:11 72:12,17 79:10 80:19 81:16 88:18 88:21 89:24 90:6 91:6 98:15 100:13 101:6 104:4,8 106:5 108:5,21 109:21 110:19 111:5,16 study's 72:14 subject 53:8 74:10 submit 4:13,21 46:21 58:4 98:9 110:16 submitted 39:5 submitting 67:17 70:19 97:19 subordinate 53:24 substantial 14:13 18:16 substantially 25:2</p>	<p>substitute 63:11 substituting 75:11 subtext 108:20 successful 17:7 suggest 45:19 suggested 97:7 suggestions 96:10 suitability 36:11 suitable 86:24 87:3 suite 1:23 sum 32:17 summarized 37:12 summarizes 19:21 summarizing 20:23 summary 22:23 supermarket 61:5 supplemental 62:7 supplier 77:21 supply 13:17,20 25:4 34:2 79:2 supplying 78:7 support 8:22 65:15 71:15 76:7 82:3 88:4,8 89:6 94:15 101:9 104:1 supported 102:20 supporting 110:1 supportive 82:6 supports 70:21 sure 5:5,18 39:8 40:4,8,24 50:6 60:24 surrounding 45:24 survey 20:18 76:8 76:9 99:3 susan 112:3 suspect 59:6</p>	<p>suspected 90:17 sustain 22:17 sustainability 2:7 3:24 4:17 6:11 38:14 39:5,6 52:23 101:6 108:3 110:17 sustainability's 12:11 39:19 sustainable 68:5 68:15 71:6 74:3 78:2,13 88:17 95:6,13 sustaining 94:7 switch 11:9 69:6 switched 86:6 switching 50:7 synthetic 25:24 64:19 105:1,6 system 16:9,15 17:12,14 20:20 24:4 25:22 27:2 27:22 29:7,9 30:18 31:7,13,13 31:16,20 34:15 35:19 36:4 47:10 48:12 49:6 50:20 56:3 58:23 59:12 59:19,23 60:11,19 61:9,17,24 62:1,4 62:9,10 67:14 75:18 86:7 system's 85:18 systems 15:6 23:20 24:6 32:2,4 36:11 51:6 52:4 54:24 66:5,9 75:19 76:13,14 86:12 109:18</p>
---	---	---	---

<p>t</p> <p>tactical 76:11</p> <p>take 9:11,21 15:14 23:7 30:17 36:20 37:10 41:9 42:3 52:10 107:11</p> <p>taken 42:10,24</p> <p>takes 66:16</p> <p>talk 41:22</p> <p>talks 42:9 55:7</p> <p>tammy 40:16,19 40:22 44:21</p> <p>tangible 108:8</p> <p>target 86:16</p> <p>targeting 67:12</p> <p>tasked 19:11</p> <p>taxpayers 88:23</p> <p>teacher 108:1</p> <p>team 11:3,7 20:7 33:6 68:1 72:24 88:3 105:20 106:4</p> <p>technical 8:21 81:10</p> <p>technologies 25:23</p> <p>technology 14:21 25:24 79:18 100:5</p> <p>tell 107:11</p> <p>telling 7:8 84:8</p> <p>temperature 60:22</p> <p>ten 26:4,9</p> <p>tenant 87:11</p> <p>tends 56:18</p> <p>tension 30:8</p> <p>term 10:13 17:11 20:4 37:10,11 59:16 78:21 80:24 99:8</p> <p>termination 90:22</p> <p>terms 6:19,19 18:14 19:1 61:14</p>	<p>62:10 66:6 72:8 80:23 88:10 100:6</p> <p>territory 78:8</p> <p>test 10:13 66:4 76:24</p> <p>testify 4:5,9,9 5:14 38:5 87:21</p> <p>testifying 4:3,5</p> <p>testimony 4:11,14 4:16 46:11 47:3 58:5 65:8 110:15</p> <p>thank 6:1 11:11 37:15,19,20 38:7 43:2,3,19,22 44:2 46:8,10,24 47:1 49:11,24 50:1 52:16 54:13,16 56:22 57:23,24 58:8 60:12,15 62:21,22 63:1 65:5,7 67:16,19,22 70:3,4,15 72:15,18 72:21 74:20,23 75:5 77:2,3,15 80:3,4 82:23,24 84:24 85:1,10 87:17,18,20 89:11 89:12 91:23,24 94:17,19 95:24 97:17,20,22 98:3 100:14,15 102:24 103:1,12 105:8,9 107:17,18 