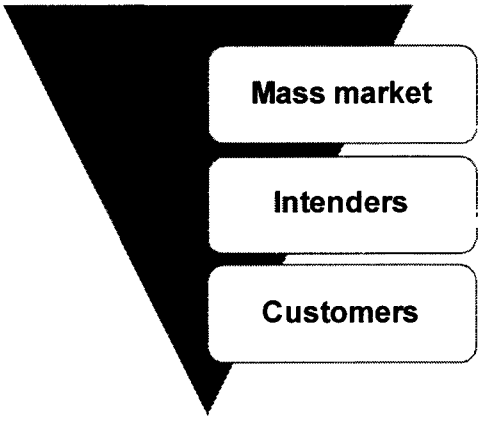
Regulatory Component #1: Customer Education and EV Experience

Addressing customer education and EV experience issues in a proactive manner is a key element in every electric transportation state regulatory filing. Although low awareness is one of the primary barriers to widespread EV adoption, customers interested in purchasing EVs also face challenges in the buying and ownership experience that present additional barriers to adoption. Electric companies are well-suited to address awareness, education, and EV experience issues and have many tools available to do so. Education and experience are important parts of an electric transportation filing, but many of these tools can be implemented outside the context of a filing (see Table 1).

Targeting the Strategy

A customer education and experience strategy should include elements that target the different stages of the customer journey. In general, this strategy can be divided into three stages:



Raising awareness among mass market customers who are not yet EV drivers.

Educating those customers who are interested in EVs to assist in the purchase decision.

Providing a **seamless customer experience** from purchase to EV ownership.

Electric companies should consider the different customer types they wish to target in a customer education and experience strategy. These customer types may include:

- **Residential customers:** Individuals who may be interested in owning or leasing an EV for their own personal use.
- **Fleets:** Commercial customers that may be interested in electrifying fleet operations.
- **Potential site hosts for charging infrastructure:** Commercial customers who may be interested in installing EV charging infrastructure for their customers or building occupants. These may include multi-unit dwellings, workplaces, and commercial businesses.

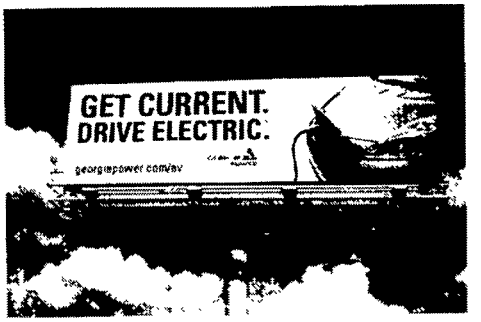
Raising Awareness

- **Challenge:** Low customer awareness is a major barrier to EV adoption. Studies consistently show that most customers know very little about EVs.
- **Goal:** As more customers become aware of EVs and their benefits, more customers will become potential EV adopters.
- **Strategy:** Utilize the various channels available for outreach to mass market customers.

- **Considerations:**
  - Mass market outreach has marketing and brand value for electric companies by associating the company with a high-tech, "green" consumer product.
  - Mass market outreach may be seen as promoting electricity over other fuels, which may create challenges.
  - Mass market outreach strategies should complement and not duplicate other efforts that already may be underway in a region, such as those funded by government entities or other stakeholder groups.
    - Example: Veloz is a nonprofit in California supported by state entities and industry stakeholders to increase consumer awareness of EVs.[4]
    - Example: The "Drive Change. Drive Electric" campaign in the Northeast is funded by state entities and automakers to increase consumer awareness of EVs.[5]
    - Example: The "Go Electric Oregon" website is supported by state agencies to provide access to EV information for potential buyers.[6]
    - Example: Plug-In America's National Drive Electric Week is comprised of hundreds of EV outreach events across the country.[7]

Design options include:

- Communications, advertising, and social media
  - Integrate EV messaging into existing mass market communication channels.
    - Example: Southern California Edison (SCE) has a Twitter handle dedicated to Transportation Electrification (@SCE_TE).[8]
    - Example: Georgia Power's education and awareness component of its Electric Transportation Pilot included TV and radio advertising, print media, digital and social media, and experiential education events, all using the "Get Current. Drive Electric" branding (see image at right).[9]



    - Example: San Diego Gas & Electric (SDG&E) announced in May 2016 that it would invest $7.5 million over five years on a shareholder-funded EV education campaign that would complement the $45 million "Power Your Drive" pilot program, which was approved by the California Public Utilities Commission in January 2016.

[4] See http://www.veloz.org/.
[5] See https://driveelectricus.com/.
[6] See https://goelectric.oregon.gov/.
[7] See https://driveelectricweek.org/.
[8] See https://twitter.com/SCE_TE.
[9] See *Review of Georgia Power's Electric Transportation Pilot and Market Dynamics Driving Future Electric Vehicle Adoption* at Georgia Public Service Commission, Docket 41373.

- Direct customer communications
  - Electric companies have existing relationships with their customers and can share EV messaging directly with these customers through existing channels, such as bill inserts, newsletters, targeted advertising on the company website, or emails.
  - Employee engagement is a great way to create ambassadors for EVs and to test strategies that can be used later for the mass market. EEI's Employee EV Engagement Initiative encourages member companies to support employee education and adoption.[10]
    - Example: National Grid launched an EV adoption campaign for its own employees, including an employee incentive and an internal website to raise awareness and education.[11]
- Experiential marketing
  - Direct experience is one of the most impactful ways to familiarize a customer with an EV.
    - Example: Many electric companies are leading by example with their own fleet purchases, such as by participating in EEI's Fleet Electrification Initiative. These vehicles become "rolling billboards" for the company and also may be used for display at community events.[12]

    - Example: Many electric companies conduct or sponsor "ride-and-drives" for the public at community events. Partnering with a local community-based organization for such events can enhance their appeal.

Providing Education and Assistance with the Purchase Decision

- **Challenge:** Customers interested in purchasing or leasing an EV are likely to face challenges that are unique to EVs, such as difficulty in getting answers to key questions and finding that no single entity has answers readily available.
- **Goal:** Simplify and streamline the EV buying process to make it easier for customers.
- **Strategy:** Provide assistance at critical points in the buyer education and purchase process, leveraging the electric company's position as a trusted energy advisor.
- **Considerations:**
  - Customers view their electric companies as a trusted source for energy information and expect their electric companies to be able to provide answers to EV-related questions.
  - The EV buying process is lengthy and involves multiple parties, including: automakers, dealers, third-party websites, EV charging equipment and service vendors, electricians, and the electric company.

[10] See http://www.eei.org/issuesandpolicy/electrictransportation/PEVengagement/Pages/default.aspx.
[11] See https://ngevcentral.com/.
[12] See https://www.mnpower.com/Environment/NewHybridBucketTruck.

Design options include:

- Website
  - A dedicated EV section of an electric company website should act as the central repository for all EV-related information and should include a contact person.
    - Example: DTE Energy recently revamped its EV website.[13]
    - Example: Kansas City Power & Light's (KCP&L's) website provides a map with "EV-friendly" car dealers.[14]
    - Example: National Grid launched a website to provide EV shopping tools to customers.[15]
  - An EV website may feature educational tools and resources, including:
    - Cost calculator: Help customers calculate how much it will cost to charge an EV and compare to the cost of refueling a conventional vehicle.
    - Rate calculator: If customers have the choice of multiple rates (such as an EV rate), a rate calculator allows customers to compare their electric bills easily under different rate options given their driving patterns.
    - Charging locator: Help customers find public charging locations in their vicinity and evaluate the feasibility of EV ownership.
    - Availability of other EV-related rebates or incentives from the electric company or state and local entities.
- Call-center
  - Customer call-centers should have the capability of answering EV-related questions and referring customers to an EV expert and available resources.
- EV Team
  - A more advanced offering is specially trained internal resources who can provide more in-depth information and advice for customers. This could involve training account management teams to provide advisory services to customers.
    - Example: SCE's proposal for its Charge Ready, Phase 1 pilot included $3.1 million for market education and Transportation Electrification Advisory Services (TEAS), intended to provide a "one-stop-shop" for business customers interested in EV charging and electrifying their fleets. SCE launched an in-person services study in Q1 2018 with 25 business customers and is proposing to expand the TEAS program in Phase 2.[16]
- Dealer engagement
  - Auto dealers are a critical link in the car buying process, as almost all new car transactions are completed at dealerships. Dealers have an opportunity to educate customers about electric company programs.
  - Dealers often represent a barrier to the EV buying process, primarily due to lack of incentive to sell EVs and/or lack of knowledge about them.

[13] See https://www.newlook.dteenergy.com/wps/wcm/connect/dte-web/home/service-request/residential/electric/pev/plug-in-electric-vehicles-pev.
[14] See https://cleanchargenetwork.com/buying-an-electric-car/find-an-electric-car-dealership/.
[15] See https://cars.nationalgridus.com/.
[16] See *Charge Ready and Market Education Pilot Report*, April 2, 2018.

- Electric companies can help mitigate this issue by giving resources directly to auto dealers or providing an incentive to dealers to help encourage EV sales.
  - Example: Plug-in America offers a PlugStar Program that trains dealer sales staff and provides informational resources. The program has been implemented successfully with support from electric companies in Los Angeles, San Francisco, and Boston.[17]
  - Example: Avista's Electric Vehicle Supply Equipment (EVSE) Pilot Program will pay a dealer $200 if an Avista customer purchases an EV and the dealer collects contact information from the customer and provides that information to Avista, with the customer's consent. The payment provides a small incentive to the dealer, while also helping to acquire customer information and potential enrollees into Avista's pilot program.[18]

Customer Experience

- **Challenge:** EV buyers face unique challenges, such as purchasing and installing a home charger (if applicable) and managing charging as part of their electric service.
- **Goal:** Make the EV ownership experience positive to improve customer satisfaction and manage customer behavior to provide benefits for all customers.
- **Strategy:** Offer solutions to customers that provide value and are easy to adopt and use.
- **Considerations:**
  - Most EV buyers today are purchasing their first EV. A positive experience will increase the likelihood of a repeat EV customer.
  - EV owners tend to consider their home charger options after deciding to purchase an EV. An owner's initial period with their EV is an important opportunity to offer solutions and shape behavior.
  - Simplification is key for mass market customers.
  - While much of the discussion here is focused on the residential customer experience, commercial customers may have a unique set of needs that should be addressed in electric transportation state regulatory filings that include commercial customer segments.

Design options include:

- Marketing programs
  - If residential customers are one of the target segments in an EV filing, resources should be devoted to marketing the programs to existing and/or prospective EV customers.
- Home charger assistance and solutions
  - Choosing, installing, operating, and maintaining a home charger can be a daunting task to new EV customers. After purchasing a home charger, EV customers generally need to hire an electrician to install it. Electric companies can provide resources to help customers select, purchase, and install a home charger, or provide more turnkey solutions that manage the installation for the customer.

[17] See https://pluginamerica.org/plugstar/.
[18] See Cover Letter, January 14, 2016, in Washington Utilities and Transportation Commission, Docket UE-160082.

        - Example: National Grid has added an EV Charger Buyer's Guide to its Marketplace, a customer-facing website where customers can buy energy-related products such as thermostats, energy efficient products, and EV chargers.[19]
        - Example: Xcel Energy provides a list of qualified electricians who can perform home charger installations through the EV Trade Partner Resource Center.[20]
        - Example: DTE Energy provides customers with a list of electricians who offer a flat-rate for home charger installations, within certain parameters.[21]
        - Example: SDG&E's Residential Charging Program was approved by the California commission on May 31, 2018. While the decision restructured the program from one of electric company ownership and operation to a rebate program, the program—if implemented—still would provide a more seamless experience for customers, including: a marketplace to select charging equipment, a process to procure the equipment and installation, and billing the customer for the balance of costs beyond the rebate amount.[22]
- Customer communication and engagement
    - EV customers represent an opportunity for ongoing customer communication. If EV charging is disaggregated from the home, for example, EV charging usage may be broken out on the customer bill to show explicit EV charging costs. For example, the national average cost to charge an EV today is the equivalent of $1.20 a gallon. This data also can be used to communicate fuel cost and emissions savings to the customer.
    - Managed charging solutions provide opportunities for ongoing customer engagement (see Component #4: Residential Managed Charging).
        - Example: Pacific Gas and Electric Company's (PG&E's) EV Smart Charging Pilot with BMW allowed customers to participate in an aggregated demand response (DR) program. Customer satisfaction from the program was overwhelmingly positive.[23]
- Create ambassadors or ongoing interest groups
    - EV owners, particularly in this early-adoption phase, tend to be passionate about their vehicles and powerful advocates for the technology.
    - Cultivating the EV owner community of customers can be valuable as a resource for program feedback and to create ambassadors to others in the community.
        - Example: Philadelphia Electric Company (PECO) provides EV owners with a $50 "Smart Driver Rebate" for registering with the company.[24]
- See Table 1 for ten actions that electric companies can take today to improve the customer's EV experience.

[19] See https://marketplace.nationalgridus.com/pages/electric-vehicle-charger-buyers-guide.
[20] See https://www.xcelenergy.com/staticfiles/xe-responsive/Energy%20Portfolio/Electricity/CO-EV-Charging-Station-Providers.pdf.
[21] See https://www.newlook.dteenergy.com/wps/wcm/connect/dte-web/home/service-request/residential/electric/pev/charger-installation.
[22] See Decision 18-05-040, May 31, 2018, in Public Utilities Commission of the State of California, Docket 17-01-020.
[23] See http://www.pgecurrents.com/wp-content/uploads/2017/06/PGE-BMW-iChargeForward-Final-Report.pdf.
[24] See https://pecorebateportal.com/electric-vehicles/smart-driver-rebate.html.

Table 1: 10 Actions Electric Companies Can Take Today to Improve the Customer Experience

	Action	Example	More Information
1	List home EV chargers on an online marketplace	National Grid: An EV Charger Buyer's Guide is available on the company's Marketplace, a customer-facing website for customers to buy energy-related products such as thermostats, energy efficient products, and EV chargers.	https://marketplace.nationalgridus.com/pages/electric-vehicle-charger-buyers-guide
2	Provide a list of electricians who can install home chargers	Xcel Energy: A list of qualified electricians is available through the company's EV Trade Partner Resource Center.	https://www.xcelenergy.com/staticfiles/xe-responsive/Energy Portfolio/MN-EV-Installation-Providers.pdf
3	Provide a list of EV-friendly car dealers	KCP&L: A map with "EV-friendly" car dealers who can answer questions and provide test drives is available on the company's website.	https://cleanchargenetwork.com/buying-an-electric-car/find-an-electric-car-dealership/
4	Get started with employee engagement	Creating programs to encourage employees to learn about and purchase EVs can help create ambassadors for the technology and inform future program offerings for the mass market.	http://www.eei.org/issuesandpolicy/electrictransportation/PEVengagement/Pages/default.aspx
5	Provide pass-through EV discounts	Electric companies can partner with automakers such as Nissan and BMW to offer EV discounts to their customers. Example: Hawaiian Electric customers can get a $3,000 discount on a 2018 Nissan LEAF by showing a flyer and their electric bill to a participating Nissan dealership.	https://www.hawaiianelectric.com/clean-energy-hawaii/electric-vehicles/nissan-leaf-sales-promotion
6	Do EV ride-and-drives	Ride-and-drives are an effective means of exposing customers to EVs. Electric companies can conduct or sponsor ride-and-drives for targeted audiences. Example: National Grid sponsored a Plug-In-America event in Washington, DC.	https://pluginamerica.org/wp-content/uploads/2018/06/2018-Senate-Ride-and-Drive.pdf
7	Provide EV 101 education	Electric companies can provide basic educational "EV 101" materials on their websites to give customers a central location to find relevant information. Example: Florida Power & Light Company has an instructional video and other fact sheets on its website.	https://www.fpl.com/energy-my-way/electric-vehicles.html
8	Offer a home charger program	Madison Gas & Electric (MGE): Through the Charge@Home program, residents can have MGE install, own, and maintain a Level 2 charger in their home for a monthly fee of about $20.	https://www.mge.com/environment/electric-vehicles/charge-at-home/
9	Provide an incentive to car dealers	Avista: EVSE Pilot Program will pay a dealer $200 if an Avista customer purchases an EV and the dealer collects contact information from the customer and provides the information to Avista, with the customer's consent.	https://www.myavista.com/-/media/myavista/content-documents/our-rates-and-tariffs/wa/wa_077.pdf
10	For business customers: provide direct advisory support	SCE: Established Transportation Electrification Advisory Services (TEAS), intended to provide a "one-stop-shop" for business customers interested in EV charging and electrifying their fleets.	www.sce.com/TE

Conclusion

Customer awareness, education, and experience are core components of an electric company EV filing. They address a primary barrier to adoption and complement other aspects of the filing, including infrastructure deployment and managed charging strategies. In addition, EVs are highly visible, advanced technology consumer products that provide many opportunities to engage with customers in new ways.

