

Agenda

Conservation Advisory Council

Friday, October 12, 2018

1:30 p.m. - 4:30 p.m.

421 SW Oak St., #300, Portland, OR 97204

1:30 Welcome, Old Business and Short Takes (*information*)

Introductions, agenda review and approve September meeting notes

1:40 Draft 2019 Action Plans (*discussion*)

Energy Trust staff will provide an overview of the draft 2019 action plan for the Planning & Evaluation Group. In addition, NEEA will provide an overview of the draft 2019 NEEA action plan for Energy Trust. These presentations round out the draft 2019 budget agenda items to prepare CAC members to participate in the public board budget workshop on October 17.

Draft Planning & Evaluation and NEEA action plans are included as part of the meeting packet.

2:10 Targeted Load Management Pilot Findings (*information*)

Energy Trust staff will present on a learning pilot carried out with Pacific Power focused on bringing additional value to the grid through deploying geographically targeted program resources. The presentation will provide an overview of current and planned efforts to use energy efficiency and renewable energy to meet localized needs, as well as early results from the pilot.

A copy of a learning topic on Distribution Systems and Energy Efficiency is included as part of the meeting packet. The learning topic was prepared for the board of directors earlier this year.

2:55 Break

3:10 2020-2024 Strategic Plan Development (*discussion*)

Staff will seek feedback on the key drivers and scenarios being explored in Energy Trust's five-year strategic planning process.

There is also an article in the meeting packet on using scenarios in strategy/planning exercises that may be helpful to read prior to the meeting.

3:55 Public Comment

4:10 Adjourn

Meeting materials (agendas, presentations and notes) are available online

<https://www.energytrust.org/about/public-meetings/conservation-advisory-council-meetings/>.

Next CAC Meeting: Friday, November 30, 2018.

Special Note: There will be a board of directors public budget workshop on Wednesday, October 17 from 1 to 4 p.m. that CAC members are encouraged to attend. The workshop was added this year to replace a series of budget-related presentations and to provide CAC, RAC and the board an opportunity to review the same information and discuss it together. This is a nice opportunity for the board to hear what is important to CAC members as they consider Energy Trust's draft budget and action plan. Please consider holding 1 to 4 p.m. on your calendar as you would a CAC meeting.

Conservation Advisory Council Meeting Notes

September 14, 2018

Attending from the council:

Anna Kim, Oregon Public Utility
Commission
Holly Braun, NW Natural
Danny Grady, City of Portland Bureau of
Planning and Sustainability
Kari Greer, Pacific Power
Charlie Grist, NW Power and Conservation
Council
Jeff Mitchell, Northwest Energy Efficiency
Alliance

Warren Cook, Oregon Department of
Energy
Jason Klotz, Portland General Electric
Wendy Gerlitz, NW Energy Coalition
Lisa McGarity, Avista
Dave Moody, Bonneville Power
Administration
Al Spector, Cascade Natural Gas

Attending from Energy Trust:

Mike Bailey
Amber Cole
Mike Colgrove
Ryan Crews
Hannah Cruz
Oliver Kesting
Jessica Kramer
Steve Lacey
Alex Novie
Amanda Potter
Thad Roth
Kate (Scott) Wellington
Cameron Starr

Peter West
Mariah Wills
Tom Beverly
Shelly Carlton
Sarah Castor
Mana Haeri
Andy Giguen
Denise Olsen
Dan Rubado
Adam Bartini
Marshall Johnson
Jessica Iplicki
Jay Olson

Others attending:

Lindsey Hardy, Energy Trust board
Karla Hendrickson, ICF
Rick Hodges, NW Natural
Alan Meyer, Energy Trust board
John Molnar, Rogers Machinery
Josh Weissert, Energy350
Mike Christianson, Energy350
Jason Eisdorfer, Oregon Public Utility
Commission

Julie Peacock, Oregon Public Utility
Commission
Elaine Prause, Oregon Public Utility
Commission
Colin Podelnik, ICF
Dan Reese, CLEAResult
Angel Swanson, ICF
Mark Kendall, Energy Trust board

1. Welcome, Old Business and Short Takes

Hannah Cruz convened the meeting at 1:35 p.m. The agenda, notes and presentation materials are available on Energy Trust's website at www.energytrust.org/about/public-meetings/conservation-advisory-council-meetings/.

Hannah introduced Anna Kim, new OPUC liaison to Energy Trust and Conservation Advisory Council member. Prior to joining the OPUC, she worked for evaluators for Energy Trust, then Seattle City Light. She brings experience and expertise in energy efficiency.

Anna Kim: Energy Trust has been a big part of the landscape in this field, along with the professional environment in Portland. You've had a strong influence.

Hannah noted staff is working with Building Owners and Managers Association on a potential replacement Conservation Advisory Council member.

Hannah presented the strengths and capabilities map, which was revised with Conservation Advisory Council feedback and will be used by staff as they develop the 2020-2024 Strategic Plan. Hannah provided a schedule to of upcoming engagements on the development of the plan. Strategic plan development will run through May 2019, when a draft of the plan will be presented to the board of directors. The board is looking for Conservation Advisory Council member advice and feedback, and there will be various sessions when staff engages with Conservation Advisory Council on the plan. This may mean a few extra hours asked of members over the next six months. We haven't set 2019 meeting dates, so we'll revise the list of meetings and resend the schedule.

2. Northwest Power and Conservation Council Underserved Populations Study

Charlie Grist from the Northwest Power and Conservation Council presented a summary of the council's "Northwest Underserved Energy Efficiency Markets Assessment" report.

A copy of the assessment is posted on the Council's website at

<https://www.nwcouncil.org/reports/northwest-under-served-energy-efficiency-markets-assessment>.

Charlie Grist: This is a quantitative look at the markets, and the first time we've done it this way. Marti Frank, who specializes in diverse and underserved markets, conducted it for us. Our goal is to tap all cost-effective conservation, but you can't get to all of it if you're leaving segments untapped. We know there's untapped potential across the region. As analysts, we decided to take a quantitative look at how we're doing. The study was equity based. The council facilitated and organized the process, and Bonneville Power Administration (BPA), Energy Trust, utilities and other organizations did much of the work. This looked at 2014 to 2016.

We didn't get full participation by all utilities and programs in the region. BPA, Energy Trust, Pacific Power, Northwest Energy Efficiency Alliance and many others put significant effort into it. Each provided their own report, all of which are appended at the end of our report. We worked on participation rates and participant distribution. We saw a participation rate of 1.8 percent for homeowners and 0.1 percent for renters. We looked at the total population of renters versus owners by utility territory.

One of the key goals to look at were what data sources were available to do this work. We got participant data from utilities and compared them against data services that Energy Trust and utilities use from credit raters. We found that race and ethnicity are an add-on data collection effort with extra costs involved, so not everyone collects that information.

One noteworthy item is that every utility territory is different. The energy efficiency resource isn't necessarily homogeneously spread across the population. For example, lightbulbs are spread evenly across everyone, but not everyone has an electric water heater or the right house for a ductless heat pump. You have to go after the savings where you can get them.

We saw participation rates of 1 to 8 percent, with the highest being on the residential side. Manufactured homes had the highest cumulative participation rates compared to single family and multifamily. When everyone had been very active with duct sealing for manufactured homes, it showed up in the data. BPA did a lot of work because it has so many member utilities. Participation rates in BPA utilities closely matched each income level. Customer participation ranged from free kits to larger home upgrades.

Al Spector: Which programs were taken into account, and did the study include things that customers didn't pay directly out of pocket?

Charlie Grist: Yes, but it's different for every utility.

Charlie continued his presentation: Energy Trust provided a lot of great data, and I see the organization as a leader in this work. Overall, we saw that schools participated heavily while offices didn't.

A few key findings are:

- We determined that enough of the right data exists to do this gap analysis.
- There is evidence of successful targeted programs.
- Different purposes require different methods and data.
- There is value in continued monitoring and analysis.
- Multifamily housing is underrepresented in most programs.
- Programs are getting out to rural areas, sometimes more than urban.
- Renters are not being reached as well as homeowners.
- Measures with addresses attached to them are only half of the savings. Measures delivered midstream are a big portion of the savings, and you can't ignore that half of the data.

One of the follow-ons is figuring out how to pursue the gaps. Most of the big providers are trying to meet goals, and they are incentivized to find out who the remaining markets are. We found that they started sharing information on their own, meaning that the council doesn't need to facilitate that work completely. A lot of good comes out of that sharing. We need to find the causes of these gaps in participation. Is it language? Culture? Different reactions to borrowing money? We will need to be clever about finding solutions.

Mark Kendall: You showed disparity in multifamily. Was that weighted by potential or number?

Charlie Grist: Every utility is different. It wasn't by potential, but Tacoma did the most along those lines. The utility reports are appended at the end of the report.

Jason Eisdorfer: Is the 1 to 8 percent participation rate per year? Did BPA include the low-income weatherization numbers while Energy Trust didn't?

Charlie Grist: The percentages were cumulative over three years. Energy Trust didn't include low-income weatherization numbers.

Josh Weissert: What's the breakout between new construction and retrofit?

Charlie Grist: There was more existing than new, but it will be whatever the program provider did as their customer touch-point.

Jeff Mitchell: Do you plan to rerun this study every year?

Charlie Grist: We're considering it, but we are headed into the eighth power plan. This was a lot of work. We'll work on it from the providers' point of view, but it's a heavy lift.

Mark Kendall: Thank your board for doing this. It's meaningful.

3. Review of How Energy Trust is Expanding Participation with a Focus on Diversity, Equity and Inclusion

Hannah Cruz: Debbie Menashe gave you an update about our diversity, equity and inclusion initiative at the November 2017 meeting. The board of directors has since revised its equity policy into a diversity, equity and inclusion policy, and staff have developed a diversity, equity and inclusion operations plan. At the core is understanding where there are the gaps in participation, where we can learn more about customers and what barriers customers face.

Shelly Carlton: Engaging diverse communities is part of our core purpose. To understand gaps in participation, we conducted research to learn what direction to take. The research plan was started in 2016. We studied Energy Trust participation data overlaid with Experian income data. We also conducted a phone survey, which included more questions on demographics. And we conducted focus groups with small business decision makers in different communities. Combined, the reports have a lot of information and findings. With the external Experian data overlay, we found that one income group participated highly where others dropped off.

Holly Braun: Charlie's presentation showed population broken out, not just participants. Does your report show that?

Alex Novie: Yes.

Mark Kendall: Does this include renewables?

Shelly Carlton: This is only residential energy efficiency.

Shelly continued that the second part of the research plan was a customer insights phone survey. We asked 1,000 people to talk for 15 to 20 minutes on the phone. We used a sample of participants in residential measures and a sample of non-participants. In this study, we learned that high school graduates weren't being served at the same rate as those who have a college degree. Bear in mind that only 30 percent of Oregonians over 25 hold a college degree.

The focus groups were an effort to learn if those in rural communities or communities of color were aware of our services, and if they are interested in our services based on printed materials. These groups included Latino, Asian and Asian Pacific Islander, and African American business decision makers and a group of decision makers in Grants Pass. There was a desire from participants for a community based liaison who looked like them and talked like them, potentially dedicated staff or a partnership with a community-based organization. A second finding was that marketing materials need to be clear, quick and representative of the community. Our example collateral didn't look like the focus group participants or their businesses. This 2016 work informed what we did going forward.

Dan Rubado: The next part of our presentation is on developing participation baselines based on race/ethnicity, income and urban/rural location. Our goal was to determine a baseline for how well we served diverse communities in each sector. We received input from outside organizations that have experience with diverse communities and with conducting this type of analysis. Programs will be using this information to develop activities to target diverse communities starting in 2019. We conducted a geographic analysis based on census tracts. Census tracts are a small, sub-county geographic unit created by the Census Bureau to report demographic data. They are a good proxy for communities and generally contain between 1,000 to 2,500 households. We used tract-level demographic data to develop a set of broad diversity indicators. We computed tract-level site participation rates from our own data that we could overlay on the diversity indicators.

Holly Braun: It makes sense that this is a small number of households, but did you develop indicators? Did you measure diversity in specific ways?

Dan Rubado: We used American Community Survey data to develop tract-level indicators of community diversity for race/ethnicity, income and urban/rural location.

Dan continued that participation in midstream measures is not included in this work, because it cannot be tied to sites. However, it is significant, especially for the Residential program, and we need to find ways to measure it in the future.

Each of the diversity indicators were created using a one-to-five scale where five always indicates the priority areas: low income, high racial/ethnic diversity and rural location. We then created a composite diversity index that combines the income and race/ethnicity scores, weighted to include rural areas that may not be quite as diverse as urban areas. These indicators highlight communities that are both low-income and racially/ethnically diverse, or very rural and moderately low-income and racially/ethnically diverse. We then overlaid our five-year tract-level participation rates for each sector over the diversity indicators. Due to time limitations, we'll only go over the composite diversity indicator for residential and the urban-rural indicator for commercial and industrial. However, the results vary depending on what index we look at.

For the residential sector, which includes multifamily buildings, attached and detached single-family homes and manufactured homes, we don't see major differences in participation rates in communities with different composite diversity scores. Participation in the areas ranked as one—the most affluent, least racially diverse areas of the state—is slightly higher than the overall average participation rate of 26 percent, but not significantly. Participation in capital measures requiring participant investment was 18 percent, which is higher than the 12 percent participation in free measures.

For the commercial sector, the most striking difference in participation rates is between large energy-using businesses and small- to medium-sized energy users. Large businesses, defined as using 100,000 kilowatt hours or more per year or the equivalent in therms, had a participation rate of 28 percent compared with only 7 percent for smaller businesses. For both large and small businesses, participation rates were higher for most urban areas than they were in rural areas.

For the industrial sector, the biggest difference is again between participation rates for large energy users and small- and medium-sized energy users. Large industrial businesses, defined as using 1 average megawatt or more per year or the equivalent in therms, had a participation rate of 79 percent compared with only 13 percent for smaller industrial businesses. For large industrial businesses, the participation rate isn't correlated with the urban-rural indicator. For smaller industrial businesses, there appears to be significantly higher participation in the urban areas than the rest of the state.

Alan Meyer: Does this include low-income weatherization?

Dan: No, this just includes Energy Trust participation.

Charlie Grist: There's some fuzziness to these numbers. I'm trying to gauge the precision.

Dan Rubado: It's the total participation versus total households for all tracts in each of the five indicator bins, so there isn't really any error because the numbers are based on a census.

However, we don't know if individual participants are non-white or low income, we just know the general demographics of the area where sites are located. The urban/rural indicator is different

because it is a geographic characteristic, so we can classify each individual site based on how rural or urban its location is. That's the nature of a geographic analysis like this. We don't have a one-to-one match between sites and demographics because we don't track participation based on income, race or ethnicity.

Holly Braun: This showed no difference based on diversity.

Dan Rubado: For residential, there is no real difference based on the composite diversity indicator. However, there are more pronounced differences based on the urban/rural and income indicators. Participation gaps are in the most rural areas and lowest income areas. Also, there is much higher participation among larger businesses and those closer to urban areas.

Karla Hendrickson: How did you define large customers?

Dan Rubado: Commercial customers using 100,000 kWh or more per year or the equivalent in therms. Industrial customers using 1 aMW or more per year or the equivalent in therms were considered large.

Dan: There seems to be relatively even participation among large industrial customers across the state, but among smaller industrial, it was stronger in urban areas.

