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To: Joan Wang, Bonneville Power Administration

From: Andrew W. Wood & Tyler Mahone, DNV

Date: 8/3/2022

Subject: 2021-2022 Adjustable Speed Drives Expert Panel Summary Memo

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This memorandum documents the process, participants, and activities completed as part of the expert panel review of BPA's 2016-2021 Adjustable Speed Drive market model and related market research. The activities summarized below were completed between February 2021 and May 2022.

ASD Market Research Overview

DNV assembled and facilitated a panel of independent experts and regional stakeholders to provide comments, advice, and review of BPA's Adjustable Speed Drive (ASD) market model and related market research. The ASD market is a complex one that spans multiple sectors, segments, end uses, and applications. In 2020, BPA and its research consultant started gathering market intelligence from market actor interviews, assessing potential sources for stock and sales data, and developing a methodology to model Momentum Savings from this market. The research explored all ASD types (not limited to variable frequency drives) and applications such as pumps, fans, compressors and circulators, and informed decision-making on narrowing the scope of a market model to industrial standalone pumps and fans for the 2016-2021 time period. DNV provided a panel of experts to provide subject matter expertise in specific applications during the model scoping and building process and in a sales data collection project.

Further details on BPA's ASD market research and final 2016-2021 ASD market model can be found on their website at [Adjustable Speed Drives Market Research - Bonneville Power Administration (bpa.gov)](#).

Expert Panel Process

The goal of the expert panel process is to provide BPA with independent expert review and advice on their market research, methodologies, market model, and results. Additionally, the expert panel process ensures continuous engagement in BPA's market research from its stakeholders representing the Northwest Power and Conservation Council (Council), the Northwest Energy Efficiency Alliance (NEEA), the Regional Technical Forum (RTF), and internal BPA staff. DNV accomplished this goal by assembling and facilitating a panel of independent experts and regional stakeholders. DNV recruited the independent expert panelists while BPA recruited regional stakeholders as appropriate for this market.

Expert panel feedback was gathered through technical working sessions and targeted desk review engagements. For each panel engagement, BPA would request facilitation of expert review by DNV. DNV would then meet with BPA and its modeling contractor to understand the objectives of each review and identify the appropriate panelists. DNV would then schedule any required meetings, distribute materials

for review, facilitate the discussion during meetings, provide detailed meeting minutes, and gather any requested feedback from each panelist.

BPA and its modeling contractor document all panelist feedback in a detailed comment tracker and provide a response to each piece of feedback that clearly summarizes any actions taken to address the feedback. After each round of review, the completed comment tracker and any meeting minutes are provided to the panel for final check prior to closing out the review. This process ensures BPA and its modeling contractor can efficiently incorporate panelist feedback into their work, and provides transparency to all parties involved. Each expert engagement occurred over a 2 – 8 week period depending on the scope of the review requested. The comment tracker and all meeting minutes are available to the public via embedded links below.

Expert Panelists

The panel included experts who participated in differing capacities throughout the review process. Independent experts recruited by DNV were classified into five categories to ensure that expertise on all elements of the market research were available to BPA.

- **Market/Industry Expert**: A market/industry subject-matter expert (SME) has a strong understanding of the markets where ASDs are present, including pumps, fans, air compressors, circulators, and material handling/processing. They know who the key market players are, what the market trends are, and how the supply chain typically works for ASDs and motors across sectors and applications. They are also familiar with different sources of motor or drive sales data, be up to date on motor-driven technology trends and codes and standards impacting ASD adoption, and preferably have past "boots on the ground" experience working within motor-driven markets (e.g., have worked with/for a motor/drive manufacturer, distributor, program implementer, engineering firms, etc.).

- **Technology Expert:** A technology SME has engineering expertise and a strong understanding of how motor-driven technologies – including pumps, fans, air compressors, and other motor-driven process loads – work and how they work when their motors are paired with an ASD. A technology SME is knowledgeable of different types of ASDs, such as variable frequency drives and electronically commutated motors, and be up to date on motor-driven technology trends and codes and standards impacting ASD adoption. A technology SME understands how different technical specifications and installation conditions affect the ASD-paired motor's performance and energy consumption and how ASDs save energy in different applications and equipment operations. A technology SME is preferably knowledgeable of current practices on replacing or upgrading motors (with and without an ASD), and the types of custom projects that involve ASDs.

- **Market Analysis Expert:** A market analysis SME is someone with experience using a mix of datasets such as sales data, regional building stock assessment data, utility program data and census data, and analyzing them for the broader regional market/population. The market analysis SME is well versed in assessing the representativeness and uncertainties of a sample dataset to determine whether and how to use it to make inferences on the population. The market analysis SME has knowledge of inputs, methods and outputs of stock turnover models and is preferably familiar with the Council's power plans and baseline methodologies.