Regulatory Component #2: Stakeholder Engagement

Engaging with stakeholders early and often is the second key component of an electric transportation state regulatory filing. Active engagement with stakeholders throughout the process is critical to gaining stakeholder buy-in and regulatory approval. As EVs are a new topic to come before commissions across the country, stakeholders that are supportive of the electric company role in EVs can be important advocates. But engagement doesn't end with the filing. Ongoing stakeholder engagement is often an important element of a program's or pilot's implementation.

Major Stakeholders and Positions

Many stakeholder positions already are well-established, particularly with respect to national groups that intervene in state proceedings. The most common issues raised by major stakeholders in EV filing proceedings can be categorized into four major issue areas, as follows:

- **Electric company participation in the EV charging infrastructure market.** Is electric company investment allowed, and how will it impact the competitive market for third parties? How certain is it that the EV market will take off as expected or that future charging behaviors will align with the type of infrastructure being deployed?
- **Customer benefits and expanding customer access.** Who benefits from EV programs, and how are these benefits made available to a broad set of communities?
- **Integrating EVs into the energy grid.** How and when should electric companies implement strategies for managing EV charging to benefit the energy grid?
- **Pricing for site host customers and EV drivers.** What types of rates are offered to site host owners/operators? Are EV drivers charged regulated electric company rates or other prices for vehicle charging?

The stakeholders typically involved in EV filings and their high priority issues include:

- **Automakers** (e.g., General Motors, Ford, Honda, Auto Alliance) generally are supportive of electric company EV filings as a means of spurring EV market growth, prioritizing deployment of charging infrastructure, and increasing education and outreach activities.
- **Charging providers** generally fall into two categories: those with "closed" networks that do not allow for interoperable backend communication (see Regulatory Component #3: Charging Infrastructure Deployment), and those with "open" networks. Closed network charging providers (e.g., ChargePoint, Electric Vehicle Charging Association) may support EV filings if the electric company has limited or no control over EV charging equipment procurement and EV driver pricing. Open network charging providers (e.g., Greenlots, Siemens) support a broader set of electric company roles, up to and including ownership and operation of EV chargers.
- **Environmental Non-Governmental Organizations (NGOs)** (e.g., Natural Resources Defense Council, Sierra Club, Arcadia Center, Union of Concerned Scientists) generally are supportive of electric company EV filings as a means of reducing emissions from the transportation sector. They also are intimately involved with the program design details of an EV filing, primarily the inclusion of managed charging and considerations for social equity.
- **Consumer advocates** generally are skeptical of, and often opposed to, electric company EV filings as they view EV investment as an inappropriate role for an electric company and a cost-shift from non-participants to participants, or a significant risk of stranded assets.

- **Commission staff** generally are skeptical of and sometimes opposed to electric company EV filings as they view the electric company role in EV charging as limited to enabling the EV market as opposed to helping to jumpstart and proactively support EV market growth.

Other stakeholders that may be involved in EV filings and their high priority issues include:

- **Environmental justice groups** (e.g., Greenlining Institute) may be supportive of EV filings as a means of reducing emissions from the transportation sector, similar to other environmental NGOs, but prioritize social equity and capturing environmental benefits.
- **Labor groups** (e.g., International Brotherhood of Electrical Workers, Coalition of California Utility Employees) may be supportive of EV filings as a new form of infrastructure investment in the energy grid, particularly if electric company programs support unionized workers.
- **Local government and other local organizations** (e.g., transit agencies such as Tri-County Metropolitan Transportation District of Oregon) may be supportive of EV filings if the investment aligns with state and local goals, such as environmental stewardship or smart community development.
- **Commercial customers** (e.g., Industrial Customers of Northwest Utilities) may be supportive of EV filings as potential site host customers for EV charging or as fleet operators that may be seeking to electrify their operations. However, some large customer groups also may be opposed to EV filings if they result in rate increases. Groups that represent gasoline station retailers (e.g., Society of Independent Gasoline Marketers of America) also may oppose EV filings because of concerns about competition.

See Table 2 for a "check list" of stakeholder positions on major issues seen in EV filings. See the EEI issue brief *EV Infrastructure Filings: Current Issues, Arguments, and Outcomes* for a more detailed discussion of stakeholder positions on these issues, as well as how they have been addressed in EV filings to date.[25]

Stakeholder Engagement in Program Design Phase and Regulatory Process

Engaging with stakeholders in the context of an EV filing may require different approaches. EVs are a new and emerging area for all parties concerned. Considerations in working with stakeholders during the program design and regulatory phases include the following:

- **Early input is critical.** Electric companies should seek stakeholder and customer feedback on program design elements before the program design is firmly established, such as through listening sessions and/or one-on-one meetings. Allowing early input into an electric company filing may not be the standard practice, but it could help ensure stakeholders are on the same page and could minimize work and surprises later in the process. Early buy-in also can lead to stakeholders supporting the regulatory filing later, through support letters and other advocacy.
- **Stakeholder requests can be detailed and substantive.** Many stakeholders, particularly environmental NGOs and charging providers, have specific program design elements that they seek in EV filings. These groups also have extensive experience in other proceedings across

[25] See http://www.eei.org/issuesandpolicy/electrictransportation/MembersDocuments/EV_Filings_Issues_Arguments_and_Outcomes_March2018.pdf

the country. In some states, the regulatory process may be initiated by requests from environmental groups.

- **Engage non-traditional players.** Electric transportation regulatory filings draw different groups of players to the process than might be found in a general regulatory rate review. Some stakeholders are new to the regulatory process, such as charging providers and automakers. These groups may be challenged by the formality of the regulatory process and may need assistance in providing support letters or in other advocacy efforts. Other groups, like environmental NGOs, may support an EV filing while opposing other electric company activities.
- **Local groups matter.** In addition to the national stakeholder groups referenced above, existing groups in many jurisdictions may be interested in an EV filing and may have more credibility in state proceedings than some national groups.

There are a variety of ways to convene stakeholders and to gather input in an open and transparent fashion. Models for stakeholder engagement include the following:

- **Commission-initiated or -facilitated stakeholder process.** Some commissions may create a stakeholder group or process that includes commission staff. These groups may be more formal and strict about engagement but may be empowered to oversee the creation of an EV filing.
    - Example: Public Conference 44 in Maryland included multiple grid-modernization topics, including the creation of an EV Work Group managed by Public Service Commission (PSC) staff to address EV issues that included environmental groups, charging providers, and electric companies. The EV Work Group was tasked with developing a portfolio of investments from electric companies that is being considered by the Maryland PSC now.[26]
    - Example: The Utility Stakeholder Group in Washington was created in response to policy guidance from the Washington Utilities and Transportation Commission (UTC) concerning EV charging regulation. The stakeholder group includes commission staff, the public counsel, and the departments of transportation and commerce, among other industry stakeholders. Electric companies must share any proposed EV programs with this stakeholder group 60 days prior to filing.[27]
- **Electric company–initiated stakeholder processes related to a specific filing.** In addition to one-on-one meetings that electric companies should conduct with key stakeholders, open and public stakeholder workshops also are valuable to cultivate buy-in and demonstrate transparency.
    - Example: Pepco in Washington, D.C., held three public stakeholder workshops in April, May, and June 2018 to gather feedback in advance of its July 2018 EV filing.[28]
    - Example: Xcel Energy in Minnesota held five stakeholder workshops throughout the summer of 2018 in advance of proposing a portfolio of pilots, which is planned for later in the year.[29]

[26] See Maryland PSC case number 9478.
[27] See Washington UTC filing UE-160799.
[28] Application of Pepco for Approval of its Transportation Electrification Program, September 6, 2018, in Public Service Commission of the District of Columbia, Docket FC 1130.
[29] Xcel Energy Reply Comments to Commission Inquiry into Electric Vehicle Charging & Infrastructure, August 24, 2018, in Minnesota Public Utilities Commission, Docket E999/CI-17-879.

- **Third-party–managed stakeholder engagement.** Third-party groups may be nonprofits or trade associations that the electric company can support to align stakeholder interests, advocate to policymakers in preparation for a filing, and intervene in the proceeding.
    - Example: ChargEVC in New Jersey is a trade association that advocates for legislation and regulation to support electric transportation. Members include electric companies, EV charging providers, and the New Jersey Coalition of Automotive Retailers.[30]
    - Example: Forth in Oregon has an educational arm and an advocacy arm with members that include automakers, EV charging providers, electric companies, and local governments.[31] Forth intervened in support of Portland General Electric's (PGE's) EV filing and entered into the record letters of support from its membership.[32]
    - Example: The Alliance for Transportation Electrification is a national trade association that advocates to state regulators on electric transportation issues.[33]
- **Establishing guiding principles.** Whether as part of a stakeholder process or created independently, guiding principles may help define the scope of a filling as well as demonstrate broad stakeholder support for it.
    - Example: A diverse group of stakeholders including automakers, EV charging providers, environmental groups, electric companies, and state clean energy groups submitted joint comments to the Michigan Public Service Commission that included guiding principles addressing the electric company role in accelerating EV deployment. The comments were in response to a docket opened by the commission to explore issues related to EV deployment.[34]
    - Example: The Transportation Electrification Accord is a set of guiding principles on electric transportation, including the electric company role and charging network interoperability. The Accord has more than 100 signatories from a diverse set of stakeholders, including automakers, EV charging providers, electric companies, and environmental groups.[35]

Stakeholder Engagement in Program Implementation

Ongoing stakeholder engagement may be a valuable element of an EV pilot or program.

- A stakeholder advisory group can provide feedback into future program design decisions, such as adjustments to rebate levels that may be needed. These groups may lend credibility to program implementation and may help ensure responsiveness to changing market dynamics.

[30] See http://www.chargevc.org/.
[31] See https://forthmobility.org/.
[32] Reply Testimony of Forth, September 19, 2017, in Public Utility Commission of Oregon, Docket UM 1811 (https://edocs.puc.state.or.us/efdocs/HTB/um1811htb162238.pdf).
[33] See https://evtransportationalliance.org/.
[34] Joint Comments on the Issues Related to the Adoption of Plug In Electric Vehicles in Michigan and Deployment of Associated Infrastructure and Technology, November 11, 2017, in Michigan Public Service Commission, Docket U-18368.
[35] See www.theevaccord.com.

  - Example: SCE established an Advisory Board made up of customers, industry stakeholders, and community representatives to assist the implementation of its Charge Ready pilot.[36]
- At a minimum, an EV filing should contain some public reporting to the commission to demonstrate outcomes from the pilot or program. This reporting can help stakeholders and others learn from the experience of the pilot or program and can keep stakeholders engaged for future filings.
  - Example: Avista files semi-annual reports on its EVSE Pilot, including metrics such as participation levels, expenditures, and revenues for each service offered.[37]

Ongoing stakeholder engagement may be helpful in acquiring and servicing program participants.

- If a program includes elements that are targeted to specific customers, engaging with relevant stakeholder groups in advance may be helpful in gathering support for a filing. EV charging companies may be helpful in marketing a program on behalf of an electric company.
  - Example: SDG&E's priority review SB 350 filing included UPS as a participant in a program designed for delivery vehicles.[38]
  - Example: Programs that include dealer education and/or incentives may be supported by dealer groups.
  - Example: Transportation Network Companies (TNCs) such as Uber and Lyft may support a filing that includes DCFC targeted to EV usage in TNC networks.
  - Example: EV charging companies are marketing California electric company programs as a sales opportunity.

Electric companies can lead regional and city-wide coordination and planning activities among critical state and local government stakeholders.

- Electric companies can position themselves as leaders in the coordination of EV charging infrastructure for cities and regions. Unlike other third parties, electric companies are subject to regulatory oversight, can help ensure equitable deployment across communities, and can leverage system-level awareness of the energy grid to ensure efficient and cost-effective infrastructure siting and integration.
- Various state entities may have interest and direct involvement in charging infrastructure deployment, including state energy offices, state environmental agencies, state transportation departments, and regional planning authorities.
- Various third parties may be in the process of deploying charging infrastructure in the region, such as Electrify America, EVgo, and state-funded deployments. In particular, more than 40 states have allocated at least some of their VW Settlement Appendix D funds to EV charging

[36] Motion for Approval of Phase 1 Settlement Agreement, July 9, 2015, in Public Utilities Commission of the State of California, Docket A.14-10-014.

[37] See, e.g., Semi-Annual Report on Electric Vehicle Supply Equipment Pilot Program, May 1, 2018, in Washington Utilities and Transportation Commission, Docket UE-160082.

[38] Decision on the Transportation Electrification Priority Review Projects, January 17, 2018, in Public Utilities Commission of the State of California, Docket A.17-01-020 (http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M204/K670/204670548.PDF).

infrastructure, representing a significant opportunity to leverage and collaborate with state stakeholders.[39]

- Electric companies can lead planning and implementation discussions with these groups in the context of an EV filing and can help identify how the filing complements other third-party activities.

Conclusion

Stakeholder engagement is core to a successful electric transportation state regulatory filing. Given the new types of stakeholder groups that engage with these filings, careful consideration is needed to cultivate buy-in early in the creation of a filing. It is also important to engage with customers to get a clear picture of their needs and pain points. Electric companies should consider the various models of conducting stakeholder engagement, whether through a commission-led process or separately, to determine how to create a process that is open, transparent, and effective in moving toward concrete action. Electric companies also should consider ongoing stakeholder engagement into the implementation stage of a pilot or program to ensure continual feedback, help recruit more stakeholders and participants, and coordinate activities across the region.

[39] EEI tracks VW Settlement activities through the Atlas EV Hub. See, e.g., EV Hub Quarterly Update, July 2018 (http://www.eei.org/issuesandpolicy/electrictransportation/MembersDocuments/EV_Hub_Quarterly_Report_Q2_2018.pdf).

Table 2: Stakeholder Positions on Major Issues in EV State Regulatory Filings

	Major Issue **Priority/Support** = top priority issue and generally supports electric company role **Priority/Oppose** = top priority issue and generally opposes or wants to limit electric company role			
Stakeholder Group	**Electric Company Participation in EV Charging Market**	**Customer Benefits and Expanding Customer Access**	**Integrating EVs into the Energy Grid**	**Pricing for Site Host Customers and EV Drivers**
Automakers Global Automakers and Auto Alliance [1]	Priority/Support • Deploy charging infrastructure, broad electric company role • Include outreach and education • Partner with industry	• Open access for drivers • Support disadvantaged communities	• Plan for technology evolution • Streamline third-party deployment • Explore managed charging	• Driver fees should be reasonable • Rates should support market adoption
Charging Providers (closed network) EVCA comments [2]	**Priority/Oppose** • Narrow electric company role • No electric company procurement of charging	• Site hosts should have "skin in the game"	• Require networked charging	**Priority/Oppose** • Full site host control of access and pricing
Charging Providers (open network) Siemens comments [3]	Priority/Support • Deploy charging infrastructure, broad electric company role • Customers should have charging options	Priority/Support • Promote interoperability and open access • Support lowering costs, maintaining equipment	• Require networked charging	• Customers should have rate options • Allow use of metering within charging equipment
Environmental NGOs NRDC paper [4]	Priority/Support • Deploy charging infrastructure, broad electric company role • Support competitive market • Partner with industry • Include outreach and education	• Expand access to charging beyond single family homes • Include commitments to disadvantaged communities	Priority/Support • Manage charging to maximize benefits, including renewable energy resources • Manage charging to benefit all customers	• Rates should allow customer fuel cost savings
Consumer Advocates NASUCA resolution [5], Illinois CUB paper [6]	**Priority/Oppose** • Narrow electric company role • Support competitive market • Promotion is responsibility of transportation sector • Concerns about program cost, technology obsolescence, and stranded assets	• Promote interoperability and open access • Target segments to address public needs • Support disadvantaged communities • Rigorous cost-benefit analysis	Priority/Support • Manage charging to maximize benefits, including renewable energy resources • Manage charging to benefit all customers • Facilitate demand aggregation • Regional planning to integrate load	• Tariffs for charging should be cost-based

[1] Global Automakers and Auto Alliance, *In Support of Petition for Implementation of a Statewide Electric Vehicle Portfolio*, available in the PC 44 EV Work Group petition in Maryland PSC Case No. 9478, https://webapp.psc.state.md.us/newIntranet/Casenum/NewIndex3_VOpenFile.cfm?FilePath=C:\Casenum\9400-9499\9478\\1.pdf.