Alex Novie: The final part of our presentation is a summary of existing and proposed program activities aimed at expanding customer participation. Energy Trust has been pursuing many of these efforts since the diversity, equity and inclusion initiative was launched in 2015. Ongoing and new activities are outlined in our draft 2019 budget action plans. New Buildings is working with women- and minority-owned businesses as design allies in both customer trainings and fellowships, for example. As we rolled these initiatives out, we didn't have baseline data and we didn't want to wait for data. Now that we have initial results from the 2018 diversity, equity and inclusion data and baselining efforts, we are examining how these parallel paths align and how the data helps inform strategies for increasing customer participation. We have made strides with our diversity, equity and inclusion initiatives in the past, but it is crucial that we measure progress, adjust strategies as necessary and report out to stakeholders.

Engaging community-based organizations is a crucial component of our diversity, equity and inclusion goals to expand customer participation. This includes establishing baseline data, discussing tactics and partnering to deliver services to customer groups. We also have an emerging leadership opportunity to encourage design allies to recruit diverse candidates for internships. From the work Dan mentioned, we are developing a more consistent and transparent approach to developing market assessments and engaging partners. Furthering the small- and medium-sized businesses initiative is integral to expanding customer participation for commercial and industrial programs. This requires continued outreach to increase customer and stakeholder awareness and engagement.

Kari Greer: From the Pacific Power point of view, many of the areas you highlighted are in our territory. It's critical that you work with us because we are also doing a lot of outreach efforts. We can double up our efforts, but we don't want to work at crossed paths with each other.

Wendy Gerlitz: I want to reinforce the importance of working with the community action agencies. Low-income participation is a red flag for me. If you do one measure for low-income customers, it can hurt their eligibility for free low-income weatherization services. It's very important to avoid getting sideways with these efforts.

Peter West: We do have a protocol for that. It's part of the engagement with community-based organizations. Directing some things through them should help.

Lisa McGarity: I didn't see anything about the relationships between energy use and energy burden. Did you look at that?

Alex Novie: We looked at energy use, but energy burden is more challenging to do without individual customer-level information on income. It's a next step for us to address in our market assessments.

Shelly Carlton: There are national studies we can look at also.

Dan Rubado: It's also incorporated into our income indicator data, but not exactly called out.

Hannah Cruz: A question for Conservation Advisory Council members is how often would you like updates on this and what's important to know about?

Holly Braun: I'm impressed with the granularity. I look forward to digesting this further, but I'm impressed with what you've done so far. Now what do we do?

Peter West: There will be chances to talk to program managers about the specifics at the individual tables later in the meeting.

Charlie Grist: I mentioned this in my slides, but wanted to reiterate the tension between efficacy and equity. Early adopters aren't evenly distributed across these groups. There are stages in this work. You may need to look at individual measures, and consider where they haven't been adopted and why. Think of it as a long-term project.

Peter West: This isn't zero sum. Early adopters are very important to us. We couldn't move forward without their early willingness to try things out. Why can't the new technologies be in a low-income setting? Who can we partner with to get it into the field? Ideas like that come out of this work. You can find early adopters, now you need to find the partners.

4. Mid-year 2018 Progress

Peter West provided an update on forecasted year-end achievements to goal by utility. We are expecting another excellent year. We are expect to achieve 98 percent of goal in Portland General Electric territory, largely due to fewer savings than expected this year from an industrial megaproject. We expect to achieve about 95 percent of goal in Cascade Natural Gas territory due to a handful of business projects delaying into 2019. New construction is still high, but there it is slowing down in rural areas. Metro areas are outbidding other projects to get things done, leading to a lack of workforce in other areas. Multifamily is very strong across the board, and lighting is also very strong. High bay lighting in industrial settings is driving very strong uptake. Commercial projects are much smaller than before, but there are more of them. Expenses are at 99 percent of budget, so we're getting more savings at lower-than-budgeted costs.

Peter West: OPUC staff and commissioners supported our approach to how we treat the federal lighting standard in our cost-effectiveness calculations for next year. If we pull out of lighting, we would be the only efficiency provider in the region to do so and it would undercut many other programs and utilities. We exclude the federal lighting standard in our calculations, but others include it. All of the analytical approaches point to a need to stick with lighting. We'll continue our plan for lighting, but lighting savings in 2019 will be much less than a year ago. We'll revisit our plan again in 2019 to plan for 2020. We will likely be in the specialty market, which isn't impacted by these standards.

Hannah Cruz: The OPUC asked for lighting trends in our quarter two report, which we included and I recommend Conservation Advisory Council members read.

Charlie Grist: On the lighting decision, I want to follow up on the logic behind it. Internally, did you get a decision memo? How do you make the decision?

Peter West: The decision is documented in an appendix to the quarterly report, and we also presented it to the OPUC during a public meeting. They supported our logic.

5. Draft 2019 Program Action Plans

Hannah Cruz: The draft 2019 budget will be public on October 10. We hope you'll attend the board budget workshop on October 17. Today, you'll receive a sector overview of the draft action plans, followed by time with staff to ask specific questions at individual tables. The objective today is to provide you with the information you need to participate in the budget workshop.

Thad Roth: One year ago, the residential sector transitioned to a single Residential program that includes three tracks: home retrofits, products and EPS new construction. This was in response to forecasted declines in savings. We are in the first year of the transition, and it is going well. We believe we are well-positioned going forward.

In the residential sector, we recognize that we must drive savings through trade allies, retailers, community-based organizations and utilities. We are testing more midstream efforts, and we need to maintain strong relationships with trade allies and customers.

Lighting savings have declined in excess of 70 percent, and we expect declines to continue. We expect to be largely out of the lighting market by 2020, driven by federal standards or market transformation. Low-flow water device savings will also continue to decline. Together, this will require the sector to change the contents of Energy Saver Kitss in 2019. Air conditioning has become a larger opportunity, so we are now looking at a pilot in the coming year. We will also explore a residential pay for performance pilot.

Lisa McGarity: As the last meeting, there was concern about the uptake for commercial pay for performance. How will residential be any different?

Thad: That's why we're going to do a pilot. We tried to learn from efforts elsewhere.

Thad continued that the residential sector will learn more about our target audiences by using data. This will allow us to follow up multiple times with customers who are likely to be interested and develop an approach based on customer characteristics.

We will continue to drive savings through water heating, space heating (including smart thermostats), and new construction as retail lighting and showerhead savings decline. As we move toward midstream delivery mechanisms, we will continue to focus on marketing to customers as they make product decisions and on trade allies through training and sales support for these key measures.

To drive diversity, equity and inclusion activities, we're looking for feedback from community-based organizations on how to approach the customers they serve. We'll contract with them, or through program management contractors, to reach diverse customers.

We worked on manufactured housing and believe there is more work to be done on the heating systems. Manufactured home replacement is another effort. We will also supporting affordable housing. We're working in Woodburn to reach the Spanish-speaking population in that area.

Holly Braun: I'm curious about low-income efforts and whether measures aren't cost effective if we're all trying to buy them.

Thad: We have to be careful what's offered through our programs in addition to or separately from low-income offers. We want to be sure that qualifying customers have access to no-cost offers. At the same time, we are discussing dual funding options with the OPUC to maximize funding and savings for these customers. There are community-based organizations that use funds that have restrictions, and we want to be sure we don't put them at risk.

Lisa McGarity: When will the Spanish microsite be launched?

Mana Haeri: It should be later this year or early next year.

Oliver Kesting: In the commercial sector, we have several programs: New Buildings, Multifamily and Existing Buildings. Existing Buildings also includes Strategic Energy Management (SEM) and Pay for Performance. We're seeing a continuing trend toward more, smaller projects. We need more projects to obtain the same level of savings as in the past. There are fewer savings due to baseline changes. Outreach is becoming more costly to reach more small customers. We are seeing less lighting savings. We are working to reach small and rural customers, which requires outreach and cultivating local trade allies.

Most of the sector will remain the same in 2019. However, we're seeing more challenges with Existing Multifamily due to changes in direct installation of energy-saving lighting and showerheads. We will consider a different program design for 2020.

SEM delivery cost is a challenge, so we need to refine it with better targeting and better vetting for services. Pay for Performance has seen very limited customer interest, and we are considering options.

Kari Greer: At what point do you consider closing Pay for Performance?

Oliver Kesting: We believe we have a good design and the work has been done to make it available to customers. We can keep the offer open for another year and consider closing it if interest levels don't change.

Wendy Gerlitz: Seattle has an offer they expanded and they received a ton of interest. I'm puzzled by this. We hope to find out more and submit comments through your budget process.

Oliver Kesting: We are working with PropertyFit in Multnomah County, as well. This is the commercial Property Assessed Clean Energy program through Prosper Portland and Multnomah County.

Amanda Potter: In the Industrial sector, we have one program with a custom track, which includes SEM, and a standard track, which includes lighting and prescriptive incentives.

We continue to see strong savings potential in the industrial sector. We are planning on evolving our program next year to meet the changing needs in the market. We still see good savings opportunities at large customer sites, but we are also looking for ways to streamline program processes for small- to medium-sized customers in custom and SEM offerings. We're seeing more small- to medium-sized customers participate in the program, and we think they will be an increasingly important part of our savings.

The custom offering is moving to a new structure. We've included SEM and technical studies in our three Program Delivery Contractor contracts. We have a new PDC in territory one. We've developed a streamlined technical study process to test this year and ramp up next year. We will also add cohorts to our continuous SEM offering and develop a more streamlined SEM offering.

We see strong lighting savings in 2018 and expect this to continue into 2019. We're looking at how to evolve the lighting offering so that we can continue to capture cost-effective savings as savings per measure decreases. We are looking at reducing incentive levels, moving measures midstream and revising the Performance Plus offering. We will launch new prescriptive measures to sustain standard track savings.

6. Break-out Session: Questions and Answers with Program Staff on Draft Action Plans

Conservation Advisory Council members, Energy Trust staff and the public in attendance broke into small groups for question and answer sessions on draft 2019 program action plans. There were five program stations (Residential, Existing Multifamily, Existing Buildings, New Buildings and Production Efficiency) available for members and the public to visit in preparation for the October 17 budget workshop with the board of directors.

7. Public Comment

There was no additional public comment.

8. Meeting Adjournment

The meeting adjourned at 4:45 p.m. The next Conservation Advisory Council meeting will be held on Friday, October 12, 2018.

Special note: There will be a board of directors budget workshop in the afternoon on Wednesday, October 17 that Conservation Advisory Council members are encouraged to attend. The workshop was added this year to replace a series of budget-related presentations and ensure that Conservation Advisory Council, Renewable Energy Advisory Council and the board are receiving and commenting on the same information through the budget development process. More information on the workshop is forthcoming as we plan the agenda for that day. Please consider holding that time on your calendar as you would a Conservation Advisory Council meeting.



Planning and Evaluation

Draft 2019 Support Group Action Plan

October 12, 2018

Planning

Ongoing Activities

- Help programs think about markets and technical opportunities
- Support organizational reporting
- Provide analytics and support for DEI initiative
- Coordinate with stakeholders and like-minded organizations
 - OPUC
 - Utilities
 - RTF, NEEA, BPA
- Measure development
- Evaluation activities

Energy Efficiency Forecasting and Goal Setting

- Provide a 20-year energy efficiency forecast for Cascade Natural Gas IRP - Summer 2019
- Provide a 20-year energy efficiency forecast for PGE IRP – Fall 2019
- Inform 2020-2024 Strategic Plan goals
- Potentially convert systems for setting goals and reporting savings to gross savings in time for 2020 budgeting

Avoided Cost Updates

- Updated avoided costs are expected to come in January 2019
- Will be used for 2020 measure and program planning
- Assess impact on Energy Trust portfolio

Energy Trust Savings, Renewables as Resources for Utility Peak Planning

- Both system-wide and local peaks are relevant
- Measures that save energy when utilities are capacity constrained will have higher value
 - This will be reflected in avoided costs
- Systematize analytical approach for utility planning to defer localized supply investments

Energy Trust Savings, Renewables as Resources for Utility Peak Planning

- Work with utilities and OPUC to create framework to combine energy efficiency and demand response value for B/C analysis for measures that do both
- Expand portfolio of measures that both save energy and provide load control options
- Work with utilities on load control efforts

Measure Development

2018 year-to-date

- 12 new MADs
- 40 MADs revised, updated and republished
- 16 MADs that will be allowed to expire at end of 2018
- 8 MADs in progress of being updated
- 7 new MADs in progress

2019

- 71 MADs that need to be updated, extended or allowed to expire

Savings Impact of 2018 Measure Development Work

Oregon Energy Efficiency Programs		
	Electric	Gas
Impact of savings changes on measures	(9,929,856)	(484,812)
Percent of savings affected measures contribute to portfolio	47%	19%
Percent of whole portfolio	-3%	-7%

Washington Energy Efficiency Programs	
	Gas
Impact of savings changes on measures	(16,111)
Percent of savings affected measures contribute to portfolio	28%
Percent of whole portfolio	-5%

Savings Impact of 2018 Measure Development Work by Sector in Oregon

Commercial Sector		
	Electric	Gas
Impact of savings changes on measures	(3,809,3254)	(151,3132)
Percent of savings affected measures contribute to Portfolio	42%	30%
Percent of Whole Portfolio	-2%	-6%

Savings Impact of 2018 Measure Development Work by Sector in Oregon

Industrial Sector		
	Electric	Gas
Impact of savings changes on measures	5,433,440	(151,9965)
Percent of savings affected measures contribute to Portfolio	45%	14%
Percent of Whole Portfolio	4%	-10%

Savings Impact of 2018 Measure Development Work by Sector in Oregon

Residential Sector		
	Electric	Gas
Impact of savings changes on measures	(11,553,971)	(181,504)
Percent of savings affected measures contribute to Portfolio	66%	11%
Percent of Whole Portfolio	-18%	-6%

Evaluation

2019 Major Impact Evaluations

- Existing Buildings and SEM 2017
- Existing Buildings and SEM 2018
- Multifamily custom track
- New Buildings 2015-2016
- New Buildings 2017
- Production Efficiency 2016-2017
- Production Efficiency 2018

2019 Major Process Evaluations

- Multifamily 2019
- Residential 2019
- Production Efficiency 2018

2019 Other Impact and Process Evaluations

- Open EE Meter residential measure savings
- New buildings large/complex projects impact evaluation
- Mega project impact evaluations
- Work with utilities to evaluate load management efforts

Market Research and Pilot Projects

- Regional End Use Load Research Project
- Property Manager Market Research
- Industrial O&M Persistence Study
- Customer Insights Study 2019
- Fast Feedback 2019 customer surveys
- Trade Ally Survey 2019
- Develop integrated datasets, documentation, and training, and perform analysis
- Efficient Wall Heater Metering Study
- Whiskerlabs Smart Thermostat Pilot
- Residential Pay for Performance Pilot
- Networked Lighting Controls Pilot
- Manufactured Home Replacement Pilot



Thank You

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Planning and Evaluation Action Plan

Group Description

The Planning and Evaluation group is comprised of the Planning team, Planning Engineering team and Evaluation team.

The Planning team develops forward-looking estimates of efficiency program costs and savings. The team works with utilities to develop forecasts for long-range savings and cost goals; updates avoided costs; develops cost-effectiveness tools; provides planning support to renewables team; helps develop long- and short-term plans; works with program groups to integrate plans into program strategies, including projects to defer utility investments in local transmission and distribution; serves as a central point of coordination on market research; and manages savings and cost-effectiveness reporting. The Planning team also participates in strategic plan and policy development, focusing on economic and quantitative issues.

The Planning Engineering team oversees the measure development process and acts as quality control agent for Energy Trust's estimates of measure energy savings, cost and cost-effectiveness. The team also coordinates the integration of emerging technologies into Energy Trust markets and programs.