110:10 110:11 111:8,19</p> <p>thanks 6:8 47:5 52:15 83:6 101:5</p> <p>thermal 58:15 59:21</p> <p>thing 5:15 39:12 41:10,15 55:9 57:17</p>	<p>things 19:3,16 25:6 32:12 33:20 34:2,21 39:3 42:23 111:15</p> <p>think 13:23 17:15 23:7 27:14 30:4 32:15 33:10 43:1 55:16 59:3 68:22 97:13 106:20 110:6 111:14</p> <p>thinking 7:23 13:15 25:16 33:3</p> <p>third 59:18 69:12 74:12 90:15</p> <p>thomas 65:10</p> <p>three 58:23 59:9 84:6</p> <p>thresholds 58:24</p> <p>thrive 8:14 50:10</p> <p>time 17:13 34:15 36:5 37:16 38:19 39:11 40:2,4,21 44:22 45:12 46:10 46:16,19 48:10 52:8 57:14 64:13 74:20 76:15 77:2 80:3 82:23 87:6 92:19 97:18 102:21 110:3</p> <p>times 14:14 26:4,9 78:12</p> <p>today 3:22 11:23 12:7,16 13:19 14:11,16 16:6,15 18:9,17 21:8,12 23:12 24:1 26:2,7 26:17 31:7 34:20 37:16 38:22 43:20 47:7 49:8 63:2 75:3 76:20 77:17 82:23 83:7 85:12</p>	<p>107:7</p> <p>today's 9:24 37:24</p> <p>todd 92:1,5</p> <p>tom 65:12 67:20</p> <p>tonnage 99:19</p> <p>tool 10:2,3</p> <p>top 21:20 76:8</p> <p>topic 95:14</p> <p>total 49:17 58:20 60:1</p> <p>town 1:4 3:2,11,13 3:15 4:22 5:6,13 37:7,24 41:6 110:12 111:24</p> <p>toxic 41:14</p> <p>trade 69:21 71:9 93:17 101:19</p> <p>traditional 73:8 76:14</p> <p>training 76:11</p> <p>transcript 39:16</p> <p>transform 50:19</p> <p>transformation 18:24</p> <p>transformational 34:19</p> <p>transition 11:18 18:10 30:16,18 54:11,22 58:23 68:4 70:18,24 81:15 84:22 88:8 88:21 89:10 95:6 95:12 96:5</p> <p>transitions 91:21</p> <p>transmission 47:23</p> <p>transparency 54:9 74:11 95:20 108:14</p> <p>transparent 49:17</p>
--	--	---	---

<p>transportation 8:24 trash 57:10 treat 55:22 trenches 16:17 trend 34:6 trends 17:19 trigger 64:6 triggering 64:3 tropical 6:24 trouble 87:24 trucks 83:21 true 59:7 truly 106:19 trust 53:20 try 46:18 76:18 trying 15:14 33:9 101:14 tsou 62:24 63:1,4 65:4 turn 5:8,17,19,21 11:6 25:18 37:11 turned 29:19 turning 30:24 40:12 twice 57:11 63:22 99:20 two 4:7 10:20 11:24 20:24 38:16 38:19 43:3 55:7 60:18 67:9 73:3 75:19 83:17,18 85:14 93:20 108:8 108:18 109:18 types 6:21 36:8 59:10 typical 99:21 typology 86:1</p>	<p style="text-align: center;">u</p> <p>u.s. 48:20 ultrafine 63:16 unable 75:3 91:15 unaffordable 50:17 unanimously 71:23 unbiased 54:7 uncertain 17:18 32:9 36:9 72:8 uncertainties 18:5 uncomfortable 75:17 unconventional 41:12 underlying 108:20 undermine 72:14 74:18 undermines 69:22 undermining 71:2 understand 9:16 48:4 71:18 92:21 96:24 99:13,24 100:2 101:20 102:16 understanding 12:5 87:24 understands 97:9 understood 86:22 undertake 6:13 52:2 undertaken 66:18 underway 71:19 unfortunately 45:4 union 10:23 18:9 22:17 74:4 106:16 unit 57:18 89:16 united 80:10 98:2</p>	<p>unquote 104:21 unsustainable 35:11 update 17:11 upgrades 31:17 49:6 98:19 upgrading 67:2 upshaw 105:11,16 105:17,18 107:1 uranium 55:13 urge 49:16 52:2 urgent 50:15 