[2] Electric Vehicle Charging Association (EVCA), *Electric Vehicle Charging Association Comments on Joint Parties' Stipulation*, available in Oregon PSC Docket No. UM 1811, https://edocs.puc.state.or.us/efdocs/HAE/um1811hae164954.pdf.

[3] Siemens, *EV Charging Company Support for SDG&E's Program and Recommended Modifications –Witness Chris King, Siemens*, available in opening joint stakeholder testimony in California Public Utility Commission (PUC) Application No. 17-01-020, http://www.ripuc.org/utilityinfo/electric/PST_BE_SC_16.pdf.

[4] Natural Resources Defense Council (NRDC), *Guiding Principles for Utility Programs to Accelerate Transportation Electrification*, https://assets.nrdc.org/sites/default/files/utility-transportation-electrification-ib.pdf.

[5] National Association of State Utility Consumer Advocates (NASUCA), *Urging the Adoption of Policies and Regulations to Protect Ratepayers as Electric Vehicle Adoption Rates Increase*, http://nasuca.org/nwp/wp-content/uploads/2017/08/2018-02-Protection-for-Ratepayers-as-EV-Adpotion-Rates-Increase-Final-6-24-18.pdf.

[6] Citizens Utility Board (CUB), *The ABCs of EVs*, https://citizensutilityboard.org/wp-content/uploads/2017/04/2017_The-ABCs-of-EVs-Report.pdf.

Regulatory Component #3: Charging Infrastructure Deployment

Deploying charging infrastructure is another core component of an electric transportation filing because:

- Charging infrastructure availability has been found to directly correlate with EV adoption;
- Low availability of charging infrastructure is consistently one of the top reasons for NOT buying an EV; and
- More charging infrastructure will be needed as the EV market grows.

Electric companies have a role to play in providing charging infrastructure to customers, but they are not the only potential providers. The specific details of the charging infrastructure component of an EV filing will vary by company, but likely should include discussion of the following six elements:

- Investment model and cost recovery
- Competitive impacts
- Market segments and use cases
- Interoperability
- Maintenance
- Coordination with other deployment efforts

Investment Model Approach and Cost Recovery

Charging infrastructure is likely to represent the largest budget component of an EV filing. This can take many different forms depending on the specific infrastructure provided, as summarized in Figure 1.

Generally, the options that have been implemented to date can be organized according to investment model and cost recovery. The investment model approaches range from simple service extension to full ownership of charging infrastructure, and are summarized below. This summary describes approaches that have been approved by commissions, not necessarily what the electric company originally proposed.

- **Service extension/distribution upgrade.** The electric company pays for distribution upgrades needed to serve charging infrastructure installations that otherwise might be paid by the customer, with the aim of incenting (or not discouraging) new charging infrastructure development. All costs associated with the charging equipment (also known as EVSE), including installation, are paid for by the customer.
- **"Make ready" infrastructure.** The electric company installs, owns, and maintains conduit and wiring to "ready" a customer site for the installation of charging equipment, as well as any distribution upgrades or service extensions needed to serve that site. The charging equipment itself is procured and paid for by the customer. The electric company also could offer a rebate to offset the cost of the charging equipment. A variant on the “make ready” approach could include a combination of line extension costs and a rebate for installation work on the customer side of the meter; under this approach, the electric company would not own any infrastructure on the customer side of the meter. This model provides an opportunity for electric companies to assist

with site design, construction, and other facility issues involved with charging infrastructure implementation.

- **Ownership of charging equipment.** The electric company installs, owns, and maintains (and perhaps operates) the charging equipment, as well as the "make ready" wiring and any distribution upgrades or service extensions. The charging equipment could be selected by the customer from a set of options that the electric company defines, or the electric company could procure (and optionally operate) the charging equipment.

Figure 1: Electric Company Charging Infrastructure Deployment Options

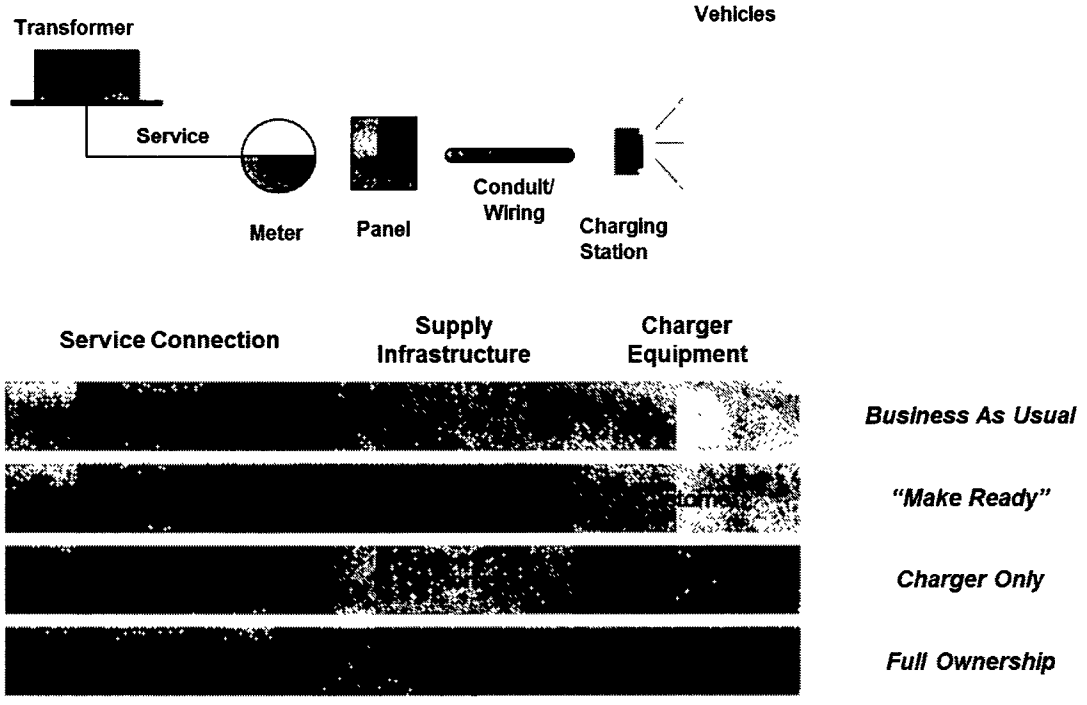


Table 3 provides options of how an electric company might recover the costs associated with different types of charging infrastructure. These include:

- Capital
  - Direct investment in "make ready" infrastructure and charging equipment is treated as capital (if approved), earning a return on investment like other electric company investments.
  - Rebates that electric companies pay customers to offset charging infrastructure costs are treated as a regulatory asset (if approved) that earns a return for the electric company.
- Expenses and performance incentives
  - Rebates issued by electric companies to customers to offset their costs for "make ready" infrastructure and charging equipment often are treated as expenses, but could be treated as a regulatory asset (if approved).

        - Example: Energy efficiency (EE) programs provide a precedent for earning on a rebate-based investment model. Maryland currently uses a five-year amortization structure to recover the costs of its EmPOWER EE program that includes a return component.[40]
    - Rebates issued by electric companies to customers could be accompanied by performance incentives (if approved) to provide an earning mechanism for the electric company.
        - Example: National Grid's EV pilot in New York, included in a joint proposal settlement that was approved in March 2018, creates an Environmentally Beneficial Electrification Earning Adjustment Mechanism (EAM) based on the lifetime metric tons of avoided carbon dioxide from incremental EVs and heat pumps.[41]
        - Example: National Grid's EV pilot in Massachusetts includes a performance incentive based on the number of EV charging stations deployed.[42]
- Facilities charge/tariff
    - An electric company installs, owns, and maintains charging infrastructure for a customer and charges the customer for the full cost of that infrastructure through an on-bill structure, such as a facility charge or special tariff.
- Energy Efficiency or Demand-Side Management Programs
    - Electric companies may be able to integrate EV charging infrastructure deployment programs into EE or demand-side management (DSM) programs, particularly if the program is targeted toward managing charging for the efficient use of the energy grid. Leveraging existing programs may allow for more expedient regulatory review.
        - Example: Puget Sound Energy provided 5,000 residential customers with a $500 rebate toward the purchase of a networked Level 2 EVSE that allowed the company to study EV load and energy grid impacts. The rebate was funded by a conservation rider.[43]

[40] See, e.g., discussion in Comments of the Public Service Commission Staff, October 10, 2018, in Maryland Public Service Commission, Case No. 9154.
[41] Joint Proposal, January 19, 2018, in New York Public Service Commission, Case 17-E-0238.
[42] Proposal filed January 20, 2017, in Massachusetts Department of Public Utilities, Docket 17-13.
[43] Order issued April 30, 2014, in Washington Utilities and Transportation Commission, Docket U-140626.

Table 3: Charging Infrastructure Investment Model Approaches and Cost Recovery Options

	Service Connection	Supply Infrastructure	Charging Equipment
Line extension *Indianapolis Power & Light (IPL), Ameren MO, CA policy for residential customers*	Capital (additional allowance)		
Make ready *Eversource*	Capital	Capital	
Make ready plus rebate *SCE Charge Ready Phase 1, PG&E (based on customer selection)*	Capital	Capital	Rebate
Make ready plus rebate (expense-based) *National Grid*	Capital	Rebate	Rebate
Ownership—EVSE only *Avista (L2 chargers)*		Rebate	Capital
Ownership—up through EVSE (customer selects) *SDG&E, PG&E (based on customer selection)*	Capital	Capital	Capital (customer selects)
Ownership—up through EVSE (electric company selects) *Avista (DCFC), PGE, PacifiCorp, Georgia Power, Hawaiian Electric Company (HECO), KCP&L*	Capital	Capital	Capital (electric company selects)
Rebate—EVSE and installation *Ameren MO, Public Service Enterprise Group Long Island (PSEG LI)*		Rebate	Rebate
Rebate—EVSE only *Puget Sound Energy*			Rebate
Facilities charge/tariff *Alaska Electric Light & Power (AELP), Louisville Gas & Electric Company and Kentucky Utilities Company (LG&E and KU), Gulf Power*			Capital

Factors to consider when determining an investment model and cost-recovery strategy include:

- **Stakeholder positions.** Some third-party EV charging companies seek to minimize the extent to which electric companies are involved in customer procurement and operational decisions. Customer advocates typically seek to minimize program costs, while environmental groups tend to support programs that will maximize EV market acceleration as well as renewable integration via managed charging. Commissions also may need to grapple with threshold policy questions, such as which entities are allowed to own charging stations, how these entities are regulated, and how they are allowed to set pricing for EV drivers.
- **Data access/control.** Rebate and "make ready" programs may offer the electric company less control over the charging equipment and/or access to charging data unless such provisions are explicitly included in charging equipment qualifications. Charging equipment procured by the electric company affords greater control and visibility. In general, electric companies should have the option to control and should have access to charging data as a prerequisite for customer funds being used.
- **Customer experience.** Rebate and "make ready" programs still require customers to procure, maintain, and operate charging equipment. Some customers may prefer more turnkey solutions that are managed by the electric company.
- **Earning potential.** "Make ready" infrastructure often makes up most of the infrastructure cost (see Figure 1). Capitalizing a rebate may be possible but may be opposed by groups that traditionally have opposed such treatment for energy efficiency programs. A rebate with a performance incentive may be one way to see earnings on a rebate program.
- **Internal management.** Rebate programs typically require fewer internal resources to manage. "Make ready" and full ownership options require project management teams to oversee customer site host recruitment, project development, and other functions that typically are not part of electric company operations.

Competition

A major point of contention in EV filings is how electric company involvement will impact third-party EV charging companies. Electric company infrastructure deployment can help jumpstart the market, while also allowing for multiple players. Program design choices can help address this issue.

Design options include:

- **Frame as a pilot.** A pilot may have less impact on the competitive market than a large program.
- **Limit the scope.** Restrict the filing to certain market segments (e.g., low-income or multi-unit dwellings) or limit the size to cover some fraction of the overall market need.
- **Make ready.** The "make ready" approach puts charging equipment procurement, ownership, and operation in control of customers.
- **Provide options to customers.** Even under a full ownership approach, customers could be allowed to choose from multiple qualified vendors. Customers also could be offered the choice between a "make ready" approach and electric company ownership/operation.
- **Issue an RFP for market response.** An electric company could issue a request for proposals (RFP) to develop charging infrastructure and allow third parties to respond first, then backstop any development that third parties do not meet.

Market Segments and Use Cases

Electric vehicle charging encompasses multiple location types and use cases. These generally include:

- Charge where you park
  - Residential homes: charging overnight
  - Multi-unit dwellings: charging overnight
  - Workplaces: charging while parked at work
  - Public destinations: charging at long-dwell public locations or opportunity charging to allow drivers to "top up" while parked
- Charge on the go
  - Public, metro-based fast charging: charging for multi-unit dwellers without dedicated parking or intra-city driving
  - Public, corridor-based fast charging: charging to complete long-distance, inter-city travel
- Fleet charging
  - Depots: charging to support commercial fleet operations

Given the wide range of charging infrastructure use cases, EV filings should be intentional and specific about the target market segments. Some considerations include:

- **Market needs.** For example, in an area with few multi-unit dwellings, the program focus may be charging for residential homes; in a dense urban area, the focus may be charging for multi-unit dwellings. In general, public charging installations should include multiple charging stations to reduce wait time and improve the customer experience, while having the capacity for future expansion.
- **Investment model and cost recovery.** The appropriate approach may vary depending on the market segment. For example, a turnkey solution in which the electric company owns the charging equipment may be more attractive to certain customers.
  - Example: SCE's Charge Ready 2 proposal, filed in July 2018, includes an option for the electric company to own and operate the charging stations at the customer's election for multi-family dwellings and government locations. This element is designed to offer an easier, turnkey solution for these customers, who had a low adoption rate in the Charge Ready pilot.[44]
- **Rationale.** Each use case is important but may need different arguments to support inclusion in a filing. For example, long-dwell charging (e.g., residential, workplace) is a prime candidate for managed charging that will improve energy grid utilization. Public charging is critically important to support urban use cases. Fleet charging needs may be customer-specific, but it is important to grow EV adoption beyond individually owned passenger cars.

Interoperability

Interoperability refers to how EV drivers interact with charging infrastructure and how charging infrastructure is managed/controlled. Generally, interoperability can be divided into three categories:

[44] Charge Ready 2 filing, June 26, 2018, in Public Utilities Commission of the State of California, Docket A.18-06-015.

- **Physical connectors.** The standards determining how the charging equipment plugs into the EV. Level 1 and Level 2 connectors are generally interoperable today with the SAE J1772 standard. DC fast charge connectors have three types (Tesla, CHAdeMO, SAE Combo).
- **User payment/access.** The process of initiating and paying for a charging session. Some charging equipment operators require (or prefer) membership to exclusive networks. Inter-network access and payment settling (e.g., roaming) is limited or non-existent in the United States.
- **Backend communication.** The communication protocols that determine how the charging equipment shares data with and is controlled by the backend charging management software. Some "closed network" charging equipment is locked into proprietary backend software, while other "open network" equipment allows network operators, whether an electric company or a customer, to more easily change equipment and/or charging management software providers.

Electric companies can influence interoperability via well-defined specifications and pre-qualification requirements. For example:

- **Direct procurement.** In a program where an electric company selects the charging equipment, an RFP could include specifications for interoperability.
- **Customer selection.** In a program where the customer selects equipment, such as a rebate program, the electric company's pre-qualification requirements could include minimum standards of interoperability.

Maintenance

Charging infrastructure must work when it's needed. Charging infrastructure today is not always maintained and operable, as charging network providers may not own or maintain equipment and site hosts may not maintain their equipment properly. The ability of a site host customer and/or a charging network provider to fund the long-term operation and maintenance of charging stations is an important consideration. As electric transportation becomes mainstream and as a growing number of users rely on charging infrastructure to meet their daily transportation needs, electric companies can help ensure that charging infrastructure adheres to the same standards for safety and reliability as any other grid asset.

Design options include:

- Electric companies own and maintain charging equipment (see the Ownership examples in Table 3).
- Customers own charging equipment as part of an electric company program in which the electric company may set requirements for maintenance and availability that ensure the charging equipment will be available when it is needed (see, e.g., the Make Ready examples in Table 3).

Coordination with Other Deployment Efforts

Today, EV charging infrastructure is being deployed by customers, charging companies, automakers, state and local governments, and, increasingly, electric companies. It is critical to recognize and complement existing charging infrastructure and other players in the market and to anticipate future development and market needs.