The Evaluation team assesses the effectiveness of efficiency and renewable energy program implementation, and estimates savings and generation on a retrospective basis. This team also performs and supports market research; performs and supports qualitative and quantitative analysis; creates and updates efficiency measures in Energy Trust's Project Tracking system; manages complex data for Energy Trust, such as third-party data and utility customer information (UCI) data; participates in regional research projects; and creates and maintains datasets for program and evaluation use.

2019 Strategic Focus

- Enhance Energy Trust's ability to focus on capacity savings, not just energy, from efficiency and renewable energy technologies and programs. This includes understanding the value, quantifying savings, forecasting, and helping programs shift focus to maximize peak savings.
- Expand the portfolio of measures that both save energy and provide load control options.
- Solidify approaches to using market data to identify and target under-served markets.
- Begin to systematize the analytic approach to using efficiency and renewable energy to defer investments in the local grid.

2019 Activities—Ongoing and New

Sustain accessible, transparent and effective management and administration of cost-effective programs and services

- Deliver enhanced energy efficiency supply and cost estimates for use in integrated planning processes for the five utilities that fund Energy Trust.
- Communicate with stakeholders to provide transparency on forecast modeling and gather feedback on how to improve methods.
- Support accuracy of energy savings and benefits reporting by Energy Trust.
- Continue to enhance benefit/cost sensitivity analysis tools for use in the budget process.

- For Energy Trust standard and other reports, provide analysis and summarize savings, generation and economic performance.
- If the proposal receives support from the board and OPUC, convert Energy Trust's goal, reporting and cost-effectiveness policies from net savings (adjusted for market effects) to gross savings (including market transformation).
- Develop and update prescriptive efficiency measures and simplified calculation tools as needed.
- Improve estimates of peak reduction from energy efficiency savings and renewable generation.
- Develop improved energy savings and savings shapes for selected measures that more accurately reflect summer peak savings. Employ metered data and analysis and explore processes to synthetically manufacture these shapes.
- Assist the renewable energy sector in analyzing and assessing specific renewable energy investments.
- Support regional end use load research project and use data from the initial sample of metered residential sites to increase understanding of load shapes of energy savings.
- With the utilities and OPUC, discuss adjusting the data transferred between Energy Trust and the utilities.
- Work with IT to create a dataset of calendarized utility customers information data and an integrated dataset combining Energy Trust, utility customers information and third-party data in a central location. Socialize and train analysts on these datasets, and support programs in utilizing the datasets for research and analysis.
- Deliver impact evaluations of savings from all major efficiency programs and select renewable energy programs. Adjust methods to reflect increased importance of peak savings and generation.
- Use evaluation results and other intelligence to true up energy savings recorded in systems.
- Conduct process evaluations on a periodic basis for all major programs.
- Update avoided costs to reflect outcomes from OPUC Docket UM 1893 and incorporate these avoided costs into 2019 planning for 2020 implementation.
- Develop framework to quantify value of energy savings in changing industry landscape where utilities are capacity constrained.
- Release new avoided costs for measure and program planning work in 2019 to prepare for 2020 implementation.

Establish 2020-2024 strategic direction

- Provide scenarios and concepts for strategic planning goals and objectives.
- Support writing of draft strategic plan and engagement with key audiences to refine plan.

Improve productivity and efficiency

- Improve the communication and coordination regarding the recently upgraded measure development and pilot processes.
- Establish process for addressing scenarios and uncertainties in stakeholder engagement regarding measure changes.
- Support efforts by programs to develop a standardized and streamlined approach to assess when to discontinue incentives and/or support services for efficiency measures.
- Expand the portfolio of demand response and energy efficiency measures jointly funded by utilities (for demand response) and Energy Trust.

- Roll out new, electronic process for requesting new measures and making changes to existing measures.

Increase flexibility and adaptability

- Use Regional Technical Forum planning savings estimates where appropriate, and use other tools to simplify savings estimation for pilots.
- Identify how to prioritize and test the most important technologies that nearly ready the market.
- Expand training on how to use pilot and field test processes efficiently.
- Accelerate the process for developing and refining datasets to support participation, market and other analyses.

Increase program performance, viability and relevance

- Provide support and expertise to staff conducting market research.
- Work with programs to implement program delivery structures that conform to OPUC policy requirements, such as evolving avoided costs.
- Broaden program initiatives to work with service providers who remotely control end-use equipment (such as lighting fixtures, HVAC equipment and water heaters) to ensure efficient operations.
- Continue technical analysis and support for Pacific Power transmission and distribution deferral pilots and a NW Natural pipeline deferral pilot. Respond to opportunities for similar pilots with other utilities.
- Complete process evaluations of transmission and deferral pilots and start evaluating other similar pilots, as needed. Draw lessons about requirements for success for these efforts and determine applicability of specific analytic techniques and value of various resources.

Increase customer participation and awareness

- Help programs create actional metrics, goal structures, and strategies for reaching historically under-served customer groups.
- Incorporate diversity and equity considerations into staff recruitment and contractor selection.
- Develop, test and refine datasets that support targeted marketing to high-savings-yield and high potential under-served markets.

Diversity, Equity and Inclusion Activities

- Apply equity lens to selection of task order contractors and to staff recruitment.
- Evaluate success reaching underserved customers and markets.

2019 Key Assumptions, Risks and/or Challenges

- In late 2018, Energy Trust is likely to receive updated avoided costs from utilities, and it is anticipated that staff will adapt a methodology for improved valuation of peak savings. The combination may both reduce the forecast value of efficiency and shift the value to further emphasize measures with summer savings. The magnitude and impact of these changes is not entirely known but will influence the overall value of energy efficiency.
- It is not known whether legislation will lead to a statewide program to reduce carbon emissions, nor how that will impact the value of efficiency and renewable energy delivered by Energy Trust.

2020 Expected Changes

- 2020 may bring significant adjustments to programs due to continued market adaption of efficient technologies and expected Federal efficiency standards for lighting.
- There may be further changes to avoided cost as the Oregon regulatory process addresses fundamental changes in power markets and the role and value of efficiency and renewable energy.

Northwest Energy Efficiency Alliance Action Plan

Program Description

Northwest Energy Efficiency Alliance identifies and drives market transformation programs to accelerate and sustain market adoption of energy-efficient products, services and practices across commercial, industrial and residential sectors, working in coordination with Energy Trust. NEEA researches and assesses emerging energy-efficiency opportunities and facilitates coordinated regional strategies to permanently remove market barriers and leverage the collective scale and power of the region. NEEA's role in market transformation efforts varies by program, and generally focuses on activities with market participants upstream from Energy Trust and utility customers.

2019 Strategic Focus

Fill the energy-efficiency market transformation pipeline with new products/services/practices.

- Identify new opportunities through scanning, research and market partner engagement.
- Assess the potential and confirm the viability of newly identified emerging technologies, including technical analysis and assessment of market barriers.
- Screen, select and prepare technologies to enter the market transformation pipeline.

Create market conditions that will accelerate and sustain the market adoption of emerging energy-efficiency products, services and practices.

- Influence market actors to increase availability of energy-efficient products and services.
- Improve/ensure product quality.
- Build market knowledge and capability to support new products, services or practices.
- Identify and develop market resources that capitalize on the compelling value proposition for a new product, service or practice.
- Increase product awareness.
- Develop strategies to address price/first cost issues.
- Influence and support the successful implementation of more stringent building codes and appliance standards.

2019 Activities—Ongoing

Fill the pipeline with new energy-efficiency products, services and practices.

- Advance an initiative to drive adoption of optimized motor driven systems for reduction in energy losses of compressed air systems.

Accelerate and sustain market adoption of electric energy-efficient electric products, services and practices.

- **Heat pump water heaters:** Increase emergency replacement penetration via trainings to ensure widespread knowledge about heat pump water heaters; execute consumer awareness tactics in the market to drive demand for HPWHs; update advanced water heater specification; continue manufacturer and targeted markets events; identify market disruptions to spur competition and motivate heat pump water heater sales.

- **Ductless heat pumps:** Educate regional and extra-regional supply chain, utilities and Regional Technical Forum on new rating system; work with willing manufacturers to evaluate new rating system and test products; continue to support market-led partnerships with adjacent trades to learn more about barriers and opportunities; continue to support community-based organizations interested in providing DHPs for consumers in target homes.
- **Retail product portfolio:** Finalize program guidelines with approval from other ENERGY STAR RPP program sponsors; coordinate with PG&E and other sponsors to build support with regulators & evaluators; continue to coordinate with Super-Efficient Dryer initiative to ensure optimal strategy for the laundry category (including washers); continue state-level codes & standards engagement; continue data quality control improvements and refinements of savings approach.
- **Super-efficient dryers:** Complete market research investigating laundry market trends; continue retailer pilots and partnerships; continue support of manufacturer marketing campaigns leveraging findings from previous market research; investigate super-efficient dryer (SED) emerging technologies; align with natural gas team and coordinate on manufacturer outreach; continue outreach to other stakeholders (such as California and Canada) to build broad support for SEDs.
- **Manufactured homes:** Provide upstream incentives to address cost differential for NEEM+ homes; support funder program planning; continue manufacturer outreach/relationship building; increase demand for NEEM+ through retailer marketing resources, retailer outreach and marketing collateral highlighting the value of NEEM+.
- **Next step homes:** Collaborate with commercial code enhancement to create state action plans to achieve long-term code targets; coordinate with city and utility activities to achieve Climate Action plans; continue to work with funders and the RTF to launch, learn from and improve Performance Path programs; continue outreach for awareness and education of raters/verifiers; coordinate Home Efficiency Forum 2019; build out Better Built Northwest (BBNW) website to highlight and connect regional market actors and provide additional building resources and tools; optimize usability and value of Axis database; continue local government outreach to connect with voluntary home certification programs.
- **Reduced wattage lamp replacement:** Complete final Market Progress Evaluation Report; update all required Long-Term Monitoring and Tracking (LTMT) documentation including data management plan, final logic model and key market diffusion metrics; document and disseminate key program lessons learned.
- **Luminaire level lighting controls (LLLC):** Collaborate with Lighting Design Lab to bring two differentiated tracks of training to region for trade allies, distributors, designers and engineers; collaborate with manufacturers to promote the technology through their sales channels; develop additional marketing resources to support funders in promoting LLLC to their customers; develop and promote case studies to trade publications; continue to bring research findings to the region to develop and fine tune both NEEA and funder program efforts.
- **Commercial code enhancement (CCE):** Coordinate with state collaboratives to review, select and assess new technologies/practices; develop state road maps; determine appropriate support to increase awareness/adoption of future code measures; utilize audience research to build awareness through trainings and direct outreach in the Architect and Engineering community; use CCE market intervention strategies to support utility program planning.
- **Window attachments:** Confirm initial target market building types; conduct market research on the supply chain and demand side target audiences; expand relationships with manufacturers; continue to advise Attachment Energy Rating Council's (AERC) Outreach committees; support AERC in new membership recruitment and development of a commercial ratings program for secondary glazing systems.
- **High Performance HVAC:** Continue market characterization work to understand barriers and inform program design and strategy development; educate and provide technical support for specifying and installing systems; identify and encourage additional heat recovery ventilator (HRV) manufacturers to enter the North American market

- **Extended Motor Products:** Conclude market characterization and baseline work to inform barriers and market interventions; complete research for pumps and circulators to validate energy savings and achieve a proven measure with RTF; work with a limited number of Northwest distributors to expand information on the stock and sales flow of pumps and circulators and to explore the viability of a market shift concept.
- **Commercial and industrial infrastructure programs:** Continue to support current commercial real estate sponsorships with Seattle 2030, BOMA (Building Owners and Managers Association) Oregon and BOMA King County; leverage Seattle's Tune-up Accelerator program for Alliance commercial program technologies; continue to deliver Industrial Technical Training (ITT) courses and coordinate annual planning with sponsors to ensure regional equity; continue to convene and lead the Northwest Strategic Energy Management (SEM) Collaborative and support growth of nascent bi-national collaborative; promote use of SEM Hub resources; continue to promote NXT Level training opportunities to trade allies and roll out NXT Level 2 training.

Accelerate development and adoption of gas efficient products, practices and services.

- **Efficient gas water heaters:** Collaborate with manufacturers to understand their product roadmaps, demonstrate business case and secure commercialization commitment; continue lab and field testing to demonstrate product evolution and resolution of issues found in early prototypes.
- **Combination space and water heating product:** Monitor and assess progress and provide guidance towards deliverables for the SMTI/Trane/DOE project; update or perform assessments of additional products; partner with other utilities and EE organizations to co-fund development, lab and/or field testing of products; establish key contacts at manufacturers.
- **Condensing Gas HVAC Rooftop Units:** Utilize the existing BetterBricks platform for program-developed collateral and market partner resources; complete successful multi-unit field test; develop value proposition based on all associated condensing RTU costs and measured energy savings; develop final field test report and case studies and disseminate to utilities, HVAC supply chain and EE energy efficiency organizations; complete and maintain HVAC Product Roadmap; engage with manufacturer partners and potential co-funding partners to refine specification.
- **Efficient gas dryers:** Continue to socialize gas dryer specification with utilities outside of the Northwest to garner support.



Pacific Power Targeted Load Management Pilot Conservation Advisory Council October 12, 2018

Agenda

- Background
- Overview of the pilot
- Preliminary findings
- Lessons learned
- Next steps

Background

- Pacific Power approached Energy Trust about a collaborative pilot
 - Learning exercise to assess demand-side strategies on specific system constraints
- Pacific Power utilizes a distributed resource screening tool
 - Focused on demand management and DER alternatives to traditional upgrades
 - Mostly demand response focused
- Wanted to explore targeted efforts

Background – Energy Trust Interest

- Fits well into our mandate to achieve all cost-effective energy efficiency
- Energy efficiency plays a key role in load management by reducing the overall load during peak times
- Economically beneficial to ratepayers
 - Could potentially negate or defer more expensive traditional capital investments
- Synergistic with our existing programs and utility objectives

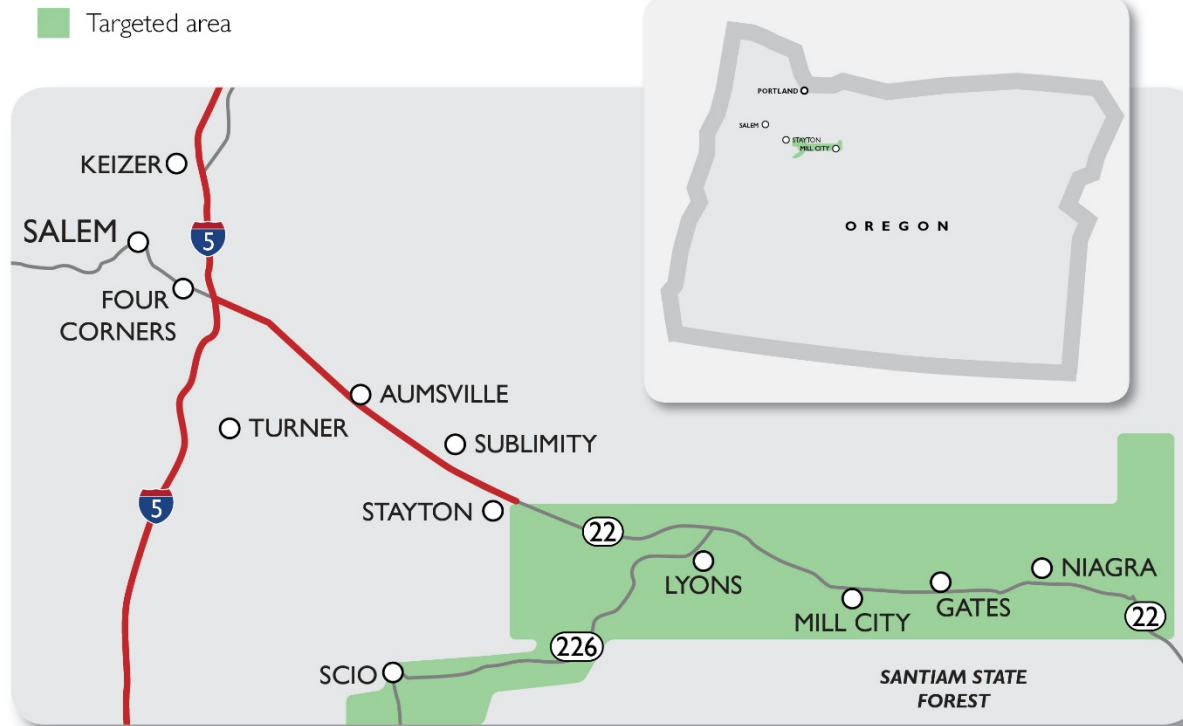
North Santiam Canyon Targeted Load Management Pilot Overview