- **Sampling/Statistical Expert:** A sampling/statistical SME has a strong understanding of sampling methods and techniques. They can review and provide feedback to BPA on sampling plans for primary data collection in a way that ensures the data are robust and representative of the population. They help inform BPA on the appropriate use of primary and secondary data sources, including appropriate uses of weights.

- **Regional Stakeholder:** Regional stakeholders are those from the Council, NEEA, RTF, or BPA that participated on behalf of their organization.

Table 1 shows the independent experts and regional stakeholders in the ASD expert panel.

Table 1. Expert Panelists

Panelist Name	Expert Classification	Affiliation during Panel
Rob Boteler	Market/Industry Expert	Nidec Motors
Dan Delaney	Market/Industry Expert	Franklin Electric
Peter Gaydon	Market/Industry Expert	Hydraulic Institute
Mike Wolf	Market/Industry Expert	Greenheck
Paul Lemar	Technical Expert	Resource Dynamics
David Morris	Technical Expert	RHT Energy
Prakash Rao	Market Analysis Expert	Independent
Miriam Goldberg	Sampling/Statistics Expert	DNV Energy
Todd Amundson	Regional Stakeholder	BPA
Ryan Firestone	Regional Stakeholder	Council - RTF
Evan Hatteberg	Regional Stakeholder	NEEA
Kevin Smit	Regional Stakeholder	Council

Review Activities

The panel kicked off in April 2021, and had 10 total panel engagements, ending with the review of draft ASD market model results in April 2022. Table 2 on the next page shows the full list of panel engagements, topics covered, and panelists involved. The table also contains the meeting minutes for all working sessions.

Appendix A follows the activities table. The appendix contains a comment matrix that documents all comments received during this period and the responses/changes made as a result by BPA and its modeling contractor. Comments resulting from both working sessions and desk reviews are documented in the comment matrix.

Table 2. Expert Panel Completed Activities

#*	Review Type	Panel Engagement Period	Topics Reviewed	Independent Experts	Regional Stakeholders	Associated Meeting Minutes
01	Desk Review	April-June 2021	Draft ASD Model Methodology Memo	Rob Boteler, Dan Delaney, Peter Gaydon, Paul Lemar, Prakash Rao, and David Morris	Todd Amundson, Ryan Firestone, and Kevin Smit	N/A
02	Work Session	July 12, 2021	Unit Energy Consumption Estimates (part 1)	Rob Boteler, Paul Lemar, and David Morris	Todd Amundson, Ryan Firestone, Evan Hatteberg, and Kevin Smit	PDF Notes BPA ASD Expert Meeting 7_12
03	Desk Review	June-August 2021	Pump/Fan Sales Data Collection Materials	Peter Gaydon and Miriam Goldberg	N/A	N/A
05	Work Session	September 3, 2021	Initial Stock Characterization (part 1)	Rob Boteler, Peter Gaydon, Paul Lemar, Prakash Rao, and Mike Wolf	Todd Amundson, Ryan Firestone, and Kevin Smit	PDF Notes BPA ASD Expert Panel Session
06	Desk Review	October 2021	Unit Energy Consumption Estimates (part 2)	N/A	Todd Amundson, Ryan Firestone, and Kevin Smit	N/A
07	Work Session	December 14, 2021	ASD Model Methodology Updates	Rob Boteler, Peter Gaydon, Paul Lemar, David Morris, Prakash Rao, and Mike Wolf	Todd Amundson, Ryan Firestone, and Kevin Smit	PDF Notes BPA ASD Expert Panel Session
08	Desk Review	November-December 2021	Initial Stock Characterization (part 2)	Prakash Rao	Ryan Firestone, Evan Hatteberg, and Kevin Smit	N/A
09	Desk Review	January 2022	Control Strategy Assumptions	Rob Boteler, Peter Gaydon, Paul Lemar, and David Morris	Todd Amundson and Ryan Firestone	N/A
10	Work Session and Desk Review	February-May 2022	Draft Model Results	Rob Boteler, Peter Gaydon, Paul Lemar, David Morris, Prakash Rao, and Mike Wolf	Todd Amundson, Ryan Firestone, Evan Hatteberg, Kevin Smit	PDF Notes BPA ASD Expert Panel Draft R

"Completed Activity" #4 was the recruitment of an additional panelist and not a review engagement.

Appendix A – Comment Tracker

The comment response matrix documents all comments received during this process, the responses by BPA and its modeling contractor, and any actions or adjustments taken as a result of the comment.

Tracker is attached to memo as an xlsx file.
Click here to view attachments