Electric companies should take the lead in regional coordination efforts by convening the key stakeholder groups and state agencies, including state departments of environment and transportation. Electric companies are not transportation experts, but their local expertise and relationships can be an asset in regional planning.

Design options include:

- Structuring deployment to allow for additional cost-share partners.
- Including robust stakeholder input to the plan to allow for adjustments and coordination.
- Working from a stakeholder-developed plan for the region.

Conclusion

Electric companies are well-positioned to increase the availability of charging infrastructure, one of the primary barriers to EV adoption. In electric transportation state regulatory filings, electric companies should consider the specific market segments they want to serve, along with the investment model and cost-recovery options that balance internal priorities with local market needs. Charging infrastructure deployment filings also should address potential competitive market impacts and core customer experience elements, including interoperability and maintenance.

Regulatory Component #4: Residential Managed Charging

Residential managed charging is an important element of an EV filing and an important tool for engaging customers to meet their needs and to achieve load management outcomes:

- EV owners today do most of their charging at home (about 80–90 percent). EVs also typically spend 12 or more hours parked at home every day. For these reasons, residential customers represent a significant opportunity to leverage a large, flexible load for the benefit of all customers.
- Managed charging strategies can help encourage EV drivers to charge at specific times (e.g., when the energy grid has capacity or to absorb excess solar/wind generation).
- Shifting EV load to improve the efficient use of the energy grid is one justification for electric company involvement in the EV market.

Approaches to Managing Residential Charging

Residential charging can be managed through a variety of approaches. However, in this early phase of the EV market, electric companies and other stakeholders have not agreed on a single or a set of solutions or approaches. An EV state regulatory filing allows electric companies to test and to demonstrate which options and approaches are most effective for their customers.

- Rate options are numerous. Some examples in place today for residential EV customers include:
    - Time-of-use (TOU) rates that provide different electricity rates at different times of day. These rates may apply to the whole house or separately to EV charging.
        - Example: Alabama Power Company's PEV Rate Rider provides a discount of 1.7 cents per kilowatt-hour (kWh) between the hours of 9 p.m. and 5 a.m.[45]
        - Example: Baltimore Gas & Electric's Schedule EV—Residential TOU rate has higher on-peak charges and lower off-peak charges than the standard TOU rate.[46]
    - Dynamic rates or other flexible rates
        - Example: SDG&E's Vehicle Grid Integration (VGI) hourly time-variant rate reflects energy prices, system capacity, and distribution circuit capacity.[47]
- Bill credits, flat monthly fees, and other incentives
    - Residential EV customers can be encouraged to charge at specific times via bill credits or other incentives based on actual charging behavior.

[45] Order issued March 6, 2012, in Alabama Public Service Commission, Docket U-5055; see also rate sheet https://www.alabamapower.com/content/dam/alabamapower/Rates/pev.pdf.

[46] EV Rate Pilot Report filed February 29, 2016, in Maryland Public Service Commission, Docket 9261; see also rate sheet: https://www.bge.com/MyAccount/MyBillUsage/Documents/Electric/ScheduleEV.pdf.

[47] Decision D.16-01-045 issued January 28, 2016, in Public Utilities Commission of the State of California, Docket A.14-04-014; see also documents: https://www.sdge.com/regulatory-filing/10676/sdge-electric-vehicle-grid-integration-pilot-program.

        - Example: Consolidated Edison's (ConEd's) SmartCharge New York program provides participants with a third-party device that tracks the EV's location and energy usage, allowing ConEd to provide credits based on charging behavior.[48]
        - Example: Green Mountain Power's (GMP's) In-Home Level 2 EV Charger program offers a free home charger to new EV buyers, plus a $30 per month flat rate charging plan that allows unlimited usage during off-peak hours.[49]
- Direct control
    - Electric companies can control EV charging directly, based on customer permissions and preferences, including programming charging to begin at certain times or lowering the charging power.
        - Example: Pepco's demand management pilot in Maryland deployed 50 smart chargers that allowed Pepco to turn down the charging power during demand response events.[50]
- Customer-managed
    - Educating drivers to program their EVs to begin charging at certain times may be a low-cost way to achieve load shifting. Other behavior "nudges" could be employed as well. This may be of interest for companies that do not have smart meters deployed.
    - Most EVs include an option to delay charging to a certain time, which the driver can be encouraged to program. Some EVs include a "charge by" setting, in which the car begins charging on its own based on how much energy it requires to complete a charge by a pre-set time.

Approaches to Metering/Measuring Residential Charging

An important element of managing charging is the ability to disaggregate the EV charging from the electricity usage of the whole house. While this often requires a second meter, new methods to measure EV charging are emerging that provide more options to electric companies.

- Data analytics
    - If smart meters are in place, EV load can be disaggregated from a household meter by identifying its unique load signature. Rates or bill credits then could be applied based on charging behavior.
        - Example: Consumers Energy's EV filing would support IT systems that collect data from existing smart meters, as well as from charging equipment and from the vehicle itself. The company currently is exploring options across all three sources, including utilizing the existing smart meter data to identify the EV load profile and to bill customers accordingly.[51]

[48] Order approving Electric and Gas Rate Plans issued January 15, 2017, in New York Department of Public Service, Case 16-E-0060; see also: https://www.coned.com/en/save-money/rebates-incentives-tax-credits/rebates-incentives-tax-credits-for-residential-customers/electric-vehicle-rewards.

[49] See https://greenmountainpower.com/product/home-level-2-ev-charger/.

[50] Order No. 85776 approving the Pepco Amended Electric Vehicle Charging Station Pilot Program, August 12, 2013, in Maryland Public Service Commission, Docket 9261.

[51] Filing on May 14, 2018, in Michigan Public Service Commission, Docket U-20134.

- Sub-metering
  - The metrology in the EVSE or the EV itself could be used to identify the EV charging load and to apply a discount or credit if the charging is determined to occur off-peak.
  - Relying on metrology other than a revenue grade meter may require commission approval.
    - Example: The California Public Utilities Commission (PUC) has conducted two phases of a sub-metering pilot to study the effectiveness of using third-party sub-meters (e.g., embedded in the EV charger) for billing purposes.[52]
    - Example: The Minnesota PUC has approved an Xcel Energy sub-metering pilot that allows up to 100 customers to pay for a smart charger with a flat monthly fee instead of installing a second meter.[53]
- A second meter
  - Today's EV-specific TOU rates typically require the whole house to go on the TOU rate or require the installation of a second meter to serve the EV charging so that the EV-only meter can be placed on the TOU rate.
  - An EV-only meter is an accepted way to meter EV charging load that meets company and regulatory requirements (e.g., for "revenue grade" metering).
  - Installation of a second EV-only meter may be expensive and could create a barrier to customers choosing EV rates.
  - On the other hand, a second EV-only meter may be a lower cost option than third-party devices and may be able to leverage communication channels (e.g., smart meters) that the electric company already has in place.
    - Example: Minnesota Power offers a Residential Off-Peak EV Service rate (Rate Code 28) that provides a discounted rate for charging an EV between the hours of 11:00 p.m. and 7:00 a.m. daily. The rate requires the installation of a separate meter.[54]

Other Considerations When Defining a Residential Managed Charging Strategy

The universe of tools available today to manage and to measure residential charging is expansive, and each set of options comes with its own set of tradeoffs. Experimentation at this point can be helpful.

The following issues should be considered when defining a managed charging strategy for an EV filing.

- Customer experience
  - An easy, seamless experience for the customer is paramount to gaining customer adoption and to achieving load management goals. EV-specific TOU rates may have low acceptance if customers are not educated, or if participation is too costly or complex.
- Innovative pricing
  - Residential EV charging could provide an entry point for electric companies to experiment with innovative pricing strategies.

[52] Resolution E-4651 issued June 27, 2014, in Public Utilities Commission of the State of California; see also: http://www.cpuc.ca.gov/general.aspx?id=5938.
[53] Order issued May 9, 2018, in Minnesota Public Utilities Commission, Docket E-002/M-17-817.
[54] Schedule 28 as approved by order on November 2, 2010, in Minnesota Public Utilities Commission, Docket E015/GR-09-1151; see also: https://www.mnpower.com/CustomerService/ElectricVehicleRate.

- Residential EV charging also could bundle the charging infrastructure into the pricing program.
  - Example: See the GMP In-Home Level 2 EV Charger program referenced above.

- Integration into EE/DR/DSM programs
  - Managed charging programs could be integrated into EE, demand response (DR), and/or DSM programs, where allowed. Leveraging existing programs may allow for more expedient review than traditional rate reviews.
- Data control/integrity
  - One electric company advantage for customers and regulators is the control over data. Managed charging strategies that are implemented by third parties could put customer data outside of regulatory oversight.
- Administrative cost
  - Tariffs are the tried-and-true electric company method of affecting customer behavior. However, creating new tariffs may be administratively costly.
- Aggregation
  - Charging aggregators, such as charging network providers or automakers, could aggregate multiple EV owners to participate in a program and to establish contracts with the electric company to deliver specific demand reductions.
    - Example: PG&E's and BMW's iChargeForward pilot allows PG&E to send a DR signal to BMW, which responds with load reduction from a mix of 100 participating EV drivers and/or a stationary storage device.[55]
    - Example: eMotorWerks is an EV charging company that allows residential users to earn "rewards" by participating in a DR program.[56]
- Infrastructure requirements
  - Electric companies may choose residential charging infrastructure as one of the target segments in the charging infrastructure component of an electric transportation state regulatory filing, creating an opportunity to implement managed charging strategies along with charging infrastructure deployment.
  - Charging stations deployed as part of a residential charging program could include specifications that allow for future optionality for charging management (e.g., "smart chargers" that can accept a DR signal and include metrology that could be used as a sub-meter, or other DR programs in which the residence may participate).
- Future options
  - EV charging technology is evolving. It is important to design pilots and programs to be flexible to allow for future offerings.
  - The ability to shift load is important because the preferred charging time may change as the energy mix changes.
  - Electric company internal capabilities (e.g., Information Technology systems) may need to evolve to accommodate current and future managed charging strategies.

[55] Decision D.12-04-045 issued April 30, 2012, and advice letter 4077-E in Public Utilities Commission of the State of California; see also final report: http://www.pgecurrents.com/wp-content/uploads/2017/06/PGE-BMW-iChargeForward-Final-Report.pdf.

[56] See https://emotorwerks.com/about/enewsso/press-releases/269-emwdram.

- Example: Home charging costs could be bundled into an EV lease payment.
- Example: Smart circuit breakers could allow a new low-cost metering and control solution for EV chargers.
- Example: Centralized clearing houses that allow communication among multiple automakers and electric companies could be implemented to manage charging generically.

Conclusion

The ability to manage residential charging is important to delivering on the promise of EVs as tools to increase the efficient use of the energy grid, providing benefits to all customers. Many strategies are available to manage residential charging, ranging from customer education to smart pricing and direct control. Deploying managed charging strategies that balance effectiveness with a positive customer experience is important to long-term scalability, customer acceptance, and regulatory acceptance.

Regulatory Component #5: Commercial Charging

Commercial charging is an important consideration for EV filings. For drivers, the availability of charging infrastructure outside the home is critical to encouraging widespread EV adoption. And, as battery costs decrease, more commercial customers are electrifying their fleets. Enabling EV charging at commercial locations is important for widespread transportation electrification.

Commercial charging in this framework refers broadly to EV charging that occurs at the location of a commercial electric company customer. This definition includes many use cases (see Table 4, below), including charging at workplaces and multi-unit dwellings, public DC fast charging, and fleet charging.

Two critical issues for commercial charging are:

- **Managed charging strategies.** Long-dwell (2 hours or more) commercial charging locations provide an opportunity for the electric company to help manage charging.
- **DCFC rate issues.** Electric rates with demand charges for commercial customers often are cited as a concern by operators of standalone DCFC stations and large fleet charging facilities with low utilization. Solutions are needed to help foster third-party development of charging infrastructure, such as during initial periods of low utilization.

Major Commercial Charging Use Cases

Table 4 shows major commercial charging use cases and the opportunities and concerns with each.

Table 4: Commercial Charging Use Cases

Use Case	Electric Company Customer	EV User	Managed Charging Opportunity	Potential Demand Charge Concerns
1. Multi-unit dwellings	Property owner	Individual	High	Low
2. Workplace charging	Commercial building owner	Individual	High	Low
3. Public long-dwell charging	Commercial location (e.g., shopping mall, airport)	Individual	Medium	Low
4. Public DCFC owned by electric company	Self (e.g., on a commercial property)	Individual	Medium	Low
5. Public DCFC at commercial locations	Commercial location (e.g., grocery store, retail)	Individual	Low	Medium
6. Public DCFC at standalone facilities	EV charging operator (e.g., EVgo, Tesla)	Individual	Low	High
7. Fleet DCFC at standalone facilities	Fleet operator (e.g., transit agency)	Fleet vehicle	Low	High
8. Fleet charging at depots	Fleet facility (e.g., UPS, FedEx)	Fleet vehicle	High	Medium

Managed Charging

One of the primary reasons for electric company involvement in EV charging is to leverage the additional load to improve the efficient use of the energy grid. Commercial charging locations in which EVs are parked for extended periods of time (generally 2 hours or more) provide opportunities for electric companies to deploy managed charging strategies, including:

- Dedicated meter (as shown in Table 4, Use Cases 1, 2, 3, and 8). Installing a separate meter for the EV chargers at a commercial customer location provides an opportunity to affect charging behavior through rate design (e.g., EV-specific commercial TOU rates).
    - Example: SDG&E's Power Your Drive pilot will install up to 3,500 chargers at multi-unit dwellings and workplaces. SDG&E owns and maintains the charging equipment. Charging stations will use the time-variant VGI rate that reflects energy prices, system capacity, and distribution circuit capacity.[57]
    - Example: The first phase of SCE's Charge Ready pilot will install "make ready" equipment for up to 1,500 chargers at multi-unit dwellings, workplaces, and long-dwell public locations. Charging stations will use a commercial TOU rate, and site hosts must participate in demand response.[58]
    - Example: PG&E's EV Charge Network pilot will install "make ready" equipment for up to 7,500 chargers at multi-unit dwellings and workplaces. Customers may choose to allow PG&E to own and maintain the chargers as well in certain locations. Charging stations will use a commercial TOU rate.[59]
- Electric company-owned/operated charging infrastructure (as shown in Table 4. Use Case 4). Electric companies that own and operate charging stations essentially may act as their own site-host and customer of record. The physical charging stations may be located on a third-party location (e.g., retail shopping center) or electric company property. The electric company may create a unique tariff for EV drivers to use the charging stations, which may change throughout the day to give preference to charging at certain times.
    - Example: Hawaiian Electric (HECO) may own and operate up to 25 DCFC. The tariff allows HECO to assess usage fees directly from EV drivers. The session fee varies by time of day.
    - Example: PGE is in the process of developing a tariff for users of DCFC at its "electric avenue" hubs. The tariff assesses fees directly on EV drivers, will test a critical peak pricing component to encourage charging off-peak, and will offer a subscription option as well as a per-usage fee option.

[57] Decision 16-01-045 issued on January 28, 2016, in Public Utilities Commission of the State of California, Docket A.14-04-014 (http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M158/K241/158241020.PDF).
[58] Decision 16-01-023 issued on January 25, 2016, in Public Utilities Commission of the State of California, Docket A.14-10-014 (http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M157/K835/157835660.PDF).
[59] Decision 16-12-065 issued on December 21, 2016, in Public Utilities Commission of the State of California, Docket A.15-02-009 (http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M171/K539/171539218.PDF).

Managed charging strategies may take many forms and will evolve over time. No single solution today has emerged as the best strategy, but there are two important considerations, regardless of the strategy chosen:

- **Line of sight into customer charging behavior.** Electric company access to customer charging behavior helps to inform future strategies and to plan future investments in the energy grid to accommodate EV charging efficiently.
- **Managed charging readiness.** Electric company investments in charging infrastructure should encourage the deployment of charging stations that potentially can be controlled and/or accept pricing signals to support the efficient use of the energy grid.

DC Fast Charging

Public DCFC is important to enable long-distance travel, provide charging solutions for drivers who do not have dedicated parking, and accommodate shared-use applications such as ride hailing, car sharing, and fleet charging. Third parties developing DCFC infrastructure (i.e., DCFC site hosts) face a "chicken-and-egg" problem: widespread EV adoption is impeded by the lack of DCFC infrastructure, but the business case for DCFC infrastructure may be challenged by low utilization in the near-term.

Today, electric companies are rethinking rate designs to recover costs appropriately, while encouraging third-party development of DCFC stations. They also are implementing a variety of solutions to address this issue, including demand mitigation strategies. Given the early stage of DCFC infrastructure deployment, experimentation and "learning by doing" are important options to consider.