Pilot Timeline

- Informal planning in 2016
- Site selected for rapid launch in 2017
- Offerings in the market July 1, 2017
- Initial 3-4 month push, extended into 2018
- Wrap up pilot by Q2 2019

North Santiam Canyon

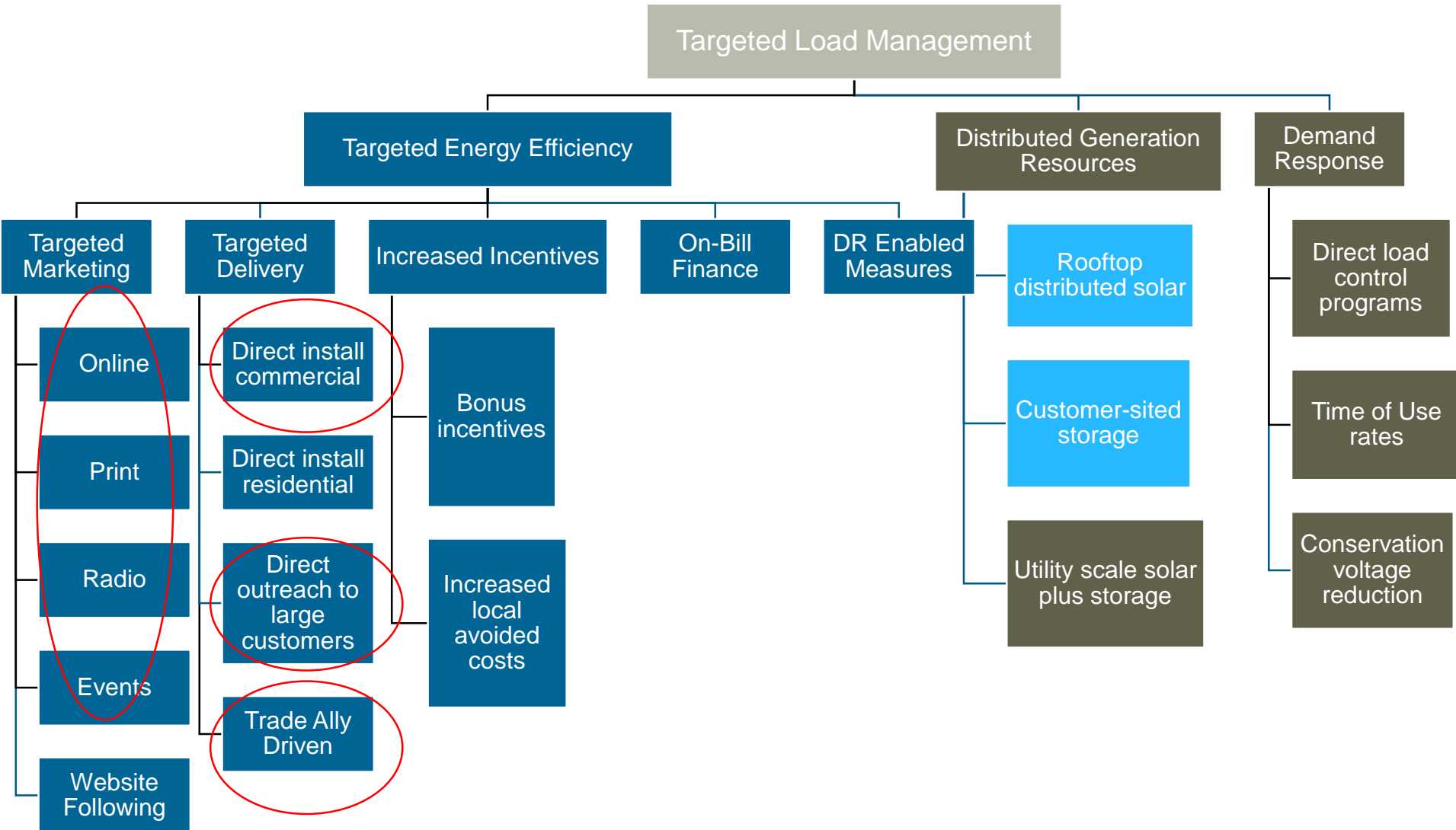
Targeted Communities Pilot – North Santiam Canyon



Pilot Goals – A Learning Pilot

- Reduce demand (kW) during specific time periods
 - 6-10 a.m. winter; 12-8 p.m. summer
 - No specific kW reduction goal for pilot
- Document replicable program design
- Coordinate Pacific Power and Energy Trust staff
- Identify process improvements
- Test “off the shelf” offerings for rapid deployment

Portfolio of Load Management Strategies



Q2 2018 Preliminary Findings

Marketing Examples



Pacific Power hosts energy saving workshop

Yup, the power company really does want you to use less power

By Michelle Gates

You might wonder why a power company would want you to use less power. We did, and so did quite a few other local residents and business owners who attended the recent workshop hosted by Pacific Power and Energy Trust of Oregon.

Turns out that the answer is simple - with more people coming to Oregon, that means more electricity demand, and the decision makers at Pacific Power discovered that it's cheaper to teach their customers how to save energy than it is to build the

new energy transfer station needed to keep supplying the growing usage, said Corey Scott, the Director of Customer Solutions for Pacific Power.

So Pacific Power bought dinner for anyone interested in learning how to save energy - and it was at Trexler Farm (who doesn't want free dinner from Trexler Farm?)

There were certainly a lot of happy diners at the event on July 18, which was targeted toward business owners. The following day event on July 19 provided program information for residential customers.

"We recognize that we're not as present in rural Oregon as we should be," said Jay Ward, the Community Relations Specialist for Energy Trust.

Pacific Power and other state-wide energy companies are working with Energy Trust, which is a non-profit group that gives people and businesses cash to replace outdated equipment.

New lighting and cooking equipment in a restaurant or store could be partially - and sometimes even completely - paid for through cash rebates and lower electricity bills. Heat pumps can qualify for up to 50% of project costs.

One of the biggest energy users is a hot oil fryer and there are in-

centives that will pay for the bulk of a new unit.

Auto shops can see savings and incentives for updated compressed air systems.

Grocery stores and markets can qualify for incentives for new refrigeration equipment.

Attic insulation has high incentive rates and usually reduces climate control costs dramatically.

Even lighting - there's still cash incentives to switch to LED lighting. "We've seen that better lighting can showcase products better. It can also possibly increase work efficiency from staffing."

Many of the projects will pay for themselves in a couple of months through energy savings and the available cash incentives.

Energy Trust wants to be a part of your upgrade planning, and wants you to know that it's important to call them first before purchasing any new equipment.

"We have guidelines that we need to follow and we can only reimburse for upgrades that fall within our qualifications. Don't make the mistake of buying first and then find out that the energy efficiency level doesn't fit."

Energy Trust has technicians in the area this week, and says that it takes about 24 hours for a first call back, and they can usually have an assessment done within 10 days.

Any technical assistance is free and paid for by the non-profit organization. Generally, Energy Trust can help you with "up to 65 percent

Did you know? Pacific Power will soon be replacing all of their meters with smart meters.

"You'll be able to log on to the system and see what you use every hour. You'll be able to create a set point and get notified by email when you reach a certain dollar amount - so you know when to cut back.

You also won't see meter readers anymore, and we won't need to access private property anymore."

Alan Meyer,
Pacific Power

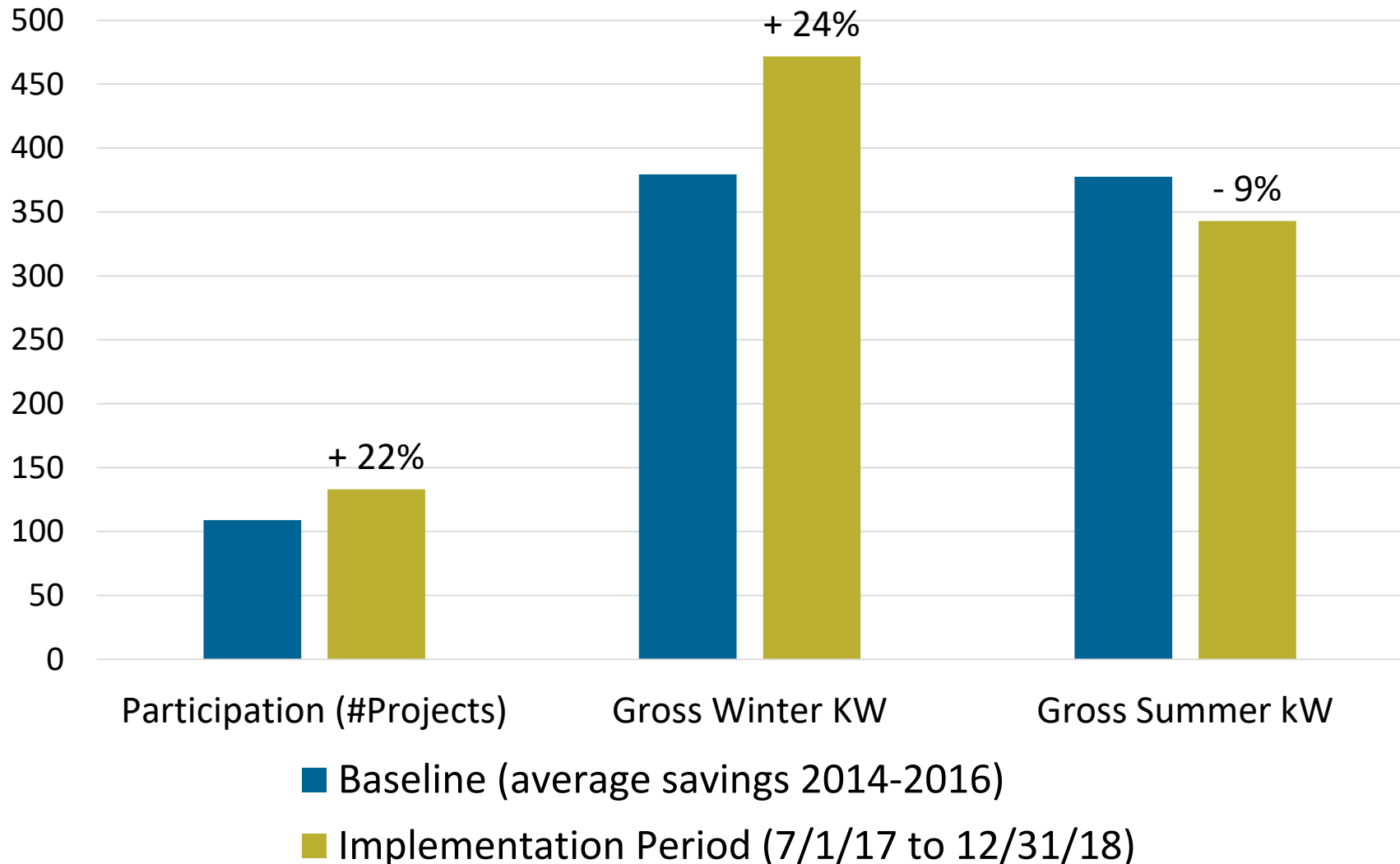
Increased Marketing and Outreach

- Increased promotional efforts
 - Co-branded advertising
 - Digital advertising
 - Business and residential events
 - Bill inserts – energy kits
 - Heat pump manufactured home mailer
- Direct-install commercial lighting
 - Audits for 44 small businesses; 21 completed projects
- Industrial team utilized an increased account manager approach

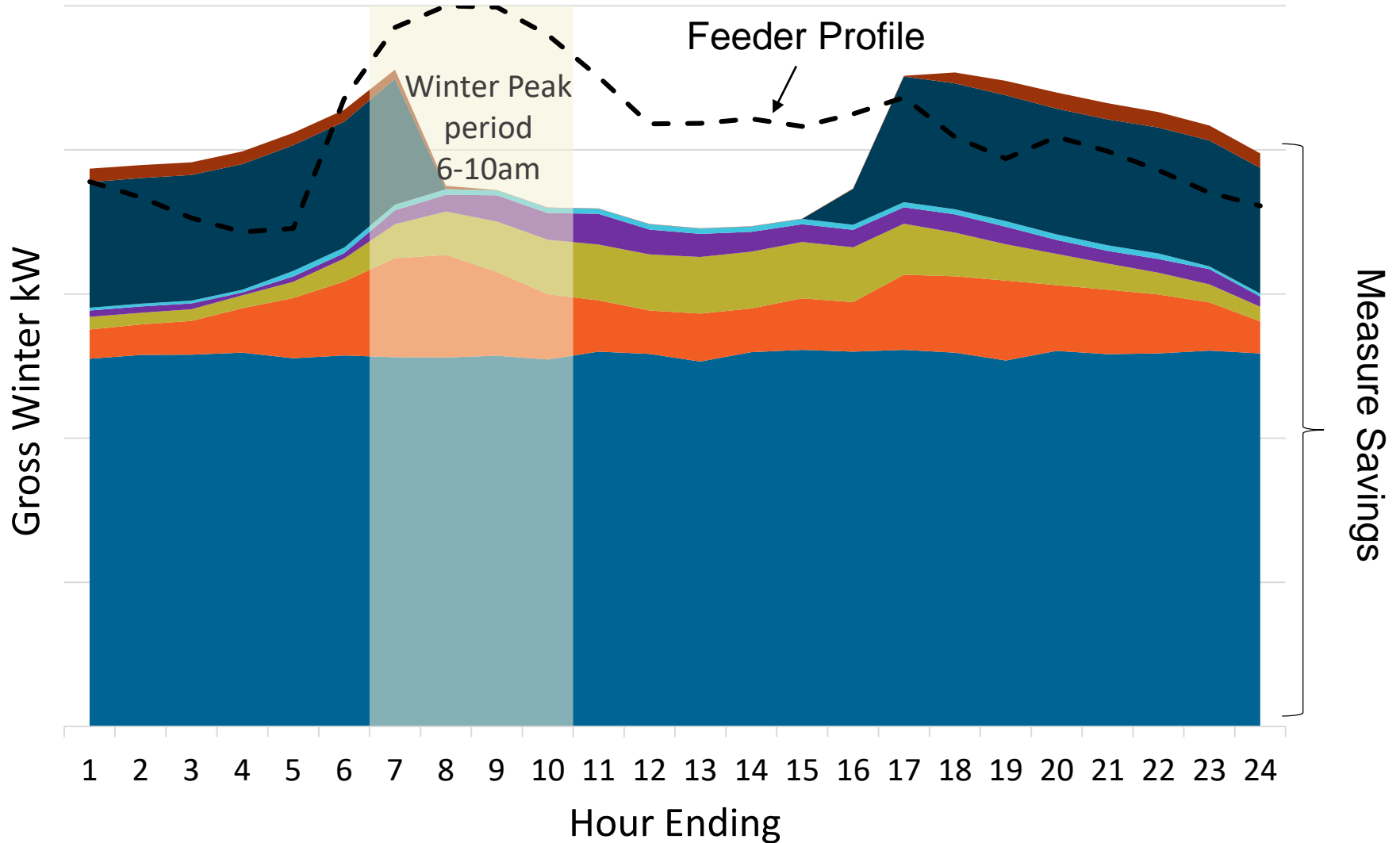
Completed Projects through 2018 Q2

Sector	Completed Projects	Gross kWh Savings	Avg kWh Saved per Project	Winter kW	Summer kW
Commercial	14	93,330	6,666	14	15
Residential	93	75,952	817	5	33
Industrial	26	1,177,039	45,271	129	135
Total	133	1,346,321	10,123	149	182