usage 80:20 104:6 use 8:7 9:9 10:4 14:8 15:2 31:2 40:5 41:12 42:15 47:24 48:14 57:10 59:3 61:5 63:12 64:10 74:5 78:5 79:24 86:3,16 89:2 102:11 103:18,21,23 users 75:23 102:4 uses 15:10 95:7 usual 45:1,4,7 68:9 usually 53:18 utilities 17:10 73:9 76:19 utility 22:15 29:16 30:12 58:13,15,17 59:2 66:9 80:24 88:24 89:19 91:15 95:6,13 96:7 utilization 29:24</p> <p style="text-align: center;">v</p> <p>value 31:14,15 78:9 values 74:19 variety 9:2 20:8 20:14 62:12</p>	<p>various 12:3 vast 59:19 81:21 86:19 vented 64:8 verification 74:12 veritext 1:22 version 12:13 98:4 98:8,10 versus 61:21 vet 81:9 viability 82:20 100:4 viable 8:16 80:19 82:4 85:15 98:17 vice 73:1 videoconference 1:10 view 28:20,21 92:11 viewpoints 53:19 violations 42:14 virtual 1:4 vision 107:15 visions 37:10 vital 74:9 90:6 voc 63:16 voices 107:8 volumes 30:5</p> <p style="text-align: center;">w</p> <p>wage 88:9 walk 11:8 22:22 84:1 walker 94:20,21 94:22 96:22 97:19 walkthrough 12:8 walter 62:24 63:3 want 5:5 9:8,14,19 9:23 13:23 37:20 39:8 40:4 46:14 46:16 58:3 64:13 84:7,20 99:12</p>
--	--	--	--

<p>106:2 110:11,13 111:8,19 wanted 60:18,24 92:9 103:16 wants 46:17 warming 18:1 warning 56:21 60:4 62:6 warrant 17:4 30:15 warrants 32:15 waste 55:13 57:3,6 57:19,21 78:3 water 16:10,19 60:21,23 61:6 64:21 83:13 way 7:17 8:5 11:5 31:14 32:5,6 56:23 57:20 68:18 68:23 93:11 94:15 106:10 107:13 110:22 ways 23:5 104:11 we've 10:1 13:14 21:14 weak 55:4 weaken 74:16 weather 86:22 weatherization 13:5 15:8 33:23 67:7 73:17 81:5 106:12,15 website 12:11 39:17,19 99:4 week 94:12 weeks 72:1 110:21 went 20:18 83:13 whichever 93:21 wide 20:14 44:9 66:22</p>	<p>wider 50:20 widespread 50:18 wife 83:8 wind 83:15 winslow 43:18,19 43:20 45:16,17 winter 31:5 34:15 63:12 96:16 wish 38:22 58:10 73:3 88:4 word 87:15 work 3:20 5:11 7:18 10:17 21:14 21:16 28:23 37:21 44:17,22 45:12 49:19 56:18 72:13 83:22 91:20 92:6 98:5,9 101:8 106:8 workers 10:24 32:1 66:7 101:8 101:14 102:23 workforce 8:15 15:24 22:14 29:2 29:6 30:14,23 32:3 47:12 69:1 79:22 94:6 working 10:18 19:16 33:7 60:7 70:12 71:15 95:2 107:14 workshop 20:10 world 11:18 13:2 27:10 29:21,23 33:12 34:14 36:10 42:2 60:11 worse 25:13 56:11 worsening 6:18 worst 7:2 worth 64:7</p>	<p>wow 42:8 wrapping 19:15 37:13 wrecking 84:18 write 11:2 writing 4:22 67:18 73:21 101:23 108:4 written 4:13,15 39:2 58:5 69:24 70:19 97:20 98:10 110:14 wrong 43:11 wushinske 2:5 40:13,15 42:6 43:2,5,10,17 45:15 46:9 47:1 49:9 50:1,6 52:6,16 54:14 56:20 57:13 57:24 60:3,12 62:5,22 65:2,7</p> <p style="text-align: center;">y</p> <p>yaw 72:5 102:7 yaw's 71:15,24 year 15:13,18 47:24 67:9 86:19 90:18 years 66:16 93:20 94:1 95:3,23 york 11:16 62:14 62:15 85:21 young 63:20</p> <p style="text-align: center;">z</p> <p>zero 13:7 24:15 48:13 55:10,11,18 57:3 86:15 95:9 zeroed 56:13 zeyneb 58:6 zoom 1:10 3:12</p>
---	--	--