DCFC Rate Options

Typically, DCFC site host customers are treated as commercial customers. Many commercial customer rates include a fixed monthly charge, a volumetric charge, and a monthly demand charge. However, other commercial rates often are available. Electric companies can offer DCFC site host customers options to choose the rates that best meet their needs.

- Some electric companies offer a non-demand charge rate option and encourage DCFC site host customers to choose this rate.
  - Example: PGE's Schedule 38[60]
  - Example: Tampa Electric's Optional General Service[61]
  - Example: DTE's Rate Schedule D3[62]
- Some electric companies are offering rate options that place limits on demand-related charges.
  - Example: Duke Energy's Rate DS available in Kentucky[63]
  - Example: Xcel Energy offers a cap mechanism that is available in Michigan, Minnesota, North Dakota, and Wisconsin[64]
- Some electric companies are reducing demand charges temporarily with a phase-in period.

[60] https://www.portlandgeneral.com/-/media/public/documents/rate-schedules/sched_038.pdf.
[61] https://www.tampaelectric.com/files/content/commratesinsert2017.pdf.
[62] https://www.michigan.gov/documents/mpsc/dtee1cur_579203_7.pdf.
[63] https://www.duke-energy.com/_/media/pdfs/for-your-home/rates/electric-ky/sheet-no-40-rate-ds-ky-e.pdf?la=en.
[64] See, e.g., https://www.xcelenergy.com/staticfiles/xe/Regulatory/Regulatory%20PDFs/rates/WI/2We_Section_2New.pdf.

- Example: SCE recently received approval for three commercial EV rates (TOU-EV-7, 8, and 9), applying to different customer sizes, that do not assess demand charges for a five-year period, then phase in demand charges for a subsequent five-year period.[65]
- Example: Pacific Power's proposed Schedule 45 moves a portion of the demand charge to on-peak energy charges, but reduces the demand charge discount 10 percent each year until reverting to normal over a nine-year transitionary period.[66]

- Some electric companies are experimenting or offering "start-up" rates to better understand customer preferences and charging behavior.

DC Site Host Options

In addition to rate options, electric companies also can encourage DCFC site host customers to take proactive steps to manage their electric bills, such as the following:

- Install stationary storage at DCFC charging locations to allow the customer to manage the EV charging load.
- Manage load at the facility to avoid demand-related charges.
- Develop DCFC stations for an existing user base (e.g., General Motors' Maven Gig deployment of EVs) to boost utilization.
- Install DCFC stations behind the meter of a large customer (e.g., as shown in Table 4, Use Case 5).

Other Commercial Charging Considerations

Due to the size of the EV charging load in commercial use cases, additional issues that may need to be considered when defining commercial charging strategies include:

- Distribution upgrades (e.g., line extension policy)
  - Customer locations may not have sufficient electrical service to provide charging for a large number of EVs, so upgrades to existing service may be required. In the owner/operator case, a new service connection is required.
  - Line extension policies determine how much of the cost of a new service connection and associated distribution upgrades are attributable to the customer. Adjustments to line extension policies that create a greater customer allowance for additional load may reduce the upfront cost for customers wishing to install charging infrastructure.
    - Example: IPL received regulatory approval to rate base distribution upgrades to support the BlueIndy EV car-sharing program that otherwise would have been charged to the customer.[67]
    - Example: Ameren Missouri's proposed "Charge Ahead" program includes a revised line extension policy that more fully considers the incremental costs and

[65] Decision D.18-05-040 issued June 6, 2018, in Public Utilities Commission of the State of California, Docket A.17-01-020 (http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M215/K783/215783846.PDF).

[66] See https://www.pacificpower.net/content/dam/pacific_power/doc/About_Us/Rates_Regulation/Oregon/Approved_Tariffs/Rate_Schedules/Public_DC_Fast_Charger_Optional_Transitional_Rate_Delivery_Service.pdf

[67] Order issued February 11, 2015, in Indiana Utility Regulatory Commission, Docket 44478.

benefits associated with the connection of new load, intended to encourage new service connections that benefit the energy grid.[68]

- Stationary storage
  - Some customers already are deploying stationary storage to mitigate demand charges.
  - Some electric companies are offering to pair charging with stationary storage.
    - Example: National Grid is planning to deploy 50-megawatt stationary battery storage installations at substations across the UK to support the energy grid and DCFC for corridor travel.[69]
- Future options
  - Automakers or other third-party service providers may offer "charging as a service," in which energy procurement and charging management are handled by the third party for the customer.
    - Example: Electric van manufacturer Chanje is proposing a bundled vehicle lease that includes charging infrastructure and energy usage. The company would manage energy procurement and delivery for the fleet.[70]

Conclusion

Charging at commercial locations is critically important to support the growth of the EV market and fleet electrification. Use cases in which vehicles are parked for long periods (2 hours or more) provide opportunities for managed charging. Electric companies are exploring managed charging strategies in use cases where it makes sense.

DCFC presents some unique challenges. In the near-term, experimentation is needed to learn what works best to facilitate deployment of DCFC stations, while ensuring appropriate cost recovery for the energy grid.

[68] Direct Testimony of Steven Wills, February 22, 2018, in Missouri Public Service Commission, Docket ET-2018-0132 (https://www.efis.psc.mo.gov/mpsc/commoncomponents/viewdocument.asp?DocId=936135251).

[69] See https://www.pivot-power.co.uk/pivot-power-work-national-grid-future-proof-energy-system-accelerate-electric-vehicle-revolution/.

[70] See https://chanje.com/energy-solutions/.

The **EDISON ELECTRIC INSTITUTE** (EEI) is the association that represents all U.S. investor-owned electric companies. Our members provide electricity for about 220 million Americans, and operate in all 50 states and the District of Columbia. As a whole, the electric power industry supports more than 7 million jobs in communities across the United States. In addition to our U.S. members, EEI has more than 60 international electric companies with operations in more than 90 countries, as International Members, and hundreds of industry suppliers and related organizations as Associate Members.

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[redacted]

Model and drivers description placeholder

X **DCF 1 General Assumptions**

Tax Rate	24.00%	*Justin Hyland*
Discount Rate	6.50%	*Blended corporate discount rate*
Model Start Year	2019	
Inflation	2.00%	
CPA		
Ad valorem Tax Rate	2.60%	*Justin Hyland*
Sales Tax Rate	[redacted]	
Debt to Capital Ratio	55.00%	*CNP Capital Structure (Q2 CoD memo)*
Equity to Capital Ratio	45.00%	
Dividend Payout %	0.00%	
Cost of LT Debt	3.90%	*2018 CNP CoD (Q3 CoD memo)*
Year of LT Debt Issuance	2018	

X **Financial Statements**

X **Income Statement**

($ in millions)	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Total Revenue ($)	$ -	$ 225,640	$ 662,444	$ 620,807	$ 584,047	$ 561,252	$ 541,944	$ 507,574	$ 477,290	$ 450,433	$ 434,048	$ 428,397
O&M	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)
Other taxes	$0	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)
EBITDA	**($30,000)**	**$160,081**	**$596,885**	**$555,248**	**$518,488**	**$495,693**	**$476,385**	**$442,015**	**$411,731**	**$384,873**	**$368,489**	**$362,838**
Depreciation	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)
EBIT	**($340,723)**	**($150,641)**	**$286,162**	**$244,525**	**$207,765**	**$184,970**	**$165,662**	**$131,292**	**$101,008**	**$74,151**	**$57,766**	**$52,115**
Interest expense	(39,988)	(74,897)	(65,463)	(57,269)	(49,960)	(43,023)	(36,089)	(29,614)	(24,059)	(18,964)	(13,868)	(8,772)
EBT	**($380,710)**	**($225,538)**	**$220,699**	**$187,257**	**$157,805**	**$141,947**	**$129,574**	**$101,678**	**$76,949**	**$55,187**	**$43,898**	**$43,343**
Income taxes	91,370	54,129	(52,968)	(44,942)	(37,873)	(34,067)	(31,098)	(24,403)	(18,468)	(13,245)	(10,536)	(10,402)
Net Income	($289,340)	($171,409)	$167,731	$142,315	$119,931	$107,879	$98,476	$77,275	$58,481	$41,942	$33,363	$32,941

Common Size Income Statement												
Regular O&M	*0%*	*13%*	*5%*	*5%*	*5%*	*5%*	*6%*	*6%*	*6%*	*7%*	*7%*	*7%*
Other taxes	*0%*	*16%*	*5%*	*6%*	*6%*	*6%*	*7%*	*7%*	*7%*	*8%*	*8%*	*8%*
EBITDA	*0%*	*71%*	*90%*	*89%*	*89%*	*88%*	*88%*	*87%*	*86%*	*85%*	*85%*	*85%*
Depreciation	*0%*	*138%*	*47%*	*50%*	*53%*	*55%*	*57%*	*61%*	*65%*	*69%*	*72%*	*73%*
EBIT	*0%*	*-67%*	*43%*	*39%*	*36%*	*33%*	*31%*	*26%*	*21%*	*16%*	*13%*	*12%*
Interest expense	*0%*	*33%*	*10%*	*9%*	*9%*	*8%*	*7%*	*6%*	*5%*	*4%*	*3%*	*2%*
EBT	*0%*	*-100%*	*33%*	*30%*	*27%*	*25%*	*24%*	*20%*	*16%*	*12%*	*10%*	*10%*
Income taxes	*0%*	*-24%*	*8%*	*7%*	*6%*	*6%*	*6%*	*5%*	*4%*	*3%*	*2%*	*2%*
Net Income	*0%*	*-76%*	*25%*	*23%*	*21%*	*19%*	*18%*	*15%*	*12%*	*9%*	*8%*	*8%*

X **Balance Sheet**

	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Property, Plant, and Equipment	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000
Accumulated Depreciation	(310,723)	(621,445)	(932,168)	(1,242,890)	(1,553,613)	(1,864,336)	(2,175,058)	(2,485,781)	(2,796,503)	(3,107,226)	(3,417,949)	(3,728,671)
Total Assets	**3,792,277**	**3,481,555**	**3,170,832**	**2,860,110**	**2,549,387**	**2,238,664**	**1,927,942**	**1,617,219**	**1,306,497**	**995,774**	**685,051**	**374,329**
Deferred Income Taxes	63,811	226,621	322,004	369,182	382,000	394,554	407,124	376,783	303,628	230,471	157,316	84,158
Long-term Debt	2,050,657	1,790,214	1,566,855	1,370,010	1,192,063	1,014,261	836,450	682,240	551,578	420,917	290,254	159,594
Total Liabilities	**2,114,468**	**2,016,835**	**1,888,859**	**1,739,192**	**1,574,063**	**1,408,815**	**1,243,574**	**1,059,023**	**855,206**	**651,388**	**447,570**	**243,752**

Owner's Equity	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150
Retained earnings	(289,340)	(502,430)	(685,177)	(846,232)	(991,826)	(1,137,300)	(1,282,782)	(1,408,954)	(1,515,859)	(1,622,763)	(1,729,669)	(1,836,573)
Total Equity	**1,677,810**	**1,464,720**	**1,281,973**	**1,120,917**	**975,324**	**829,850**	**684,368**	**558,196**	**451,291**	**344,386**	**237,481**	**130,577**
Total Liabilities & Equity	**3,792,277**	**3,481,555**	**3,170,832**	**2,860,110**	**2,549,387**	**2,238,664**	**1,927,942**	**1,617,219**	**1,306,497**	**995,774**	**685,051**	**374,329**
Balance Check	**0**	**0**	**0**	**0**	**0**	**0**	**(0)**	**0**	**0**	**(0)**	**0**	**(0)**
D/E	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%
Return on Equity	***-17%***	***-12%***	***13%***	***13%***	***12%***	***13%***	***14%***	***14%***	***13%***	***12%***	***14%***	***25%***

X **Cash Flow Statement**

	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Net Income	(289,340)	(171,409)	167,731	142,315	119,931	107,879	98,476	77,275	58,481	41,942	33,363	32,941
Depreciation and amortization	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723
Change in deferred taxes	63,811	162,810	95,383	47,178	12,818	12,554	12,570	(30,341)	(73,155)	(73,157)	(73,155)	(73,158)
Cash Flow from Operations	**85,194**	**$302,123**	**$573,837**	**$500,216**	**$443,472**	**$431,156**	**$421,769**	**$357,657**	**$296,049**	**$279,508**	**$270,930**	**$270,505**
Capital expenditures	(4,103,000)	-	-	-	-	-	-	-	-	-	-	-
Cash Flow from Investing	**(4,103,000)**	-	-	-	-	-	-	-	-	-	-	-
Cash Flow Pre-Financing	**(4,017,806)**	**302,123**	**573,837**	**500,216**	**443,472**	**431,156**	**421,769**	**357,657**	**296,049**	**279,508**	**270,930**	**270,505**
Change in LT Debt	2,050,657	(260,443)	($223,358)	($196,845)	($177,947)	($177,802)	($177,811)	(154,210)	($130,662)	($130,661)	($130,662)	($130,661)
Cash Available to Equityholders	**(1,967,150)**	**41,680**	**350,479**	**303,370**	**265,525**	**253,354**	**243,958**	**203,447**	**165,387**	**148,847**	**140,268**	**139,845**
Equity-New Issuances	1,967,150	-	-	-	-	-	-	-	-	-	-	-
Equity-Dividends	$0	($41,680)	($350,479)	($303,370)	($265,525)	($253,354)	($243,958)	($203,447)	($165,387)	($148,847)	($140,268)	($139,845)
Cash From Equity Financing	**1,967,150**	**(41,680)**	**(350,479)**	**(303,370)**	**(265,525)**	**(253,354)**	**(243,958)**	**(203,447)**	**(165,387)**	**(148,847)**	**(140,268)**	**(139,845)**
Total Cashflow from Financing	**4,017,806**	**($302,123)**	**($573,837)**	**($500,216)**	**($443,472)**	**($431,156)**	**($421,769)**	**(357,657)**	**($296,049)**	**($279,508)**	**($270,930)**	**($270,505)**
Change in Cash and Equivalents	-	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

FINANCING

Debt												
Long Term Debt BOY	$0	$2,050,657	$1,790,214	$1,566,855	$1,370,010	$1,192,063	$1,014,261	$836,450	$682,240	$551,578	$420,917	$290,254
Additions (Payoff)	2,050,657	(260,443)	(223,358)	(196,845)	(177,947)	(177,802)	(177,811)	(154,210)	(130,662)	(130,661)	(130,662)	(130,661)
Long Term Debt EOY	**$2,050,657**	**$1,790,214**	**$1,566,855**	**$1,370,010**	**$1,192,063**	**$1,014,261**	**$836,450**	**$682,240**	**$551,578**	**$420,917**	**$290,254**	**$159,594**
Average LT Debt Balance	$1,025,328	$1,920,435	$1,678,535	$1,468,433	$1,281,036	$1,103,162	$925,355	$759,345	$616,909	$486,247	$355,585	$224,924
Interest Expense on LT Debt	(39,988)	(74,897)	(65,463)	(57,269)	(49,960)	(43,023)	(36,089)	(29,614)	(24,059)	(18,964)	(13,868)	(8,772)
Total Interest Expense	(39,988)	(74,897)	(65,463)	(57,269)	(49,960)	(43,023)	(36,089)	(29,614)	(24,059)	(18,964)	(13,868)	(8,772)
Equity												
Retained Earnings BOY	-	(289,340)	(502,430)	(685,177)	(846,232)	(991,826)	(1,137,300)	(1,282,782)	(1,408,954)	(1,515,859)	(1,622,763)	(1,729,669)
+Net Income	(289,340)	(171,409)	167,731	142,315	119,931	107,879	98,476	77,275	58,481	41,942	33,363	32,941
-Dividends	-	(41,680)	(350,479)	(303,370)	(265,525)	(253,354)	(243,958)	(203,447)	(165,387)	(148,847)	(140,268)	(139,845)
Retained Earnings EOY	(289,340)	(502,430)	(685,177)	(846,232)	(991,826)	(1,137,300)	(1,282,782)	(1,408,954)	(1,515,859)	(1,622,763)	(1,729,669)	(1,836,573)
Owners Equity	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150	1,967,150
Total Shareholder's Equity	**1,677,810**	**1,464,720**	**1,281,973**	**1,120,917**	**975,324**	**829,850**	**684,368**	**558,196**	**451,291**	**344,386**	**237,481**	**130,577**
Total Capital	**$3,728,466**	**$3,254,934**	**$2,848,828**	**$2,490,928**	**$2,167,387**	**$1,844,110**	**$1,520,818**	**$1,240,436**	**$1,002,869**	**$765,303**	**$527,735**	**$290,171**
Target Structure												
Target equity content	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%