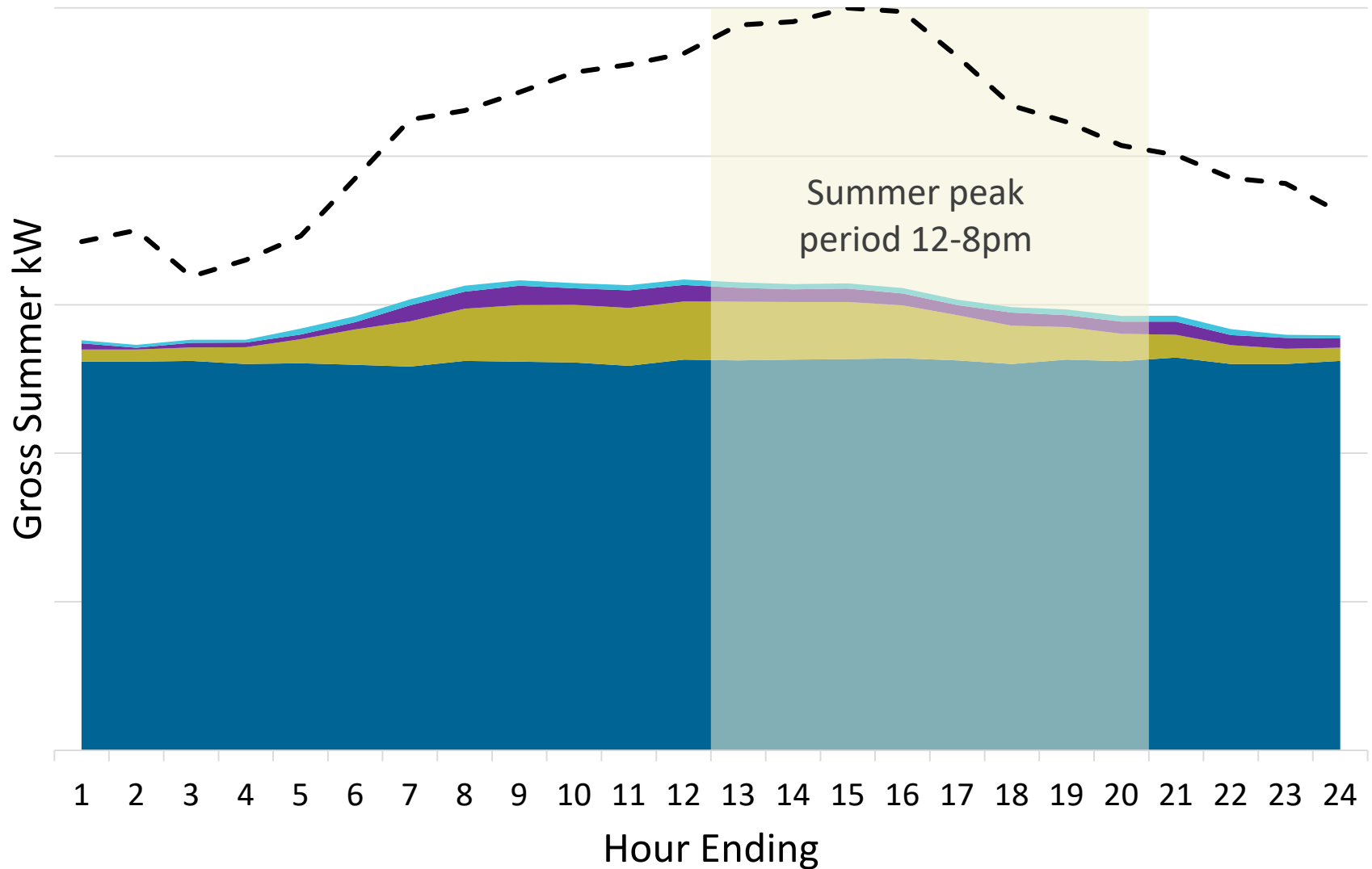
Targeted Effects versus Baseline



December Estimated Peak Day Savings



July Estimated Peak Day Savings



Lessons Learned

Overall Learnings

- It's different than business as usual
- Coordination between different parts of our respective organizations
 - 2017 NEEA Leadership Award for Collaboration
- A lot of staff interest and new ideas

Key Takeaways from N. Santiam Pilot

- Focused on rapid deployment and saw impact
- Need to shift from rapid deployment to planning for maximum kW influence
- Joint promotional efforts best received
- Deploy large customer scoping tactics early
- Lighting outreach strategy quickest to deploy and quickest to impact load

Identified Process Improvements

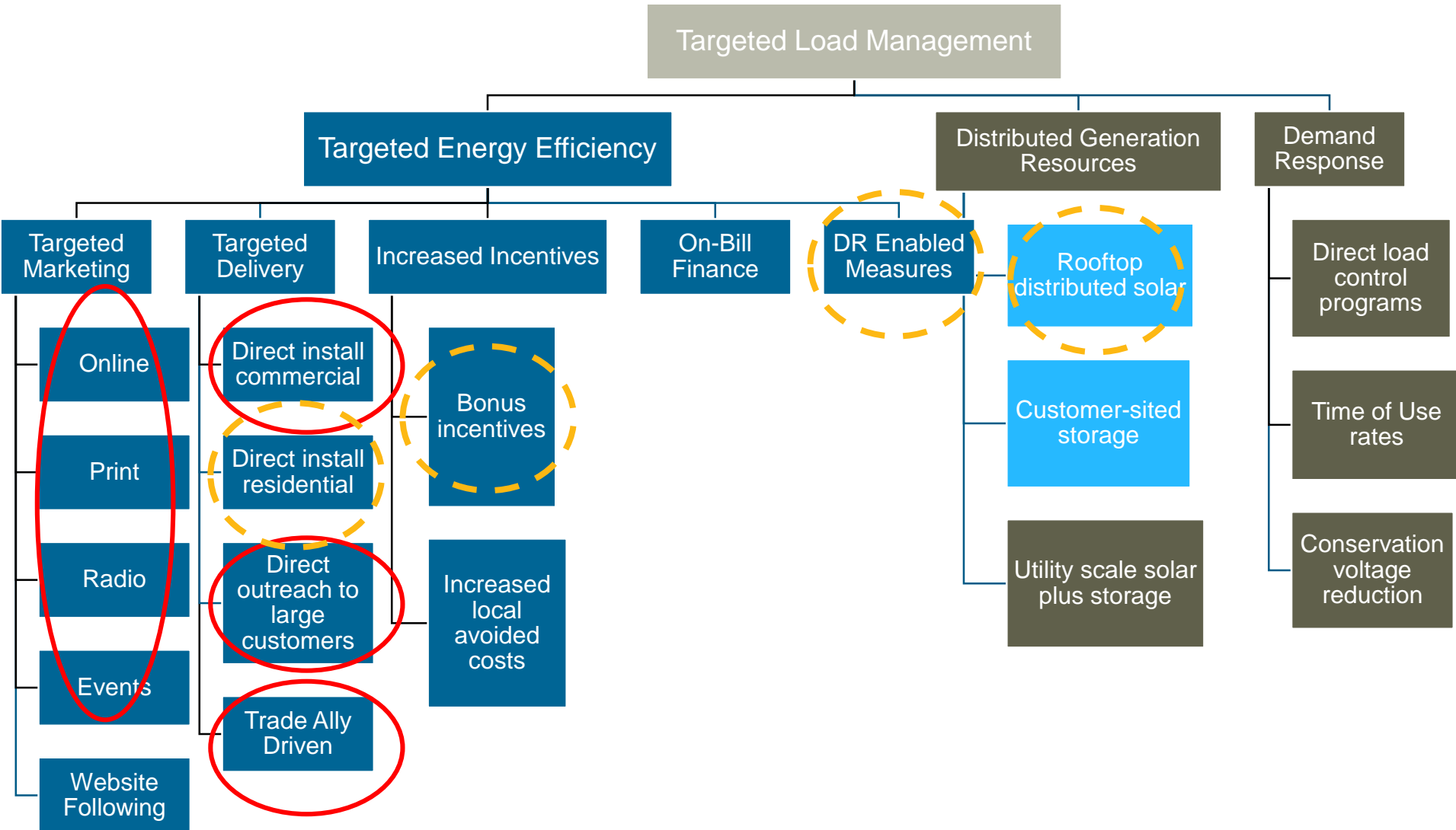
Improvement	Timeframe
Determine key messages for the market to hear ahead of time and test key messages in the market.	Long-term
Develop evaluation methodology ahead of program design phase to ensure collection of pertinent data points.	Long-term
Communicate specifics about targeted location earlier to program implementers.	Short-term
Deploy Industrial PDCs quickly to scope measure potential at large sites.	Short-term
Better incorporation of utility consumption data to custom-tailored outreach and offerings to high-energy users.	Short-term

Next Steps

Applying the Learnings

- Second Pacific Power pilot location in Oregon in 2019
- Collaborate with Pacific Power to refine kW estimation methodology
- Share lessons learned across other targeted efforts
 - NW Natural targeted load mgt pilot
 - PGE Smart Grid Test Bed
- Refine and revisit research questions

Portfolio of Load Management Strategies



Remaining Research Aims - General

- Develop deeper understanding of technology-specific role at various sites
- Better understanding of what is driving the distribution constraint
- Increase knowledge of how savings shapes differ
- Continue to develop streamlined systems for analysis of impacts

Remaining Research Aims – Marketing

- Understand how marketing campaigns affect measure-specific uptake
- Test impact of increased incentives up to maximum incentive
- Impact on customer satisfaction of higher incentives

Remaining Research Aims – Savings

- Extreme temperature impacts on heat pump performance
- Do heat pumps add summer load?
- Understand how certain classes of VFD motor projects impact peak
- How does the bottom up kW estimate compare with feeder-level view?

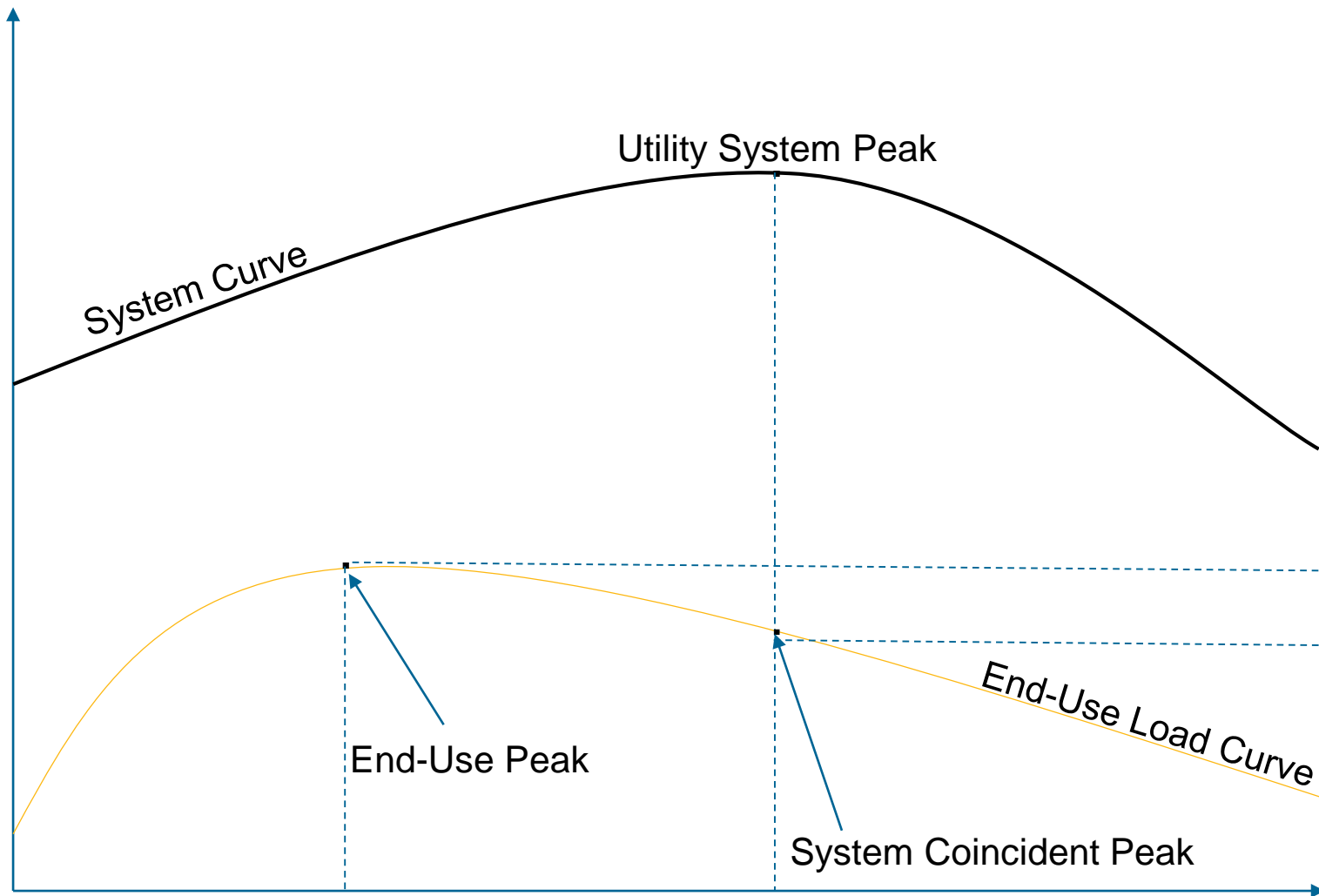


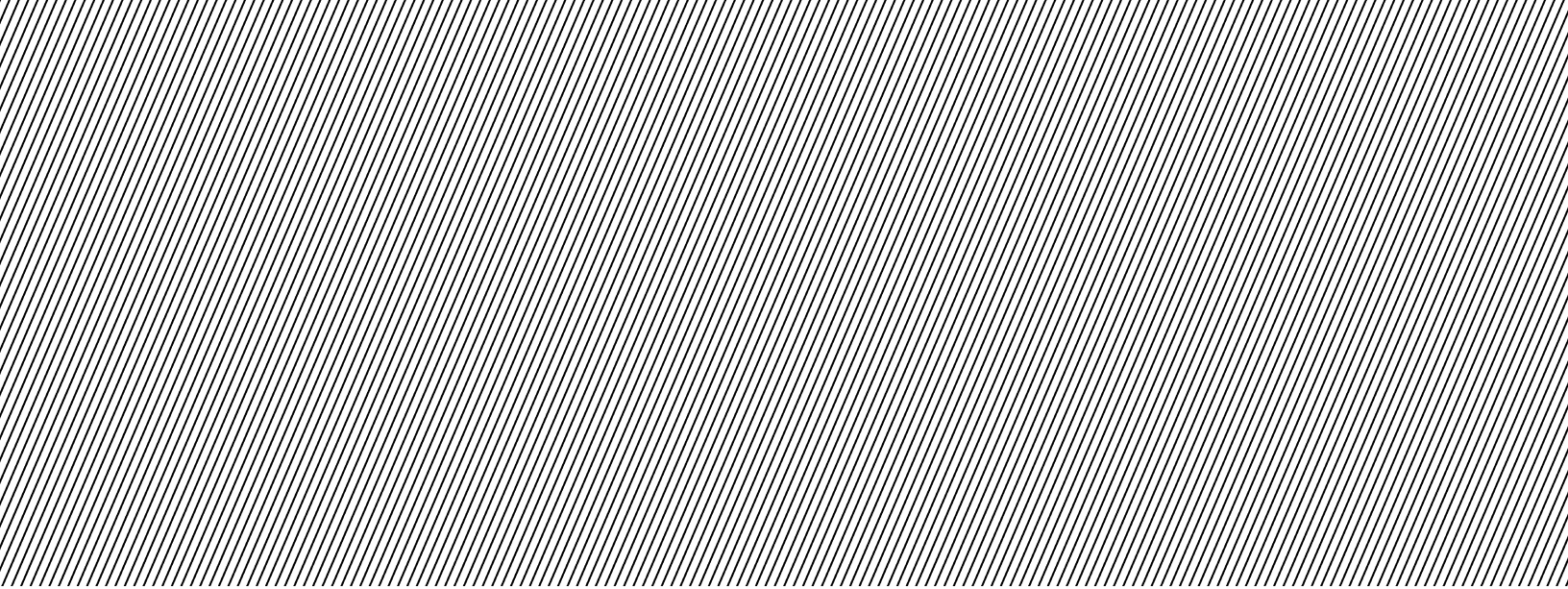
Thank You

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Graphical Depiction of Peak Demand





Distribution Systems and Energy Efficiency

Board Learning Paper

Prepared by
Amanda Potter, Thad Roth, Hannah Kramer, Susan Jowaiszas, Becky
Engel
February 2018

Preface

This paper is part of a series that describes a variety of topics identified by the Energy Trust of Oregon's Board of Directors as potentially influential to the organization during the time period of its next strategic plan (2020 – 2024). This series of papers will educate and inform the Board about the potential impact of these topics and enable its Directors to better to assess risk, identify opportunity and guide the direction and goals of Energy Trust.