Target equity	$1,677,810	$1,464,720	$1,281,973	$1,120,917	$975,324	$829,850	$684,368	$558,196	$451,291	$344,386	$237,481	$130,577
Target debt	$2,050,657	$1,790,214	$1,566,855	$1,370,010	$1,192,063	$1,014,261	$836,450	$682,240	$551,578	$420,917	$290,254	$159,594
Effective Equity Ratio	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
Effective Debt Ratio	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%

DCF Valuation

	1	2	3	4	5	6	7	8	9	10	11	12
Total Revenue ($)	-	225,640	662,444	620,807	584,047	561,252	541,944	507,574	477,290	450,433	434,048	428,397
O&M	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)
Other Taxes	-	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)
EBITDA	(30,000)	160,081	596,885	555,248	518,488	495,693	476,385	442,015	411,731	384,873	368,489	362,838
Depreciation	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)
EBIT	(340,723)	(150,641)	286,162	244,525	207,765	184,970	165,662	131,292	101,008	74,151	57,766	52,115
Tax Effect	81,773	36,154	(68,679)	(58,686)	(49,864)	(44,393)	(39,759)	(31,510)	(24,242)	(17,796)	(13,864)	(12,508)
Unlevered Net Income	(258,949)	(114,488)	217,483	185,839	157,901	140,577	125,903	99,782	76,766	56,354	43,902	39,608
Depreciation ($)	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723
Deferred Taxes	63,811	162,810	95,383	47,178	12,818	12,554	12,570	(30,341)	(73,155)	(73,157)	(73,155)	(73,158)
Capex	(4,103,000)	-	-	-	-	-	-	-	-	-	-	-
Unlevered Free Cash Flows ($)	(3,987,416)	359,045	623,589	543,740	481,442	463,854	449,196	380,164	314,334	293,920	281,470	277,172
Discount Rate	6 5%	6 5%	6 5%	6 5%	6 5%	6 5%	6 5%	6 5%	6 5%	6 5%	6 5%	6 5%
Time Period of Discount-Years	-	1	2	3	4	5	6	7	8	9	10	11
Discount Factor for Free Cash Flow	1 00	0 94	0 88	0 83	0 78	0 73	0 69	0 64	0 60	0 57	0 53	0 50
PV of Unlevered Free Cash Flow	(3,987,416)	337,132	549,793	450,135	374,236	338,558	307,849	244,638	189,930	166,757	149,946	138,645
Sum of PV 20 Years Unlevered FCF	(330,505)											
IRR	4.3%											

CapEx	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Capital Expenditures	$ 4,103,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Ad Valorem	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Ad Valorem Tax		$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)

O&M	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Operating Expense	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000

Battery Cost	$	4,000,000
KWh		6
Cost per MWh	$	666,667
Cost per KWh	$	667
PV of Transformer		#REF!
Cost needed for Indifference	$	277 per KWh

2031E	2032E	2033E	2034E	2035E	2036E	2037E	2038E	2039E	2040E
$ 404,668	$ 380,091	$ 261,025	$ 55,663	$ 67,966	$ 71,824	$ 71,745	$ 71,506	$ 71,347	$ 71,372
$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)
($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)
$339,108	**$314,532**	**$195,466**	**($9,897)**	**$2,407**	**$6,265**	**$6,185**	**$5,947**	**$5,788**	**$5,813**
(310,723)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)
$28,386	**$311,501**	**$192,436**	**($12,927)**	**($623)**	**$3,234**	**$3,155**	**$2,916**	**$2,757**	**$2,783**
(3,676)	(1,088)	(1,009)	(936)	(879)	(830)	(781)	(731)	(682)	(632)
$24,709	**$310,413**	**$191,427**	**($13,864)**	**($1,503)**	**$2,404**	**$2,374**	**$2,185**	**$2,075**	**$2,150**
(5,930)	(74,499)	(45,942)	3,327	361	(577)	(570)	(524)	(498)	(516)
$18,779	**$235,914**	**$145,485**	**($10,536)**	**($1,142)**	**$1,827**	**$1,804**	**$1,661**	**$1,577**	**$1,634**
7%	*8%*	*11%*	*54%*	*44%*	*42%*	*42%*	*42%*	*42%*	*42%*
9%	*9%*	*14%*	*64%*	*52%*	*50%*	*50%*	*50%*	*50%*	*50%*
84%	*83%*	*75%*	*-18%*	*4%*	*9%*	*9%*	*8%*	*8%*	*8%*
77%	*1%*	*1%*	*5%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*
7%	*82%*	*74%*	*-23%*	*-1%*	*5%*	*4%*	*4%*	*4%*	*4%*
1%	*0%*	*0%*	*2%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*
6%	*82%*	*73%*	*-25%*	*-2%*	*3%*	*3%*	*3%*	*3%*	*3%*
1%	*20%*	*18%*	*-6%*	*-1%*	*1%*	*1%*	*1%*	*1%*	*1%*
5%	*62%*	*56%*	*-19%*	*-2%*	*3%*	*3%*	*2%*	*2%*	*2%*

2031E	2032E	2033E	2034E	2035E	2036E	2037E	2038E	2039E	2040E
4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000
(4,039,394)	(4,042,424)	(4,045,455)	(4,048,485)	(4,051,515)	(4,054,545)	(4,057,576)	(4,060,606)	(4,063,636)	(4,066,667)
63,606	**60,576**	**57,545**	**54,515**	**51,485**	**48,455**	**45,424**	**42,394**	**39,364**	**36,333**
11,003	11,692	12,383	12,364	11,636	10,909	10,182	9,455	8,727	8,000
28,932	26,886	24,839	23,183	21,917	20,650	19,383	18,116	16,851	15,580
39,935	**38,578**	**37,222**	**35,547**	**33,553**	**31,559**	**29,565**	**27,571**	**25,578**	**23,580**

1,967,150	1,967,150	1,967,150	1,976,331	1,976,437	1,976,437	1,976,437	1,976,437	1,976,437	1,976,437
(1,943,478)	(1,945,152)	(1,946,827)	(1,957,363)	(1,958,505)	(1,959,542)	(1,960,578)	(1,961,615)	(1,962,650)	(1,963,685)
23,671	21,998	20,323	18,968	17,932	16,895	15,859	14,822	13,787	12,752
63,606	60,576	57,545	54,515	51,485	48,455	45,424	42,394	39,365	36,332
(0)	0	(0)	(0)	0	(0)	0	0	(1)	1
55%	55%	55%	55%	55%	55%	55%	55%	55%	55%
79%	*1072%*	*716%*	*-56%*	*-6%*	*11%*	*11%*	*11%*	*11%*	*13%*

2031E	2032E	2033E	2034E	2035E	2036E	2037E	2038E	2039E	2040E
18,779	235,914	145,485	(10,536)	(1,142)	1,827	1,804	1,661	1,577	1,634
310,723	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030
(73,155)	689	691	(19)	(728)	(727)	(727)	(727)	(728)	(727)
$256,347	$239,633	$149,206	($7,525)	$1,160	$4,131	$4,108	$3,964	$3,880	$3,938
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
256,347	239,633	149,206	(7,525)	1,160	4,131	4,108	3,964	3,880	3,938
($130,662)	($2,046)	($2,047)	($1,656)	($1,266)	($1,267)	($1,267)	($1,267)	($1,266)	($1,270)
125,685	237,587	147,159	(9,181)	(106)	2,864	2,841	2,697	2,614	2,667
-	-	-	9,181	106	-	-	-	-	-
($125,685)	($237,587)	($147,159)	$0	$0	($2,864)	($2,841)	($2,697)	($2,614)	($2,667)
(125,685)	(237,587)	(147,159)	9,181	106	(2,864)	(2,841)	(2,697)	(2,614)	(2,667)
($256,347)	($239,633)	($149,206)	$7,525	($1,160)	($4,131)	($4,108)	($3,964)	($3,880)	($3,938)
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

$159,594	$28,932	$26,886	$24,839	$23,183	$21,917	$20,650	$19,383	$18,116	$16,851
(130,662)	(2,046)	(2,047)	(1,656)	(1,266)	(1,267)	(1,267)	(1,267)	(1,266)	(1,268)
$28,932	$26,886	$24,839	$23,183	$21,917	$20,650	$19,383	$18,116	$16,851	$15,583
$94,263	$27,909	$25,863	$24,011	$22,550	$21,283	$20,017	$18,750	$17,484	$16,217
(3,676)	(1,088)	(1,009)	(936)	(879)	(830)	(781)	(731)	(682)	(632)
(3,676)	(1,088)	(1,009)	(936)	(879)	(830)	(781)	(731)	(682)	(632)
(1,836,573)	(1,943,478)	(1,945,152)	(1,946,827)	(1,957,363)	(1,958,505)	(1,959,542)	(1,960,578)	(1,961,615)	(1,962,650)
18,779	235,914	145,485	(10,536)	(1,142)	1,827	1,804	1,661	1,577	1,634
(125,685)	(237,587)	(147,159)	-	-	(2,864)	(2,841)	(2,697)	(2,614)	(2,667)
(1,943,478)	(1,945,152)	(1,946,827)	(1,957,363)	(1,958,505)	(1,959,542)	(1,960,578)	(1,961,615)	(1,962,651)	(1,963,683)
1,967,150	1,967,150	1,967,150	1,976,331	1,976,437	1,976,437	1,976,437	1,976,437	1,976,437	1,976,437
23,671	21,998	20,323	18,968	17,932	16,895	15,859	14,822	13,786	12,754
$52,603	$48,884	$45,162	$42,151	$39,849	$37,546	$35,242	$32,939	$30,637	$28,337
45%	45%	45%	45%	45%	45%	45%	45%	45%	45%

$23,671	$21,998	$20,323	$18,968	$17,932	$16,895	$15,859	$14,822	$13,786	$12,751
$28,932	$26,886	$24,839	$23,183	$21,917	$20,650	$19,383	$18,116	$16,850	$15,585
45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
55%	55%	55%	55%	55%	55%	55%	55%	55%	55%

13	14	15	16	17	18	19	20	21	22
404,668	380,091	261,025	55,663	67,966	71,824	71,745	71,506	71,347	71,372
(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)
(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)
339,108	314,532	195,466	(9,897)	2,407	6,265	6,185	5,947	5,788	5,813
(310,723)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)
28,386	311,501	192,436	(12,927)	(623)	3,234	3,155	2,916	2,757	2,783
(6,813)	(74,760)	(46,185)	3,102	150	(776)	(757)	(700)	(662)	(668)
21,573	236,741	146,251	(9,825)	(474)	2,458	2,398	2,216	2,096	2,115
310,723	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030
(73,155)	689	691	(19)	(728)	(727)	(727)	(727)	(728)	(727)
-	-	-	-	-	-	-	-	-	-
259,141	240,460	149,972	(6,813)	1,829	4,761	4,701	4,520	4,398	4,418
6 5%	6 5%	6 5%	6 5%	6 5%	6 5%	6 5%	6 5%	6 5%	6 5%
12	5	6	5	6	5	6	5	6	6
0 47	0 73	0 69	0 73	0 69	0 73	0 69	0.73	0 69	0 69
121,714	175,507	102,781	(4,973)	1,253	3,475	3,222	3,299	3,014	3,028

2031	2032	2033	2032	2033	2032	2033	2032	2033	2033
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

2031	2032	2033	2032	2033	2032	2033	2032	2033	2033
$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)

2031	2032	2033	2032	2033	2032	2033	2032	2033	2033
$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000

DCRF	%	Cost	WACC
Equity	45%	9 50%	4 28%
Debt	55%	4 69%	2 58%
Total	100%		6 85%
	% allocated to Filings		100%
	% to TCOS		0%
	% to DCRF		100%

TCOS	%	Cost	WACC
Equity	45%	9 50%	4 28%
Debt	55%	4 69%	2 58%
Total	100%		6 85%
Taxes			
Other Taxes	1 8%		
Tax Rate	21 00%		

Depreciation	Book	asset life othe
Asset Life	40 4877111	18
Dep Rate	2 5%	5 6%
Years Between RC		5

Capex	Life	Wgt Avg Cap	Wgt Avg Life
3,135,275	41	0 87640253	40 0325039
54,125	18	0 01685533	0 30329598
21,650	24	0 00674213	0 16181119
		0	0
			40 4877111

Requires Linking to Strategic Planning Model (incl depreciation table below RC recovery)

Model Inputs	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Capex			0	4,103,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Accumulated Depreciation			0	(310,723)	(621,445)	(932,168)	(1,242,890)	(1,553,613)	(1,864,336)	(2,175,058)	(2,485,781)	(2,796,503)	(3,107,226)	(3,417,949)	(3,728,671)	(4,039,394)	(4,042,424)	(4,045,455)	(4,048,485)
Change in Accumulated Depreciation			0	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(3,030)	(3,030)	(3,030)
AFUDC			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Deferred Taxes			0	63,811	226,621	322,004	369,182	382,000	394,954	407,124	376,783	303,628	230,471	157,316	84,158	11,003	11,692	12,383	13,364
Change in Deferred Taxes			0	63,811	162,810	95,383	47,178	12,818	12,554	12,570	(30,341)	(73,155)	(73,157)	(73,155)	(73,158)	(73,155)	689	691	(19)
EBIT			0	(515,723)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(54,186)	(54,186)	(54,186)
Unlevered Net Income (EBIT x (1-t))			0	(407,421)	(297,263)	(297,263)	(297,263)	(297,263)	(297,263)	(297,263)	(297,263)	(297,263)	(297,263)	(297,263)	(297,263)	(297,263)	(54,186)	(54,186)	(54,186)
Net Plant			0	3,792,277	3,481,555	3,170,832	2,860,110	2,549,387	2,238,664	1,927,942	1,617,219	1,306,497	995,774	685,051	374,329	63,606	60,576	57,545	54,515
Rate Base			0	3,728,466	3,254,934	2,848,828	2,490,928	2,167,387	1,844,110	1,520,818	1,240,436	1,002,869	765,303	527,735	290,171	52,603	48,884	45,162	42,151

DCRF Filings

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Assumed new Capital in Service at Year End		-	-	4 10	-	-	-				-		-	-			-	-	-
Change in Accumulated Depreciation				(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 00)	(0 00)	(0 00)
AFUDC			-								-	-	-	-	-	-	-	-	-
Net Increase to Plant in Service	-		-	3 79	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 31)	(0 00)	(0 00)	(0 00)
Change in Deferred Taxes	-		-	(0 06)	(0 16)	(0 10)	(0 05)	(0 01)	(0 01)	(0 01)	0 03	0 07	0 07	0 07	0 07	0 07	(0 00)	(0 00)	0 00
Net Increase to Rate Base	-	-	-	3 73	(0 47)	(0 41)	(0 36)	(0 32)	(0 32)	(0 32)	(0 28)	(0 24)	(0 24)	(0 24)	(0 24)	(0 24)	(0 00)	(0 00)	(0 00)

Revenue Requirement For DCRF Filing	Filing in 2017	Filing in 2018	Filing in 2019	Filing in 2020	Filing in 2021	Filing in 2022	Filing in 2023	Filing in 2024	Filing in 2025	Filing in 2026	Filing in 2027	Filing in 2028	Filing in 2029	Filing in 2030	Filing in 2031	Filing in 2032	Filing in 2033	Filing in 2034	Filing in 2035
Full Year Book Depreciation on Incremental Capital	-	-	-	0 31	-	-	-	-	-	-	-	-	-	-	-	-	(0 31)	-	-
Other Taxes on Incremental Capital	-		-	0 07	(0 01)	(0 01)	(0 01)	[illegible]	(0 01)	(0 01)	(0 01)	(0 01)	[illegible]	(0 01)	(0 01)	(0 01)	(0 00)	[illegible]	(0 00)
FIT for Revenue Requirement on Incremental Capital	-	-	-	0 04	(0 01)	(0 00)	(0 00)	[illegible]	(0 00)	(0 00)	(0 00)	(0 00)	[illegible]	(0 00)	(0 00)	(0 00)	(0 00)	[illegible]	(0 00)
Return on Rate Base on Incremental Capital	-		-	0 26	(0 03)	(0 03)	(0 02)	[illegible]	(0 02)	(0 02)	(0 02)	(0 02)	[illegible]	(0 02)	(0 02)	(0 02)	(0 00)	[illegible]	(0 00)
Annual Incremental Revenue Requirement	-	-	-	0 68	(0 04)	(0 04)	(0 03)		(0 03)	(0 03)	(0 03)	(0 02)	-	(0 02)	(0 02)	(0 02)	(0 31)	-	(0 00)