Remaining current on potentially significant and influential developments in the clean energy industry is critical to the fundamental role of the Board. These topics have been identified because of their potential to influence, impact or otherwise affect Energy Trust's ability to serve the ratepayers of Oregon and Southwest Washington. **These papers should not be interpreted as policy proposals or recommendations for roles in which Energy Trust intends or desires to be directly involved.**

Introduction

Energy efficiency is the cleanest, cheapest, and most important resource for the utilities and ratepayers of Oregon and Energy Trust is the prime organization delivering that resource. Energy Trust's programs can have significant impacts on utilities' ability to effectively manage their distribution systems. The location of solar installations, for example, can affect local distribution issues on the grid. Additionally, Energy Trust's energy efficiency programs, with the types of improvements they encourage and the specific location of participant sites, can potentially be used as tool to manage constraints on the local grid.

Utilities across the country are investigating expanding the use of distributed energy resources, commonly referred to as DERs¹ as they transition to more renewable resources in the generation mix and create a more resilient and flexible system. Because of the high cost of building new central generation facilities, economics is clearly a factor, but it's not the only driver for this change. Changes in public policy and

consumer demand and expectations of customers for their utilities are also playing a significant role in this transformation.

The evolution of DERs creates new challenges and drives changes in how utilities manage their distribution systems. The traditional planning process for upgrading and expanding electric distribution systems is inadequate in the age of two-way electric and data flows and decentralized generation. As they expand distributed energy resources, utilities must invest in grid modernization² – a smart grid – to manage the grid and avoid outages while maintaining safety and reliability in the distribution system. Of particular interest in Oregon, this situation is also providing opportunities for real benefit to utilities seeking to delay or phase in transmission and distribution investments.

In envisioning a path toward grid modernization and deeper integration of renewables, utilities are figuring out how distributed energy resources could provide load relief and serve distribution system needs. This is a case where DERs are both a challenge and a solution – they are part of what is driving the need for change in grid management and planning, but they have equal or greater potential to be part of the solution.

Consider these scenarios: Instead of adding or upgrading distribution feeders, utilities may implement a combination of **demand response**³ during peak hours and **targeted energy efficiency** to reduce overall load growth to distribution constraint and delay or eliminate the need for capital investment. Distributed generation sources like **rooftop solar on the customer side of the meter** could be installed in locations on the grid that can best support it and thereby eliminate distribution constraints. **Battery storage with solar** could smooth out the impact of rooftop solar on the grid or be a flexible asset to provide demand response and peak mitigation.

How this transition to a modernized, resilient and flexible grid will evolve to meet these new needs is a question that can be, and is being, approached in a variety of ways. How do we value investments and benefits of targeted DER deployment versus those of traditional distribution system upgrades? What might be the role for Energy Trust of

Oregon in our future delivery of energy efficiency and renewable resource services to customers to support these efforts?

Oregon has begun the process of addressing use of DERs to alleviate distribution constraints. Oregon utilities have been reporting on smart grid enhancements that include both transmission and distribution upgrades and operations improvements. There are several open dockets with the Oregon Public Utility Commission (OPUC) on related topics, including Resource Value of Solar and Storage.

In 2017, Senate Bill 978 directed the OPUC to explore changes to the existing regulatory system and incentives that could accommodate industry trends towards utility or customer owned distributed energy resources. Oregon's investor-owned utilities as well as Bonneville Power Administration are interested in taking a proactive approach to distribution planning processes and exploring the integration of more DERs into the grid. Through Energy Trust, Oregon also has a strong program infrastructure for energy efficiency and renewable energy. This foundation for collaborative development of targeted demand-side management pilots is being explored with some of Energy Trust's funding utilities.

Oregon's needs for addressing grid constraints are less urgent than California or New York where the cost of building new infrastructure, especially in cities, is higher. But constraints on the transmission and distribution system can happen anywhere, and there is interest from all parties to avoid building infrastructure when less costly – and potentially cleaner – alternatives are available. Oregon's approach is to learn from other states while moving forward at a more deliberate pace.

This paper provides background and summarizes opportunities and challenges in implementing DERs, specifically related to delaying investment in distribution system upgrades. It draws on interviews with stakeholders in the Northwest and case studies from numerous states, including Oregon, to illustrate different strategies and identify potential pathways for Energy Trust. This national conversation is actively underway for

electric utilities with needs to address distribution constraints. This paper focuses primarily on strategies for electric utilities. However, this is not solely an electric utility issue. Gas utilities may also face distribution constraints, particularly at peak times. Some gas utilities, including NW Natural in Oregon, are testing strategies to deploy targeted energy efficiency to offset gas pipeline constraints and ensure the safe and reliable delivery of natural gas.

Overview of Distribution Planning

The primary role of a utility is to ensure the safe, reliable and cost-effective delivery of electricity to their customers. The electric distribution system was designed to move electricity generated by a centralized power plant and deliver it to end-use customers through their transmission and distribution system. For natural gas utilities, transmission pipelines deliver natural gas to the distribution system of the local distribution company.

Figure 1 illustrates the layout of hardware of an electric distribution system includes:

- A distribution substation, which reduces transmission voltage from hundreds of kilovolts (e.g., 115 kV, 230 kV, 500 kV), to tens of kilovolts (12 kV is the most common);
- The feeders or circuits, which originate at the distribution substation and serve approximately 1,000 customers each;
- The customer, who is connected to the feeder by a service transformer, which reduces voltage from tens of kilovolts to hundreds of volts (e.g., 120 V for a typical household outlet or 240 V for an electric dryer).

This original design did not envision distributed energy resources, and instead assumed that power moved in a single direction from generation through transmission and distribution lines to reach end-use customers. As these new resources have emerged affecting the direction of power flows and as power demands have grown over the years, Oregon utilities have managed the relatively low penetration of DERs with

moderate upgrades to their distribution systems; however, other states have challenges that are more acute.

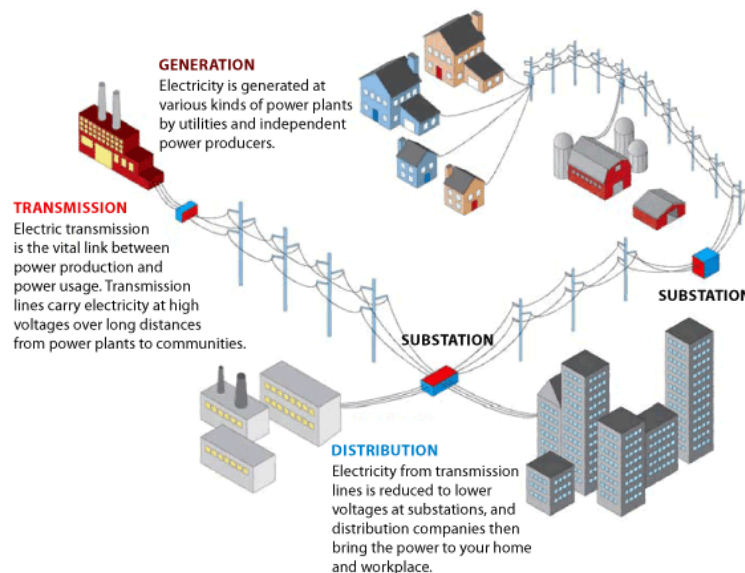


Figure 1: Layout of Typical Transmission and Distribution Systems

Utilities annually review their distribution systems against load forecasts to identify areas where new load could tax the distribution system. When faced with a distribution constraint, utilities first see whether they can reconfigure the distribution system by shifting loads through switches and by moving loads served by one substation to another substation. If this is insufficient to mitigate the constraint, the utility will look at investments in substation upgrades, capacitor bank replacements, or upgrading a feeder line to allow for more current-carrying capacity. More recently, utilities have considered non-wire alternatives⁴, including DERs, to infrastructure investments; however, measuring the relative value of each of the varied alternatives is not clear-cut.

Oregon has taken steps to enable utilities to address this issue proactively. In the Northwest, the 7th Power Plan from the NW Power & Conservation Council⁵ includes conservation resource projections for energy efficiency, distributed solar photovoltaic estimated costs and maximum achievable potential, and achievable potential for demand response in the region. This information informs plans for all utilities in Oregon.

In 2017, the OPUC indicated that utilities should begin distribution system planning to allow for the evaluation of the most beneficial placement and efficient use of new DERs.

Today's Considerations

I. Distributed Energy Resources and the Grid

To manage grid modernization costs many state regulators are starting to push for the deferral of upgrades to the transmission and distribution network through new investment in non-wire alternatives. Utilities and regulators are seeking long-term distribution planning approaches and acquiring analytical tools that support improved DER forecasting, assessment of DER locational value and analysis of least-cost hosting⁶ capacity for rooftop solar. Depending on the scope of a distribution constraint, the types of DERs available, and the load forecasts, utilities may choose a number of different options.

Adding more DERs requires a comprehensive approach to grid modernization that, in turn, requires new operational capabilities for managing multi-directional power and data flows and variable grid conditions. These improvements can provide a more granular visibility into system conditions and the ability to meet load by reconfiguring the distribution grid and dispatch from a growing number of resources.

II. Opportunities: Using DER to address distribution system needs

Utilities can benefit from better DER planning in a number of ways. Providing up to date solar hosting capacity maps support a more efficient interconnection process while directing customers to invest in locations that do not lead to distribution constraints. More detailed planning expands the grid's capacity to accommodate DERs.

DERs, if deployed intentionally in specific locations on the grid, can provide a range of benefits for energy and capacity services and can also be a cost-effective alternative to traditional capital investment in infrastructure – “poles and wires.”

- **Demand response** can be used to reduce load during peak times and shift usage to off-peak times
- **Battery storage systems** can provide both customer services and grid services. For instance, a battery storage system can store energy during off-peak for dispatch during peak demand times.
- **Energy Efficiency** reduces overall load, which can increase the hosting capacity of other DERs on the grid, with many measures also lowering load during peak times.
- **Solar** can provide generation to reduce load during daylight hours with the peak output dependent on the tilt and orientation of the array. Solar when paired with battery storage can become a DER option that utilities can call upon when needed.

Grid conditions and DER attributes dictate which DERs will be the most viable. For example, DER that can be dispatched when the network's peak demand occurs is generally more valuable than one that is not.

As an example, according to the 7th Power Plan⁷, distributed solar has no peak demand reduction potential during the 6 pm winter peak hour and only about 30% of installed solar system capacity occurs during the peak summer hour. Energy efficiency, including the current mix of Energy Trust offerings, contributes more capacity savings during the peak winter hour than the peak summer hour. By combining long-term planning processes that incorporate these complexities and grid modernization efforts that allow for better visibility and management of DERs, utilities can reap the benefits of DER expansion.

III. Challenges: Using DERs to address distribution system needs

Planning and forecasting tools have not kept pace with the evolving needs of the grid, and utilities are working hard to close this gap. Distribution constraints are not always apparent to DER developers because grid maps, like that shown in Figure 2, showing

where DERs can be accommodated need to be created, updated frequently and made publicly available. This slows the analysis that can identify whether a given feeder can accept electricity from a DER and also ensure reliability.

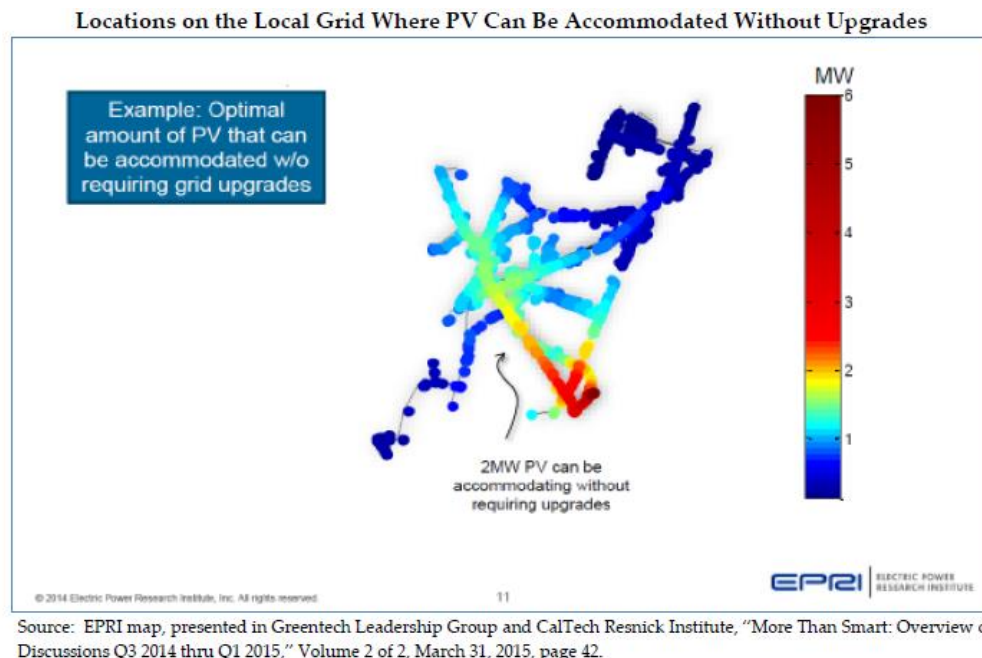


Figure 2: Example of DER Planning Tool

An emerging challenge for planners is implementing demand reduction efforts through targeted energy efficiency and demand response. Energy efficiency programs and their associated demand reduction cannot be easily attributed to a single location. Likewise, utilities may tap demand response to address generation capacity shortfalls and their demand response signals are made for the whole system, not specific areas.

Developing strategies to localize both energy efficiency and demand response – make them more dispatchable -- is on the minds of distribution planners. Many grid operators, trained in the tradition of managing a distribution system fed by centralized power plants, are less confident in the reliability of DERs due to their frequently non-dispatchable nature.

Utilities have historically had a financial disincentive to invest in non-wires alternatives, including DERs, since utility revenues are based upon the value of investments in centralized assets comprising the utility's "rate base." But signs of change are in sight

as states look at different policies, up to and including mandates and incentives for DER deployment. For traditional transmission and distribution upgrades or centralized generation plants, standard practice has been that utilities request to recover their costs through rates, while earning a negotiated rate of return on top of the cost of the investments. However, for energy efficiency and other DER investments, they may only recover their costs. This can make DER investment less attractive to the utility's bottom line.

Developing distribution management systems that provide greater visibility would help address these challenges. Having better ways of modeling and predicting how DERs will be adopted by customers (e.g., which type of DERs, where and at what rate) is one area for improvement. Enhancing operational control to view and manage what's happening in real time on the distribution system is another. Every piece of the grid matters in its management. The characteristics of each link in the chain, ranging from the characteristics and technology of the current feeder networks, to whether there are other DERs nearby, influences what approach is most cost-effective and robust for multiple, sometimes competing, grid management goals.

Current Policy Efforts and Case Studies

Regulators in some states are pushing for distribution planning changes and least-cost planning that incorporates DERs. Some utilities see this as an opportunity to meet their states' DER policy mandates while reducing distribution costs.

I. New York

The New York Public Service Commission instituted a *Reforming the Energy Vision* proceeding in early 2015 to address distributed generation and energy storage, and the ability of utilities and regulators to adopt them, in part to mitigate the relatively high cost of forecasted distribution system upgrades in New York. Through this top-down approach, the utilities are creating Distributed System Implementation Plans and tools to support valuation of DER and enable integration of higher levels of DER through third-party engagement in the market and power system. New York sees the future of

the regulated utility as an enabler of customer choice and provider of distribution planning, integrated grids, and deployment of DER to cost-effective levels.

Prior to REV, New York has been proactive in integrating end-use efficiency into transmission and distribution system planning, with geo-targeted load reductions occurring since 2003 when distribution networks were approaching peak capacity. ConEd implemented geographically-targeted energy efficiency programs in over 1/3 of its distribution networks to delay or eliminate the need for distribution capacity expansion. Savings from these efforts were close to forecast and provided \$300 million in net benefits to ratepayers⁸.

In 2014, Con Ed received regulatory approval to invest in approaches to mitigate capacity constraints in Brooklyn and Queens and defer a \$1 billion substation investment. The deferral of electric substations is expected until 2026 because of these efforts. Instead, a \$150 million investment will cover increased incentives for customer-sited solutions, resulting in over 40 MW customer-sited load reduction measures (or \$3.7 million per MW). Customer-sited load reduction could take the form of energy efficiency measures and on-site generation technologies.

II. California

In 2014, the California Public Utilities Commission (CPUC) initiated a Distribution Resource Plan proceeding that laid out the following goals for utilities:

- Characterize the ability of the utilities' systems to accommodate additional DERs
- Develop an approach to assign locational values in the distribution system
- Offer projections of DER growth and how that growth affects infrastructure investments
- Initiate pilot projects to demonstrate innovative technical and operational approaches to integrate DERs. In 2015, the California Investor-Owned Utilities filed distribution resource plans that described their proposed strategies to meet those goals.

Utilities and the CPUC are taking a bottom-up approach to their state's distribution system. They have jointly developed Integrated Capacity Analysis methods at the feeder level to identify the capacity of the distribution system to integrate DERs, and Locational Net Benefits Analysis methods to determine how to measure the value of DERs at specific locations on the distribution system. Southern California Edison and Pacific Gas & Electric have begun to explore how DERs, including energy efficiency, can be used to meet distribution system needs, looking at the load reductions achievable through energy efficiency at peak time periods and matching to the feeders that need it most.

III. Oregon

A. BPA: I-5 Corridor Reinforcement Project (South of Allston)

The Bonneville Power Administration had planned for an investment of more than \$1 billion for 79 miles of 500 kV transmission line near Longview, Wash., called South of Allston, to address the issues of high congestion in its transmission system⁹. This project was halted in 2017 and BPA committed to evaluating how a non-wires alternative could alleviate constraints. Like other utilities, BPA is working on DER valuation analysis and screening criteria so that non-wires solutions can be evaluated as standard practice.

BPA began a two-year pilot in the summer of 2017 to analyze the costs, benefits and impacts of non-wires solutions South of Allston. It would be implemented on both sides of the meter -- customers will reduce demand on 10 summer days for four hours at a time, and BPA will forecast peak energy demands and then coordinate with generators to the south of the constraint to take the pressure off the transmission system. In terms of dispatchable resources, BPA is tapping into 46 MW of demand response for the pilot, but has chosen not to use storage at this time due to cost. BPA is also making targeted upgrades to system components – all in an effort to avoid building a new transmission line. If the pilot is successful at alleviating the strain, BPA will apply this approach to other congestion points in the system.

B. Pacific Power

Currently, Pacific Power is working with Energy Trust to identify areas where targeted community-focused DER solutions could improve system operation during specific locational peak hours and also possibly defer traditional system investments.

The first effort is a pilot in the North Santiam Canyon. The objective of this pilot project is to measure the impacts of increased marketing and outreach of existing Energy Trust energy efficiency offerings to residential, commercial and industrial customers. The results of this project will inform whether and how the utility and Energy Trust could jointly deliver targeted energy efficiency as a solution in areas at risk of distribution constraint.

Pacific Power also released a targeted locational demand response request for proposal, through which they expect to learn more about how to manage targeted demand response. The utility is developing screening criteria to help direct analysis to determine when non-wire alternatives would likely be cost-effective. The results of this pilot will produce data and findings to assist Pacific Power distribution planners in using these screening criteria.

"PacifiCorp recognizes the role that distributed energy resources (DER) may play in the deferral or offset of traditional poles and wires infrastructure investments. Where feasible and cost-effective, DER solutions are expected to supplant traditional solutions for implementation." ¹⁰

C. NW Natural

Energy Trust is currently working with NW Natural to implement a multi-year pilot to develop cost, savings and timing estimates for peak-hour gas targeted energy efficiency strategies to help NW Natural plan for future capacity constraints. The pilot builds on expertise within Energy Trust program delivery and lessons learned from similar efforts. It will test the results gained through a range of delivery strategies, including but not limited to: targeted marketing, targeted delivery, and increased incentives. The pilot

team will investigate the costs of these specific strategies that could help determine specific cost-per-therm for geographically targeted energy efficiency offerings.

Summary/Conclusions

I. How Do We Get There From Here? Enabling, Valuing, Planning And Regulating DERs

Reaching these goals requires that a few conditions be true:

DER Solutions are tested and reliable: Building the modern grid will require that currently available DERs, including demand response, storage and energy efficiency, are robust and reliable.

The value of DERs to the distribution grid is understood: Stakeholders in the industry must improve the valuation of DERs to the grid. Valuation methodologies must be developed and applied so distribution planners will have reliable data for decision-making on the locational net value of each DER.

Distribution planning tools exist and are in use: New solutions require a complete toolkit for planners to keep pace with changing DER integration. Utilities will help steer the market by incentivizing favorable locational deployment of DERs and dis-incentivizing unfavorable locations.

Grid modernization investments are made: All of these changes to optimize the current system are setting up a path toward the larger vision for grid modernization that can accommodate future complexity from even more DERs.

Utility policies and incentives are considered and developed: Policy changes will loom large as states address new areas, including setting conditions under which DER capacity procurements must be considered by utilities, and incentives for utilities to employ DERs to mitigate or defer distribution grid needs.

II. The Role for Energy Trust In Distribution Planning

Energy Trust serves roughly 70 percent of the state's electric ratepayers. The nonprofit's historic focus on energy efficiency and renewable energy programs has the potential to evolve to support partner utilities in different ways. Portland General Electric and Pacific Power serve very different territories and have distinct challenges in serving a growing population. Working with Energy Trust on geographically-targeted energy efficiency and renewable energy efforts to address distribution constraints or other future challenges with distribution could help all partner utilities defer costly distribution investment. One immediate opportunity is already underway to use targeted energy efficiency programs in communities to test what results are possible, what approaches are most effective and how much it will all cost compared to other non-wires alternatives or capital upgrades.

As explored earlier in this paper, Energy Trust is working currently with both Pacific Power and NW Natural to pilot how targeted energy efficiency and renewable energy program offerings can address distribution constraints with cost-effective solutions¹¹. Based on this and on the development of locational avoided-costs, Energy Trust could potentially increase incentives incrementally in targeted locations.

Stakeholders see significant potential for using targeted energy efficiency as a lever for the distribution system, but they also warn of the risk of overcorrecting in the quest to meet locational needs. These stakeholders suggest careful consideration in the design of targeted energy efficiency and renewable energy efforts to ensure that they appropriately value locational benefits against other benefits.

All parties agree that a shared, big-picture view is necessary to build the grid of the future. Establishing a valuation framework to determine which DERs are cost-effective under what circumstances and how utilities and Energy Trust can combine DERs to alleviate distribution constraints is the research question at hand.

Energy Trust's next step is to continue on its path to learn from other states and from pilots here in Oregon. Developing these ideas from small-scale pilots to full-scale implementation will require that new distribution planning tools and processes be adopted by utilities. It also indicates a new paradigm for how the market interacts with utilities as they plan and operate the distribution system. Energy Trust's experience in working with customers, and with the businesses such as contractors, designers, builders and developers who serve the market, could be helpful to utilities as they make this transition.

About Energy Trust of Oregon

Energy Trust of Oregon is an independent nonprofit organization dedicated to helping utility customers benefit from saving energy and generating renewable power. Our services, cash incentives and energy solutions have helped participating customers of Portland General Electric, Pacific Power, NW Natural, Cascade Natural Gas and Avista save on energy bills. Our work helps keep energy costs as low as possible, creates jobs and builds a sustainable energy future.

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¹ Distributed Energy Resources, or DERs, is used in this paper as a term that includes rooftop solar, energy storage, demand response, combined heat and power, fuel cells and energy efficiency to deliver power to customers.

² <https://energy.gov/under-secretary-science-and-energy/grid-modernization-initiative>

³ Demand response provides an opportunity for consumers to play a significant role in the operation of the electric grid by reducing or shifting their electricity usage during peak periods in response to time-based rates or other forms of financial incentives. Demand response programs are being used by some electric system planners and operators as resource options for balancing supply and demand. Demand Response can take many forms, including direct load control of air conditioning and industrial process load shifting.

<https://www.energy.gov/oe/activities/technology-development/grid-modernization-and-smart-grid/demand-response>

⁴ Non-wires alternatives are electric utility system investments and operating practices that can defer or replace the need for specific transmission and/or distribution projects, at lower total resource cost, by reliably reducing transmission congestion or distribution system constraints at times of maximum demand in specific grid areas

⁵ <https://www.nwcouncil.org/energy/powerplan/7/plan/>

⁶ Hosting capacity is defined as the amount of solar that can be accommodated without impacting power quality or reliability under existing control and infrastructure configurations

⁷ https://www.nwcouncil.org/media/7149926/7thplanfinal_chap12_conservationres.pdf

⁸ Gazze et al, 2010, ACEEE Summer Study

⁹ The same issues that apply to deferring distribution are also useful in how it works on the transmission side.

¹⁰ Pacific Power. 2017. *Pacific Power Smart Grid Oregon Annual Report*.

¹¹ See pages 8-9 for more information

Article
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The use and abuse of scenarios

By Charles Roxburgh

Although it is surprisingly hard to create good ones, they help you ask the right questions and prepare for the unexpected. That is hugely valuable.

Scenarios are a powerful tool in the strategist's armory. They are particularly useful in developing strategies to navigate the kinds of extreme events we have recently seen in the world economy. Scenarios enable the strategist to steer a course between the false certainty of a single forecast and the confused paralysis that often strike in troubled times. When well executed, scenarios boast a range of advantages—but they can also set traps for the unwary.

There is a significant amount of literature on scenarios: their origins in war games, their pioneering use by Shell, how to construct them, how to move from scenarios to decisions, and so on. Rather than attempt anything encyclopedic, which would require a book rather than a short article, I have put forward my personal convictions, based on experience in building scenarios over the past 25 years, about both the power and the dangers of scenarios, and how to sidestep those dangers. I close with some rules of thumb that help me—and will, I hope, help you—get the best out of scenarios.

The power of scenarios

Scenarios have three features that make them a particularly powerful tool for understanding uncertainty and developing strategy accordingly.

Scenarios expand your thinking

You will think more broadly if you develop a range of possible outcomes, each backed by the sequence of events that would lead to them. The exercise is particularly valuable because of a human quirk that leads us to expect that the future will resemble the past and that change will occur only gradually. By demonstrating how—and why—things could quite quickly become much better or worse, we increase our readiness for the range of possibilities the future may hold. You are obliged to ask yourself why the past might not be a helpful guide, and you may find some surprisingly compelling answers.

This quirk, along with other factors, was most powerfully illustrated in the recent meltdown. Many financial modelers had used data going back only a few years and were therefore entirely unprepared for what we have since seen. If they had asked themselves why the recent past might not serve as a good guide to the future, they would have remembered the Asian collapse of the late 1990s, the real-estate slump of the early 1990s, the crash of October 1987, and so on. The very process of developing scenarios generates deeper insight into the underlying drivers of change. Scenarios force companies to ask, “What would have to be true for the following outcome to emerge?” As a result, they find themselves testing a wide range of hypotheses involving changes in all sorts of underlying drivers. They learn which drivers matter and which do not—and what will actually affect those that matter enough to change the scenario.

Scenarios uncover inevitable or near-inevitable futures

A sufficiently broad scenario-building effort yields another valuable result. As the analysis underlying each scenario proceeds, you often identify some particularly powerful drivers of change. These drivers result in outcomes that are the inevitable consequence of events that have already happened, or of trends that are already well developed. Shell, the pioneer in scenario planning, described these as “predetermined outcomes” and captured the essence of this idea with the saying, “It has rained in the mountains, so it will flood in the plains.” In developing scenarios, companies should search for predetermined outcomes—particularly unexpected ones, which are often the most powerful source of new insight uncovered in the scenario-development process.

Broadly speaking, there are four kinds of predetermined outcomes: demographic trends, economic action and reaction, the reversal of unsustainable trends, and scheduled events (which may be beyond the typical planning horizon).

- *Demography is destiny.* Changes in population size and structure are among the few highly predictable aspects of the future. Some uncertainties exist (potential increases in longevity, for example), but only at the margin. Sometimes, the effects of these trends are far off—as with Social Security in the United States today—so they are generally ignored. When these trends grow near, however, their effects can be powerful indeed, as when the baby boom generation is on the brink of leaving the workforce.
- *“You canna change the laws of economics!”* Just as Scotty the engineer could not change the laws of physics when Captain Kirk^[1] demanded more warp speed, so business leaders cannot assume away the laws of economics. If demand shoots up, prices will too—which will limit demand and drive increasing supply—with the result that demand, prices, or both will drop. Nothing increases in price forever, in real terms. We recently saw oil prices more than double and then sink back again by an equal amount. Price changes of this scale inevitably drive supply and demand reactions in every relevant value chain. As in physics, every economic action has a predetermined reaction. These reactions are often ignored in business strategy. If uncovered through scenario planning, however, they can generate powerful insights.
- *“Trees don’t grow to the sky.”* Business plans often extrapolate into the future trends that are clearly unsustainable. Economies are fundamentally cyclical, so beware of politicians bearing tales about the end of boom and bust. Equally, do not build a strategy based on the claim that the business cycle has been tamed. Often, optimistic projections are accompanied by bold claims of a new paradigm. Strategists need to be very cautious about alleged new paradigms. The appearance of even a genuine new paradigm almost always results in a speculative bubble. The “new economy” was a good example. More recently, securitization proved to be another sound idea that resulted in a speculative bubble. And in the past, many new, innovative technologies—railroads and radio, for example—were hailed as “new paradigms” and then promptly led to investment

bubbles. A useful test is to project a trend at least 25 years out. Then ask how long can this trend really be sustained. Challenge yourself to try and prove why the shape of the future should be so fundamentally different from the more cyclical past. Chances are you won't be able to, and this will open your eyes to the possibility of a break in the trend.