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
DCRF Revenue from 2015 Capital Spend Placed in Service in 2016				-				-		-	-	-						-	-
DCRF Revenue decrease from Rate Base Decline in 2017				-			-	-	-	-	-	-	-	-	-	-	-	-	-
[illegible]																			
DCRF Revenue decrease from Rate Base Decline in 2019					0 23	0 68	0 68	0 68	0 68	0 68	0 68	0 68	0 68	0 68	0 68	0 68	0 68	0 68	0 68
DCRF Revenue decrease from Rate Base Decline in 2020						(0 01)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)
DCRF Revenue decrease from Rate Base Decline in 2021							(0 01)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)	(0 04)
DCRF Revenue decrease from Rate Base Decline in 2022								(0 01)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)
[illegible]																			
DCRF Revenue decrease from Rate Base Decline in 2024									(0 01)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)
DCRF Revenue decrease from Rate Base Decline in 2025										(0 01)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)
DCRF Revenue decrease from Rate Base Decline in 2026											(0 01)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)	(0 03)
DCRF Revenue decrease from Rate Base Decline in 2027												(0 01)	(0 02)	(0 02)	(0 02)	(0 02)	(0 02)	(0 02)	(0 02)
[illegible]																			
DCRF Revenue decrease from Rate Base Decline in 2029														(0 01)	(0 02)	(0 02)	(0 02)	(0 02)	(0 02)
DCRF Revenue decrease from Rate Base Decline in 2030																(0 01)	(0 02)	(0 02)	(0 02)
DCRF Revenue decrease from Rate Base Decline in 2031																	(0 01)	(0 02)	(0 02)
DCRF Revenue decrease from Rate Base Decline in 2032																		(0 10)	(0 31)
[illegible]																			
DCRF Revenue decrease from Rate Base Decline in 2034																			
DCRF Revenue decrease from Rate Base Decline in 2035																			
DCRF Revenue decrease from Rate Base Decline in 2036																			
DCRF Revenue decrease from Rate Base Decline in 2037																			
[illegible]																			
Cumulative DCRF Revenue		-	-	-	0.23	0.68	0 62	0.58	0.56	0.55	0.52	0.49	0.46	0.45	0.44	0.41	0.39	0.27	0.06

TCOS Filings

Rate Case Filings

[illegible] last year

Revenue Deficiency Analysis	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Net Income pre DCRF Recovery, unlevered	-				(0 41)	(0 30)	(0 30)	(0 30)	(0 30)	(0 30)	(0 30)	(0 30)	(0 30)	(0 30)	(0 30)	(0 30)	(0 30)	(0 30)	(0 05)	(0 05)
Interest Expense after tax					(0 08)	(0 07)	(0 06)	(0 05)	(0 04)	(0 04)	(0 03)	(0 03)	(0 02)	(0 02)	(0 01)	(0 01)	(0 00)	(0 00)	(0 00)	(0 00)
Allowed Net Income (Equity Rate Base * Allowed ROE)	-	-			0 16	0 14	0 12	0 11	0 09	0 08	0 07	0 05	0 04	0 03	0 02	0 01	0 00	0 00	0 00	0 00
Net Income over (under) earning	-		-		(0 64)	(0 50)	(0 48)	(0 45)	(0 43)	(0 41)	(0 39)	(0 38)	(0 36)	(0 35)	(0 33)	(0 32)	(0 30)	(0 06)	(0 05)	(0 06)
Revenue over (under) earning					(0 81)	(0 64)	(0 60)	(0 58)	(0 56)	(0 52)	(0 50)	(0 48)	(0 46)	(0 44)	(0 42)	(0 40)	(0 38)	(0 07)	(0 07)	(0 07)
Plus Recovery not yet collected	-					0 68	0 63	0 60	0 58	0 56	0 52	0 49	0 46	0 43	0 43	0 41	0 39	0 36	0 06	0 06
Adjusted Revenue over (under) earning					(0 81)	0 04	0 03	0 02	0 01	0 04	0 02	0 01	0 00	(0 00)	0 02	0 01	0 01	0 29	(0 02)	(0 02)

		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Rate Case Revenue from 2019 Filing						-	-	-		-										-
Rate Case Revenue from 2024 Filing											(0 01)	(0 01)	(0 01)	(0 01)	(0 01)	(0 01)	(0 01)	(0 01)	(0 01)	(0 01)
Rate Case Revenue from 2029 Filing																0 00	0 00	0 00	0 00	0 00
Rate Case Revenue from 2034 Filing																				
Rate Case Revenue from 2039 Filing																				
Rate Case Revenue from 2044 Filing																				
Rate Case Revenue from 2049 Filing																				
Rate Case Revenue from 2054 Filing																				
Rate Case Revenue from 2059 Filing																				
Rate Case Revenue from 2064 Filing																				
Cumulative Rate Case Revenue		-	-	-	-	-	-	-	-	-	**(0.01)**	**(0.01)**	**(0.01)**	**(0.01)**	**(0.01)**	**(0.01)**	**(0.01)**	**(0.01)**	**(0.01)**	**(0 01)**

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Total Revenues from Recovery	-	-	-	-	**0.23**	**0 06**	**0.62**	**0.58**	**0.56**	**0.54**	**0 51**	**0 48**	**0.45**	**0.43**	**0.43**	**0.40**	**0.38**	**0.26**	**0.06**

Depreciation Schedule

Cases		Book Life	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
	4,000,000	13			-	307,692	307,692	307,692	307,692	307,692	307,692	307,692	307,692	307,692	307,692	307,692	307,692	307,692	-		-
	100,000	33	-	-	-	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030
Annual Depreciation			-			310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	3,030	3,030	3,030
Change in Depreciation					-	310,723		-	-	-	-	-	-		-	-	-		(307,692)	-	-

Analysis continues on next page

[redacted]

Model and drivers description placeholder

X **DCF 1 General Assumptions**

Tax Rate	24.00%	*Justin Hyland*
Discount Rate	6.50%	*Blended corporate discount rate*
Model Start Year	2019	
Inflation	2.00%	
CPA		
Ad valorem Tax Rate	2.60%	*Justin Hyland*
Sales Tax Rate		
[redacted]		
Debt to Capital Ratio	55.00%	*CNP Capital Structure (Q2 CoD memo)*
Equity to Capital Ratio	45.00%	
Dividend Payout %	0.00%	
Cost of LT Debt	3.90%	*2018 CNP CoD (Q3 CoD memo)*
Year of LT Debt Issuance	2018	

X **Financial Statements**

X **Income Statement**

($ in millions)	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Total Revenue ($)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
O&M	$ (205,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)
Other taxes	$0	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)
EBITDA	**($205,000)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**
Depreciation	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)
EBIT	**($515,723)**	**($376,282)**	**($376,282)**	**($376,282)**	**($376,282)**	**($376,282)**	**($376,282)**	**($376,282)**	**($376,282)**	**($376,282)**	**($376,282)**	**($376,282)**
Interest expense	(39,988)	(74,897)	(65,463)	(57,269)	(49,960)	(43,023)	(36,089)	(29,614)	(24,059)	(18,964)	(13,868)	(8,772)
EBT	**($555,710)**	**($451,179)**	**($441,745)**	**($433,551)**	**($426,242)**	**($419,305)**	**($412,371)**	**($405,896)**	**($400,341)**	**($395,246)**	**($390,150)**	**($385,054)**
Income taxes	133,370	108,283	106,019	104,052	102,298	100,633	98,969	97,415	96,082	94,859	93,636	92,413
Net Income	**($422,340)**	**($342,896)**	**($335,726)**	**($329,499)**	**($323,944)**	**($318,672)**	**($313,402)**	**($308,481)**	**($304,259)**	**($300,387)**	**($296,514)**	**($292,641)**

Common Size Income Statement												
Regular O&M	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Other taxes	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
EBITDA	*0%*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*
Depreciation	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
EBIT	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Interest expense	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
EBT	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Income taxes	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Net Income	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*

X **Balance Sheet**

	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Property, Plant, and Equipment	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000
Accumulated Depreciation	(310,723)	(621,445)	(932,168)	(1,242,890)	(1,553,613)	(1,864,336)	(2,175,058)	(2,485,781)	(2,796,503)	(3,107,226)	(3,417,949)	(3,728,671)
Total Assets	**3,792,277**	**3,481,555**	**3,170,832**	**2,860,110**	**2,549,387**	**2,238,664**	**1,927,942**	**1,617,219**	**1,306,497**	**995,774**	**685,051**	**374,329**
Deferred Income Taxes	63,811	226,621	322,004	369,182	382,000	394,554	407,124	376,783	303,628	230,471	157,316	84,158
Long-term Debt	2,050,657	1,790,214	1,566,855	1,370,010	1,192,063	1,014,261	836,450	682,240	551,578	420,917	290,254	159,594
Total Liabilities	**2,114,468**	**2,016,835**	**1,888,859**	**1,739,192**	**1,574,063**	**1,408,815**	**1,243,574**	**1,059,023**	**855,206**	**651,388**	**447,570**	**243,752**

Owner's Equity	2,100,150	2,229,956	2,382,935	2,551,378	2,729,729	2,902,926	3,070,847	3,253,156	3,450,510	3,643,992	3,833,601	4,019,338
Retained earnings	(422,340)	(765,236)	(1,100,962)	(1,430,461)	(1,754,405)	(2,073,077)	(2,386,479)	(2,694,960)	(2,999,219)	(3,299,606)	(3,596,120)	(3,888,761)
Total Equity	**1,677,810**	**1,464,720**	**1,281,973**	**1,120,917**	**975,324**	**829,850**	**684,368**	**558,196**	**451,291**	**344,386**	**237,481**	**130,577**
Total Liabilities & Equity	**3,792,277**	**3,481,555**	**3,170,832**	**2,860,110**	**2,549,387**	**2,238,664**	**1,927,942**	**1,617,219**	**1,306,497**	**995,774**	**685,051**	**374,329**
Balance Check	0	0	0	0	0	0	0	(0)	0	(0)	0	0
D/E	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%
Return on Equity	*-25%*	*-23%*	*-26%*	*-29%*	*-33%*	*-38%*	*-46%*	*-55%*	*-67%*	*-87%*	*-125%*	*-224%*

X **Cash Flow Statement**

	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Net Income	(422,340)	(342,896)	(335,726)	(329,499)	(323,944)	(318,672)	(313,402)	(308,481)	(304,259)	(300,387)	(296,514)	(292,641)
Depreciation and amortization	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723
Change in deferred taxes	63,811	162,810	95,383	47,178	12,818	12,554	12,570	(30,341)	(73,155)	(73,157)	(73,155)	(73,158)
Cash Flow from Operations	**(47,806)**	**$130,637**	**$70,380**	**$28,402**	**($404)**	**$4,605**	**$9,891**	**($28,100)**	**($66,692)**	**($62,821)**	**($58,946)**	**($55,076)**
Capital expenditures	(4,103,000)	-	-	-	-	-	-	-	-	-	-	-
Cash Flow from Investing	**(4,103,000)**	-	-	-	-	-	-	-	-	-	-	-
Cash Flow Pre-Financing	**(4,150,806)**	**130,637**	**70,380**	**28,402**	**(404)**	**4,605**	**9,891**	**(28,100)**	**(66,692)**	**(62,821)**	**(58,946)**	**(55,076)**
Change in LT Debt	2,050,657	(260,443)	($223,358)	($196,845)	($177,947)	($177,802)	($177,811)	(154,210)	($130,662)	($130,661)	($130,662)	($130,661)
Cash Available to Equityholders	**(2,100,150)**	**(129,806)**	**(152,979)**	**(168,443)**	**(178,351)**	**(173,198)**	**(167,920)**	**(182,310)**	**(197,354)**	**(193,482)**	**(189,608)**	**(185,737)**
Equity-New Issuances	2,100,150	129,806	152,979	168,443	178,351	173,198	167,920	182,310	197,354	193,482	189,608	185,737
Equity-Dividends	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cash From Equity Financing	**2,100,150**	**129,806**	**152,979**	**168,443**	**178,351**	**173,198**	**167,920**	**182,310**	**197,354**	**193,482**	**189,608**	**185,737**
Total Cashflow from Financing	**4,150,806**	**($130,637)**	**($70,380)**	**($28,402)**	**$404**	**($4,605)**	**($9,891)**	**28,100**	**$66,692**	**$62,821**	**$58,946**	**$55,076**
Change in Cash and Equivalents	**-**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

FINANCING

Debt												
Long Term Debt BOY	$0	$2,050,657	$1,790,214	$1,566,855	$1,370,010	$1,192,063	$1,014,261	$836,450	$682,240	$551,578	$420,917	$290,254
Additions (Payoff)	2,050,657	(260,443)	(223,358)	(196,845)	(177,947)	(177,802)	(177,811)	(154,210)	(130,662)	(130,661)	(130,662)	(130,661)
Long Term Debt EOY	**$2,050,657**	**$1,790,214**	**$1,566,855**	**$1,370,010**	**$1,192,063**	**$1,014,261**	**$836,450**	**$682,240**	**$551,578**	**$420,917**	**$290,254**	**$159,594**
Average LT Debt Balance	$1,025,328	$1,920,435	$1,678,535	$1,468,433	$1,281,036	$1,103,162	$925,355	$759,345	$616,909	$486,247	$355,585	$224,924
Interest Expense on LT Debt	(39,988)	(74,897)	(65,463)	(57,269)	(49,960)	(43,023)	(36,089)	(29,614)	(24,059)	(18,964)	(13,868)	(8,772)
Total Interest Expense	(39,988)	(74,897)	(65,463)	(57,269)	(49,960)	(43,023)	(36,089)	(29,614)	(24,059)	(18,964)	(13,868)	(8,772)
Equity												
Retained Earnings BOY	-	(422,340)	(765,236)	(1,100,962)	(1,430,461)	(1,754,405)	(2,073,077)	(2,386,479)	(2,694,960)	(2,999,219)	(3,299,606)	(3,596,120)
+Net Income	(422,340)	(342,896)	(335,726)	(329,499)	(323,944)	(318,672)	(313,402)	(308,481)	(304,259)	(300,387)	(296,514)	(292,641)
-Dividends	-	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings EOY	(422,340)	(765,236)	(1,100,962)	(1,430,461)	(1,754,405)	(2,073,077)	(2,386,479)	(2,694,960)	(2,999,219)	(3,299,606)	(3,596,120)	(3,888,761)
Owners Equity	2,100,150	2,229,956	2,382,935	2,551,378	2,729,729	2,902,926	3,070,847	3,253,156	3,450,510	3,643,992	3,833,601	4,019,338
Total Shareholder's Equity	**1,677,810**	**1,464,720**	**1,281,973**	**1,120,917**	**975,324**	**829,850**	**684,368**	**558,196**	**451,291**	**344,386**	**237,481**	**130,577**
Total Capital	**$3,728,466**	**$3,254,934**	**$2,848,828**	**$2,490,928**	**$2,167,387**	**$1,844,110**	**$1,520,818**	**$1,240,436**	**$1,002,869**	**$765,303**	**$527,735**	**$290,171**
Target Structure												
Target equity content	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%

Target equity	$1,677,810	$1,464,720	$1,281,973	$1,120,917	$975,324	$829,850	$684,368	$558,196	$451,291	$344,386	$237,481	$130,577
Target debt	$2,050,657	$1,790,214	$1,566,855	$1,370,010	$1,192,063	$1,014,261	$836,450	$682,240	$551,578	$420,917	$290,254	$159,594
Effective Equity Ratio	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
Effective Debt Ratio	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%

DCF Valuation

	1	2	3	4	5	6	7	8	9	10	11	12
Total Revenue ($)	-	-	-	-	-	-	-	-	-	-	-	-
O&M	(205,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)
Other Taxes	-	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)
EBITDA	**(205,000)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**
Depreciation	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)
EBIT	(515,723)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)	(376,282)
Tax Effect	123,773	90,308	90,308	90,308	90,308	90,308	90,308	90,308	90,308	90,308	90,308	90,308
Unlevered Net Income	**(391,949)**	**(285,974)**	**(285,974)**	**(285,974)**	**(285,974)**	**(285,974)**	**(285,974)**	**(285,974)**	**(285,974)**	**(285,974)**	**(285,974)**	**(285,974)**
Depreciation ($)	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723
Deferred Taxes	63,811	162,810	95,383	47,178	12,818	12,554	12,570	(30,341)	(73,155)	(73,157)	(73,155)	(73,158)
Capex	(4,103,000)	-	-	-	-	-	-	-	-	-	-	-
Unlevered Free Cash Flows ($)	**(4,120,416)**	**187,558**	**120,131**	**71,926**	**37,566**	**37,302**	**37,318**	**(5,593)**	**(48,407)**	**(48,409)**	**(48,407)**	**(48,410)**
Discount Rate	6 5%	6 5%	6.5%	6 5%	6 5%	6 5%	6 5%	6.5%	6 5%	6 5%	6 5%	6 5%
Time Period of Discount-Years	-	1	2	3	4	5	6	7	8	9	10	11
Discount Factor for Free Cash Flow	1.00	0 94	0 88	0 83	0 78	0 73	0 69	0 64	0 60	0 57	0 53	0 50
PV of Unlevered Free Cash Flow	**(4,120,416)**	**176,111**	**105,915**	**59,544**	**29,201**	**27,226**	**25,576**	**(3,599)**	**(29,249)**	**(27,465)**	**(25,787)**	**(24,215)**
Sum of PV 15 Years Unlevered FCF	**(3,898,401)**											
Discounted Payback Period	**#REF!**											