- *Scheduled events may fall beyond typical planning horizons.* There is also a simpler kind of predetermined outcome that does not involve any unalterable laws: scenarios must take into account scheduled events just beyond corporate planning horizons. A recent example, the results of which we have already seen, is reset dates on adjustable-rate mortgages. Well before the event, one could have predicted a spike in resets as mortgages sold in 2005 and 2006—the peak years—completed their low, three-year introductory rates. Something bad was going to happen to the economy in 2008. Right now, there is another important “timetable” to watch: the wave of large bond issues that has resulted from banks having to refinance hundreds of billions of dollars of maturing debt. Although these types of scheduled events ought to be common knowledge, they tend to be overlooked in planning exercises because they fall beyond the next 12 to 18 months. Scenarios should account for scheduled events that could have a big impact in the 24–60 month time frame.

While some errors can be avoided by recalling certain fundamental economic and demographic facts or scheduled events, problems of timing will continue to exist. Your company's strategic planners may know that a massive dollar value of mortgages is about to reset. But when will the market actually wake up to this reality? Financial services cannot grow as a percentage of GDP forever. But at what percentage will this stop? We didn't know before, and we still don't know today. Still, the realization that something *must* happen, even if it is not clear when, leads to the inclusion of at least one scenario in which, say, financial services stop growing sooner rather than later.

Scenarios protect against ‘groupthink’

Often, the power structure within companies inhibits the free flow of debate. People in meetings typically agree with whatever the most senior person in the room says. In particularly hierarchical companies, employees will wait for the most senior executive to state an opinion before venturing their own—which then magically mirrors that of the senior person. Scenarios allow companies to break out of this trap by providing a political “safe haven” for contrarian thinking.

Scenarios allow people to challenge conventional wisdom

In large corporations, there is typically a very strong status quo bias. After all, large sums of money, and many senior executives’ careers, have been invested in the core assumptions underpinning the current strategy—which means that challenging these assumptions can be difficult. Scenarios provide a less threatening way to lay out alternative futures in which the these assumptions underpinning today’s strategy may no longer be true.

Avoiding the common traps in using scenarios

For all these benefits, there is a downside to scenarios. Inexperienced people and companies are prone to fall into a number of traps.

Don’t become paralyzed

Creating a range of scenarios that is appropriately broad, especially in today’s uncertain climate, can paralyze a company’s leadership. The tendency to think we know what is going to happen is in some ways a survival strategy: at least it makes us confident in our choices (however misplaced that confidence may be). In the face of a wide range of possible outcomes, there is a risk of acting like the proverbial deer in the headlights: the organization becomes confused and lacking in direction, and it changes nothing in its behavior as an uncertain future bears down upon it.

The answer is to pick the scenario whose outcome seems most likely and to base a plan upon that scenario. It should be buttressed with clear contingencies if another scenario—or one that hasn’t been imagined—begins to emerge instead. Ascertain the “no regrets” moves that are

sound under all scenarios or as many as possible. Ultimately, the existence of multiple possibilities should not distract a company from having a clear plan.

Don't let scenarios muddy communications

The former CEO of a global industrial company once suggested that scenarios are an abdication of leadership. His point was that a leader has to set a vision for the future and persuade people to follow it. Great leaders do not paint four alternative views of the future and then say, “Follow me, although I admit I’m not sure where we are going.”

Leaders *can* use scenarios without abdicating their leadership responsibilities but should not *communicate* with the organization via scenarios. You cannot stand up in front of an organization and say, “Things will be good, bad, or terrible, but I am not sure which.” Winston Churchill’s remarks about British aims in World War II—“Victory at all costs, victory in spite of all terror, victory however long and hard the road may be”—are instructive. By insisting on only one final outcome, Churchill was not refusing to acknowledge that a wide range of conditions might exist. What he did was to set forth a goal that he regarded as what we would call “robust under different scenarios.” He was acknowledging the range of uncertainties (“however long and hard the road may be”), and he resisted overoptimism (which affected many bank CEOs early in the recent crisis).

A chief executive, a prime minister, or a president must provide clear and inspiring leadership. That doesn’t mean these leaders should not study and prepare for a number of possibilities. Understanding the range of likely events will embolden corporate leaders to feel prepared against most eventualities and allow those leaders to communicate a single, bold goal convincingly.

One additional point about communication and scenarios is worth noting. Scenarios can help leaders avoid looking stupid. A wide range of scenarios—even if not publicly discussed—can help prevent leaders from making statements that can be proven wrong if one of the more extreme scenarios unfolds. For instance, one financial regulator boldly announced, early in the financial crisis, that its banking system was, at the time, capitalized to a level that made it bulletproof under all reasonable scenarios—only to announce, a few months later, that a further recapitalization was required. Similarly, the head of a large bank confidently suggested that the

downturn was in its final phases shortly before the major indexes plummeted by 25 percent and we entered a new and even more dangerous phase of the crisis. Many CEOs have given hostages to fortune; scenarios would have helped them avoid doing so.

Don't rely on an excessively narrow set of outcomes

The astute reader will have noticed that the above-mentioned financial regulator managed to embarrass itself even though it *was* using scenarios. One of the more dangerous traps of using them is that they can induce a sense of complacency, of having all your bets covered. In this regard at least, they are not so different from the value-at-risk models that left bankers feeling that all was well with their businesses—and for the same reason. Those models typically gave bankers probabilistic projections of what would happen 99 percent of the time. This induced a false sense of security about the potentially catastrophic effects of an event with a 1 percent probability. Creating scenarios that do not cover the full range of possibilities can leave you exposed exactly when scenarios provide most comfort.

One investment bank in 2001, for instance, modeled a 5 percent revenue decline as its worst case, which proved far too optimistic given the downturn that followed. Even when constructing scenarios, it is easy to be trapped by the past. We are typically too optimistic going into a downturn and too pessimistic on the way out. No one is immune to this trap, including professional builders of scenarios and the companies that use them. When the economy is heading into a downturn, pessimistic scenarios should always be pushed beyond what feels comfortable. When the economy has entered the downturn, there is a need for scenarios that may seem unreasonably optimistic.

The breadth of a scenario set can be tested by identifying extreme events—low-probability, high-impact outcomes—from the past 30 or 40 years and seeing whether the scenario set contains anything comparable. Obviously, such an event would never be a core scenario. But businesses ought to know what they would do, say, if some more virulent strain of avian flu were to emerge or if an unexpected geopolitical conflict exploded. Remember too that it would not take a pandemic or a terrorist attack to threaten the survival of many businesses. Sudden spikes in raw-material costs, unexpected price drops, major technological breakthroughs—any of these might take down many large businesses. Companies can't build all possible events into their scenarios and should not spend too much time on the low-probability ones. But they must be sure of surviving high-severity outcomes, so such possibilities must be identified and kept on a watch list.

Don't chop the tails off the distribution

In our experience, when people who are running businesses are presented with a range of scenarios, they tend to choose one or two immediately to the right and left of reality as they experience it at the time. They regard the extreme scenarios as a waste because “they won’t happen” or, if they do happen, “all bets are off.” By ignoring the outer scenarios and spending their energy on moderate improvements or deteriorations from the present, leaders leave themselves exposed to dramatic changes—particularly on the downside.

So strategists must include “stretch” scenarios while acknowledging their low probability. Remember, risk and probability are not the same thing. Because the risk of an event is equal to its probability times its magnitude, a low-probability event can still be disastrous if its effects are large enough.

Don't discard scenarios too quickly

Sometimes the most interesting and insightful scenarios are the ones that initially seem the most unlikely. This raises the question of how long companies should hold on to a scenario. Scenarios ought to be treated dynamically. Depending on the level of detail they aspire to, some might have a shelf life numbered only in months. Others may be kept and reused over a period of years. To retain some relevance, a scenario must be a living thing. Companies don't get a scenario “right”—they keep it useful. Scenarios get better if revised over time. It is useful to add one scenario for each that is discarded; a suite of roughly the same number of scenarios should be maintained at all times.

Remember when to avoid scenarios altogether

Finally, bear in mind the one instance in which strategists will *not* want to use scenarios: when uncertainty is so great that they cannot be built reliably at any level of detail.^[2] Just as scenarios help to avoid groupthink, they can also generate a groupthink of their own. If everyone in an organization thinks the world can be categorized into four boxes on a quadrant, it may convince itself that only four outcomes or kinds of outcomes can happen. That's very dangerous. Strategists should not think that they have all reasonable scenarios when there are quite different possibilities out there.

Don't use a single variable

The future is multivariate, and there are elements strategists will miss. They should therefore avoid scenarios that fall on a single spectrum (“very good,” “good,” “not so good,” “very bad”). At least two variables should be used to construct scenarios—and the variables must not be dependent, or in reality there will be just one spectrum.

Some rules of thumb

Obviously, some general principles can be assembled from the points above: look for events that are certain or nearly certain to happen; make sure scenarios cover a broad range of outcomes; don't ignore extremes; don't discard scenarios too quickly just because short-term reality appears to refute them and never be embarrassed by a seemingly too pessimistic or optimistic scenario; understand when not enough is known to sketch out a scenario; and so on. But there are some additional rules of thumb that I have found particularly useful.

Always develop at least four scenarios

A scenario set should always contain at least four alternatives. Show three and people always pick the middle one. Four forces them to discover which way they truly lean—an important input into the discussion. Two is always too few unless there is only one big swing factor affecting the situation.

Technically, of course, many scenarios can be sketched out in almost any situation. All possible combinations of just three uncertainties will create 27 scenarios. But many of them will be impossible because the variables are rarely completely independent. Usually, the possibilities can be boiled down to four or five major possible futures.

“Crunch” the quadrants

Often people use a two-by-two matrix when *presenting* scenarios. But it is not routinely the case that there are just two major variables. In developing scenarios, it would be typical to identify three to five critical uncertainties. How to resolve this tension? One approach is to create multiple two-by-twos using all possible combinations of the four or five critical uncertainties. It

will quickly become clear that some uncertainties are highly correlated and so can be combined—and that others are not principal drivers of the various scenarios. At minimum, this will allow for simplification. Sometimes, however, it is possible to uncover a real insight when trying to describe a quadrant created by an unusual combination of uncertainties.^[3]

There should always be a base or central case

This point goes back to the chief executive, mentioned above, who claimed that scenarios were an abdication of responsibility. It is fine to put forward scenarios—it is, in fact, the responsible thing to do. But those who must weigh scenarios and reach decisions based on them expect and deserve to get a specific point of view about the future. The scenario that is highest in probability should always be identified, and that ought to become the base case. If that proves impossible, it should at least be feasible to fashion a “central” case—but there must be crystal clarity about the degree of certainty attached to it, the alternatives, and the resilience of any strategy to those alternatives.

Scenarios must have catchy names

The notion of attaching clever names to scenarios may well sound trivial. It is not. Unless scenarios become a living part of an organization, they are useless. And if they do not have snappy, memorable names, they will not enter the organization’s lexicon. Use two to four words—no more. Plays on film titles and historical events are recommended. Some names that I have used, and that appear to have stuck, are “Groundhog Day,” “the long chill,” “perfect summer,” “end of an era,” “silver age,” and “Mexican spring.”

Avoid long, descriptive titles. No one will remember “Restrengthening world economy at a lower level of overall growth.” And avoid boring “bull, bear, and base” scenarios, even though these are used by many stock analysts. If no snappy title seems to present itself (assuming that someone creative is available), the scenario is probably too diffuse and may contain elements of two different scenarios jammed together.

Learn from being totally wrong

Developing scenarios is an art rather than a science. People learn by experience. It is useful to look back at old scenarios and ask what, in retrospect, they missed. What could have been known at the time that would have made for better scenarios? Events will prove that some scenarios were too narrow or that one was thrown out too soon. The more comfortable an organization and its people are with mistakes and learning from them, the less likely it is to be mistaken again.

Listen to contrary voices

This is a good corrective to groupthink. We tend to dismiss the mavericks. Scenarios are there to make room for them. Maverick scenarios have the virtue of being surprising, which makes people think. If a company's scenarios are all completely predictable (conventionally good, conventionally bad, and somewhere in the middle), they are not going to be valuable. The best scenarios are built on a new insight—either something predetermined that others have missed or an unobvious but critical uncertainty.

On one occasion, when oil was at \$120 a barrel, we presented a scenario with oil at \$70. Someone asked what would happen if oil dropped to \$10 a barrel. We said that was unnecessarily radical. But we probably should not have been so dismissive, as oil promptly fell below \$50 a barrel. We should have been more open to the possibility of this radical price swing—after all, oil has been at \$10 a barrel well within living memory. Scenarios should not assume a short-term time series; they should go back as far as possible. If a data series going back 300 years is available, you should consider using it (they do exist for UK interest rates and UK government debt as a percentage of GDP and these long-term data series have certainly informed current debates about the possible interest rates and sustainable debt to GDP ratios). Most variables can only be supported by data going back tens of years—but even this is much more instructive than the meager data often used and helps broaden the range of possible outcomes.

Even modest environmental changes can have enormous impact

The best example of this principle is that specialist business models fail when the business environment changes. I call this the “saber-toothed tiger” problem. The saber-toothed tiger was a specialist killing machine, its big teeth perfectly evolved to capture large mammals. When the environment changed and the large mammals became extinct, saber-toothed tigers became

extinct too—those large teeth were not as good for catching small, furry mammals. By contrast, the shark is a generalist killing machine—and so has remained highly successful for hundreds of millions of years.

A specialist business model can suffer the fate of the saber-toothed tiger if the environment changes. Many winning business models are highly specialized and precisely adapted to the current business environment. Therefore no one should ever assume that today's winners will be in an advantaged position in all possible futures (or even most of them). Therefore, scenarios should be based on creative thinking about how predicted changes in the business environment will alter the competitive landscape. If the environment changes in a scenario but the competitors remain the same, that scenario may not be imaginative enough.

None of the above is rocket science. Why, then, don't people routinely create robust sets of scenarios, create contingency plans for each of them, watch to see which scenario is emerging, and live by it? Scenarios are in fact harder than they look—harder to conceptualize, harder to build, and uncomfortably rich in shortcomings. A good one takes time to build, and so a whole set takes a correspondingly larger investment of time and energy.

Scenarios will not provide all of the answers, but they help executives ask better questions and prepare for the unexpected. And that makes them a very valuable tool indeed.

1. For the uninitiated, Scotty and Captain Kirk are two characters from *Star Trek*, a famous US science fiction television series from the 1960s.
2. For more, see the *McKinsey Quarterly's* interview with author Hugh Courtney, "[A fresh look at strategy under uncertainty](#)."
3. I am grateful to Pherson Associates, specifically Randy Pherson and Grace Scarborough, for bringing this technique to my attention. I have found it extremely powerful in a number of client settings.

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