CapEx	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Capital Expenditures	$ 4,103,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Ad Valorem	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Ad Valorem Tax		$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)

O&M	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Annual Battery O&M	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000
LROW Estimate	$ 75,000	-	-	-	-	-	-	-	-	-	-	-
Sensor Estimate	$ 100,000	-	-	-	-	-	-	-	-	-	-	-
Operating Expense	$ 205,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000

Battery Cost	$	4,000,000
KWh		6
Cost per MWh	$	666,667
Cost per KWh	$	667
PV of Transformer		#REF!
Cost needed for Indifference	$	277 per KWh

2031E	2032E	2033E	2034E	2035E	2036E	2037E	2038E	2039E	2040E	2041E	2042E
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)	$ (30,000)
($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)	($35,559)
($65,559)	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**	**($65,559)**
(310,723)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)
($376,282)	**($68,590)**	**($68,590)**	**($68,590)**	**($68,590)**	**($68,590)**	**($68,590)**	**($68,590)**	**($68,590)**	**($68,590)**	**($68,590)**	**($68,590)**
(3,676)	(1,088)	(1,009)	(936)	(879)	(830)	(781)	(731)	(682)	(632)	(583)	(534)
($379,958)	**($69,678)**	**($69,598)**	**($69,526)**	**($69,469)**	**($69,420)**	**($69,370)**	**($69,321)**	**($69,271)**	**($69,222)**	**($69,173)**	**($69,123)**
91,190	16,723	16,704	16,686	16,673	16,661	16,649	16,637	16,625	16,613	16,601	16,590
($288,768)	**($52,955)**	**($52,895)**	**($52,840)**	**($52,797)**	**($52,759)**	**($52,721)**	**($52,684)**	**($52,646)**	**($52,609)**	**($52,571)**	**($52,534)**

0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
#DIV/0!	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*	*#DIV/0!*
0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*

2031E	2032E	2033E	2034E	2035E	2036E	2037E	2038E	2039E	2040E	2041E	2042E
4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000	4,103,000
(4,039,394)	(4,042,424)	(4,045,455)	(4,048,485)	(4,051,515)	(4,054,545)	(4,057,576)	(4,060,606)	(4,063,636)	(4,066,667)	(4,069,697)	(4,072,727)
63,606	**60,576**	**57,545**	**54,515**	**51,485**	**48,455**	**45,424**	**42,394**	**39,364**	**36,333**	**33,303**	**30,273**
11,003	11,692	12,383	12,364	11,636	10,909	10,182	9,455	8,727	8,000	7,273	6,545
28,932	26,886	24,839	23,183	21,917	20,650	19,383	18,116	16,850	15,583	14,317	13,050
39,935	**38,578**	**37,222**	**35,547**	**33,553**	**31,559**	**29,565**	**27,571**	**25,577**	**23,583**	**21,590**	**19,595**

4,201,200	4,252,482	4,303,702	4,355,187	4,406,947	4,458,670	4,510,355	4,562,002	4,613,612	4,665,185	4,716,719	4,768,217
(4,177,529)	(4,230,484)	(4,283,379)	(4,336,219)	(4,389,015)	(4,441,774)	(4,494,496)	(4,547,180)	(4,599,826)	(4,652,435)	(4,705,006)	(4,757,540)
23,671	**21,998**	**20,323**	**18,968**	**17,932**	**16,895**	**15,859**	**14,823**	**13,786**	**12,750**	**11,714**	**10,677**
63,606	**60,576**	**57,545**	**54,515**	**51,485**	**48,455**	**45,424**	**42,394**	**39,364**	**36,333**	**33,303**	**30,273**
(0)	0	(0)	(0)	0	(0)	0	0	(0)	0	(0)	0
55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%
-1220%	*-241%*	*-260%*	*-279%*	*-294%*	*-312%*	*-332%*	*-355%*	*-382%*	*-413%*	*-449%*	*-492%*

2031E	**2032E**	**2033E**	**2034E**	**2035E**	**2036E**	**2037E**	**2038E**	**2039E**	**2040E**	**2041E**	**2042E**
(288,768)	(52,955)	(52,895)	(52,840)	(52,797)	(52,759)	(52,721)	(52,684)	(52,646)	(52,609)	(52,571)	(52,534)
310,723	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030
(73,155)	689	691	(19)	(728)	(727)	(727)	(727)	(728)	(727)	(727)	(728)
($51,201)	**($49,236)**	**($49,173)**	**($49,829)**	**($50,494)**	**($50,456)**	**($50,418)**	**($50,381)**	**($50,344)**	**($50,305)**	**($50,268)**	**($50,231)**
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
(51,201)	**(49,236)**	**(49,173)**	**(49,829)**	**(50,494)**	**(50,456)**	**(50,418)**	**(50,381)**	**(50,344)**	**(50,305)**	**(50,268)**	**(50,231)**
($130,662)	($2,046)	($2,047)	($1,656)	($1,266)	($1,267)	($1,267)	($1,267)	($1,266)	($1,267)	($1,267)	($1,266)
(181,863)	**(51,282)**	**(51,220)**	**(51,485)**	**(51,760)**	**(51,722)**	**(51,685)**	**(51,647)**	**(51,610)**	**(51,572)**	**(51,535)**	**(51,498)**
181,863	51,282	51,220	51,485	51,760	51,722	51,685	51,647	51,610	51,572	51,535	51,498
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
181,863	**51,282**	**51,220**	**51,485**	**51,760**	**51,722**	**51,685**	**51,647**	**51,610**	**51,572**	**51,535**	**51,498**
$51,201	$49,236	$49,173	$49,829	$50,494	$50,456	$50,418	$50,381	$50,344	$50,305	$50,268	$50,231
-	-	-	-	-	-	-	-	-	-	-	-
$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

$159,594	$28,932	$26,886	$24,839	$23,183	$21,917	$20,650	$19,383	$18,116	$16,850	$15,583	$14,317
(130,662)	(2,046)	(2,047)	(1,656)	(1,266)	(1,267)	(1,267)	(1,267)	(1,266)	(1,267)	(1,267)	(1,266)
$28,932	**$26,886**	**$24,839**	**$23,183**	**$21,917**	**$20,650**	**$19,383**	**$18,116**	**$16,850**	**$15,583**	**$14,317**	**$13,050**
$94,263	$27,909	$25,863	$24,011	$22,550	$21,283	$20,017	$18,750	$17,483	$16,217	$14,950	$13,683
(3,676)	(1,088)	(1,009)	(936)	(879)	(830)	(781)	(731)	(682)	(632)	(583)	(534)
(3,676)	(1,088)	(1,009)	(936)	(879)	(830)	(781)	(731)	(682)	(632)	(583)	(534)
(3,888,761)	(4,177,529)	(4,230,484)	(4,283,379)	(4,336,219)	(4,389,015)	(4,441,774)	(4,494,496)	(4,547,180)	(4,599,826)	(4,652,435)	(4,705,006)
(288,768)	(52,955)	(52,895)	(52,840)	(52,797)	(52,759)	(52,721)	(52,684)	(52,646)	(52,609)	(52,571)	(52,534)
-	-	-	-	-	-	-	-	-	-	-	-
(4,177,529)	(4,230,484)	(4,283,379)	(4,336,219)	(4,389,015)	(4,441,774)	(4,494,496)	(4,547,180)	(4,599,826)	(4,652,435)	(4,705,006)	(4,757,540)
4,201,200	4,252,482	4,303,702	4,355,187	4,406,947	4,458,670	4,510,355	4,562,002	4,613,612	4,665,185	4,716,719	4,768,217
23,671	**21,998**	**20,323**	**18,968**	**17,932**	**16,895**	**15,859**	**14,823**	**13,786**	**12,750**	**11,714**	**10,677**
$52,603	**$48,884**	**$45,162**	**$42,151**	**$39,849**	**$37,546**	**$35,242**	**$32,939**	**$30,637**	**$28,333**	**$26,030**	**$23,728**
45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%

$23,671	$21,998	$20,323	$18,968	$17,932	$16,895	$15,859	$14,823	$13,786	$12,750	$11,714	$10,677
$28,932	$26,886	$24,839	$23,183	$21,917	$20,650	$19,383	$18,116	$16,850	$15,583	$14,317	$13,050
45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%

13	14	15	13	14	15	13	14	15	13	14	15
-	-	-	-	-	-	-	-	-	-	-	-
(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)	(30,000)
(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)	(35,559)
(65,559)	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**	**(65,559)**
(310,723)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)
(376,282)	(68,590)	(68,590)	(68,590)	(68,590)	(68,590)	(68,590)	(68,590)	(68,590)	(68,590)	(68,590)	(68,590)
90,308	16,462	16,462	16,462	16,462	16,462	16,462	16,462	16,462	16,462	16,462	16,462
(285,974)	**(52,128)**	**(52,128)**	**(52,128)**	**(52,128)**	**(52,128)**	**(52,128)**	**(52,128)**	**(52,128)**	**(52,128)**	**(52,128)**	**(52,128)**
310,723	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030
(73,155)	689	691	(19)	(728)	(727)	(727)	(727)	(728)	(727)	(727)	(728)
-	-	-	-	-	-	-	-	-	-	-	-
(48,407)	**(48,409)**	**(48,407)**	**(49,117)**	**(49,826)**	**(49,825)**	**(49,825)**	**(49,825)**	**(49,826)**	**(49,825)**	**(49,825)**	**(49,826)**
6 5%	6 5%	6 5%	6 5%	6 5%	6 5%	6 5%	6.5%	6 5%	6 5%	6 5%	6 5%
12	5	6	12	5	6	12	5	6	12	5	6
0 47	0 73	0 69	0 47	0.73	0 69	0 47	0 73	0 69	0 47	0 73	0 69
(22,736)	**(35,333)**	**(33,175)**	**(23,069)**	**(36,367)**	**(34,147)**	**(23,402)**	**(36,366)**	**(34,147)**	**(23,402)**	**(36,366)**	**(34,147)**

2031	2032	2033	2031	2032	2033	2031	2032	2033	2031	2032	2033
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

2031	2032	2033	2031	2032	2033	2031	2032	2033	2031	2032	2033
$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)	$ (35,559)

2031	2032	2033	2031	2032	2033	2031	2032	2033	2031	2032	2033
$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000

Rows 3 300, Columns A-BC

Bonus Depreciation Model

Enter data in colored cells ONLY

Notes.

Row 8 must be the first year of your model, if there is no spend in the first year, just enter the capex as $0)

Book life must be a whole number (no decimals)

If you copy and paste the entire workbook but not the tab, you may need adjust the pull-down menu data location

The EBITDA rows and the Interest Expense rows do not need to be filled in for the deferred tax to be calculated correctly

Federal

Capital Expenditures	Year in Service	Asset Cost	Tax Life	Bonus Depr?	% Bonus	Book Life	Month en Books
2018 CapEx	2019		7	No		30	Jan
2019 CapEx	2019		15	No		30	Jan
Battery	2019	4,000,000	7	No		13	Jan
Battery	2030		7	No		13	Jul
Land Improvements	2019	100,000	15	No		33	Jan
	2019		5	No		7	Dec
	2019		3	No		12	Dec
2025 CapEx	2019		15	No		30	Jan
2026 CapEx	2026		15	No		30	Jan
2027 CapEx	2027		15	No		30	Jan
2028 CapEx	2028		5	No		6	Jul
2029 CapEx	2029		5	No		6	Jul
2030 CapEx	2030		5	No		6	Jul
2031 CapEx	2031		5	No		6	Jul
2032 CapEx	2032		5	No		6	Jul
2033 CapEx	2033		5	No		6	Jul
2034 CapEx	2034		5	No		6	Jul
2035 CapEx	2035		5	No		6	Jul
2036 CapEx	2036		5	No		6	Jul
2037 CapEx	2037		5	No		6	Jul

Tax Rate 21.00% *Use the blended tax rates as provided by Tax*

Stand Alone

Annual Book Depreciation	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310 723	310,723	310,723	310,723	310,723	310,723	3,030	3,030	3,030
Annual Tax Depreciation	576,600	989,100	708,150	507,300	364,130	363,030	363,100	184,300	5,910	5,900	5,910	5,900	5,910	5,900	5,910	2,950
Annual Deferred Income Tax	(63,811)	(162,811)	(95,383)	(47,179)	(12,818)	(12,554)	(12 571)	30,341	73,155	73,157	73,155	73,157	73,155	(689)	(691)	19
Annual Asset in Service	4,100,000	-	-													
Accumulated Book Depreciation	310,723	621,445	932,168	1,242,890	1,553,613	1,864,336	2,175,058	2,485,781	2,796,503	3,107,226	3,417,949	3,728,671	4,039,394	4,042,424	4,045,455	4,048,485
Accumulated Tax Depreciation	576,600	1,565,700	2,273,850	2,781,150	3,145,280	3,508,310	3,871 410	4,055,710	4,061,620	4 067,520	4 073,430	4,079,330	4,085,240	4,091 140	4,097,050	4,100,000
Accumulated Deferred Income Tax	(63,811)	(226,621)	(322,004)	(369,182)	(382,000)	(394,554)	(407,124)	(376,783)	(303,628)	(230,471)	(157,316)	(84,158)	(11,003)	(11,692)	(12,383)	(12,364)
Accumulated Asset in Service	4 100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100 000	4,100 000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100 000
Cash Tax Calculations																
EBITDA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax Depreciation (MACRS & Bonus)	576,600	989,100	708,150	507,300	364,130	363,030	363,100	184,300	5,910	5,900	5,910	5,900	5,910	5,900	5,910	2,950
Interest Expense	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Income (Loss)	(576,600)	(989,100)	(708,150)	(507,300)	(364,130)	(363,030)	(363,100)	(184,300)	(5,910)	(5,900)	(5,910)	(5,900)	(5,910)	(5,900)	(5,910)	(2,950)
Total Cash Taxes Paid	(138,384)	(237,384)	(169,956)	(121,752)	(87,391)	(87,127)	(87,144)	(44,232)	(1,418)	(1,416)	(1,418)	(1,416)	(1,418)	(1,416)	(1,418)	(708)
US GAAP Book Taxes																
EBITDA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Book Depreciation (Straight Line)	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	310,723	3,030	3,030	3,030
Interest Expense	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pre tax Income	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310,723)	(310 723)	(3,030)	(3,030)	(3,030)
Book Tax Provision	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(727)	(727)	(727)
Deferred Income Taxes																
Cash Taxes Paid (Refunded)	(138,384)	(237,384)	(169,956)	(121,752)	(87,391)	(87,127)	(87,144)	(44,232)	(1 418)	(1,416)	(1,418)	(1,416)	(1,418)	(1,416)	(1,418)	(708)
Book Tax Provision	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(74,573)	(727)	(727)	(727)
Annual Deferred Taxes (Benefit)	(63,811)	(162,811)	(95,383)	(47,179)	(12,818)	(12,554)	(12,573)	30,341	73,155	73,157	73,155	73,157	73,155	(689)	(691)	19

DO NOT CHANGE ANYTHING BELOW THIS LINE

Federal

Book Depreciation Workbook

2018 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2019 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Battery																
	Annual D	307,692	307,692	307,692	307,692	307,692	307,692	307,692	307,692	307,692	307,692	307,692	307,692	307,692	-	-
Battery																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Land Improvements																
	Annual D	3,030	3,030	3,030	3,030	3,030	3,030	3,030	5,020	3,030	3,030	3,030	3,030	3,030	3,030	3,030
	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	Annual D													
	0													
	Annual D													
2025 CapEx														
	Annual D													
2026 CapEx														
	Annual D													
2027 CapEx														
	Annual D													
2028 CapEx														
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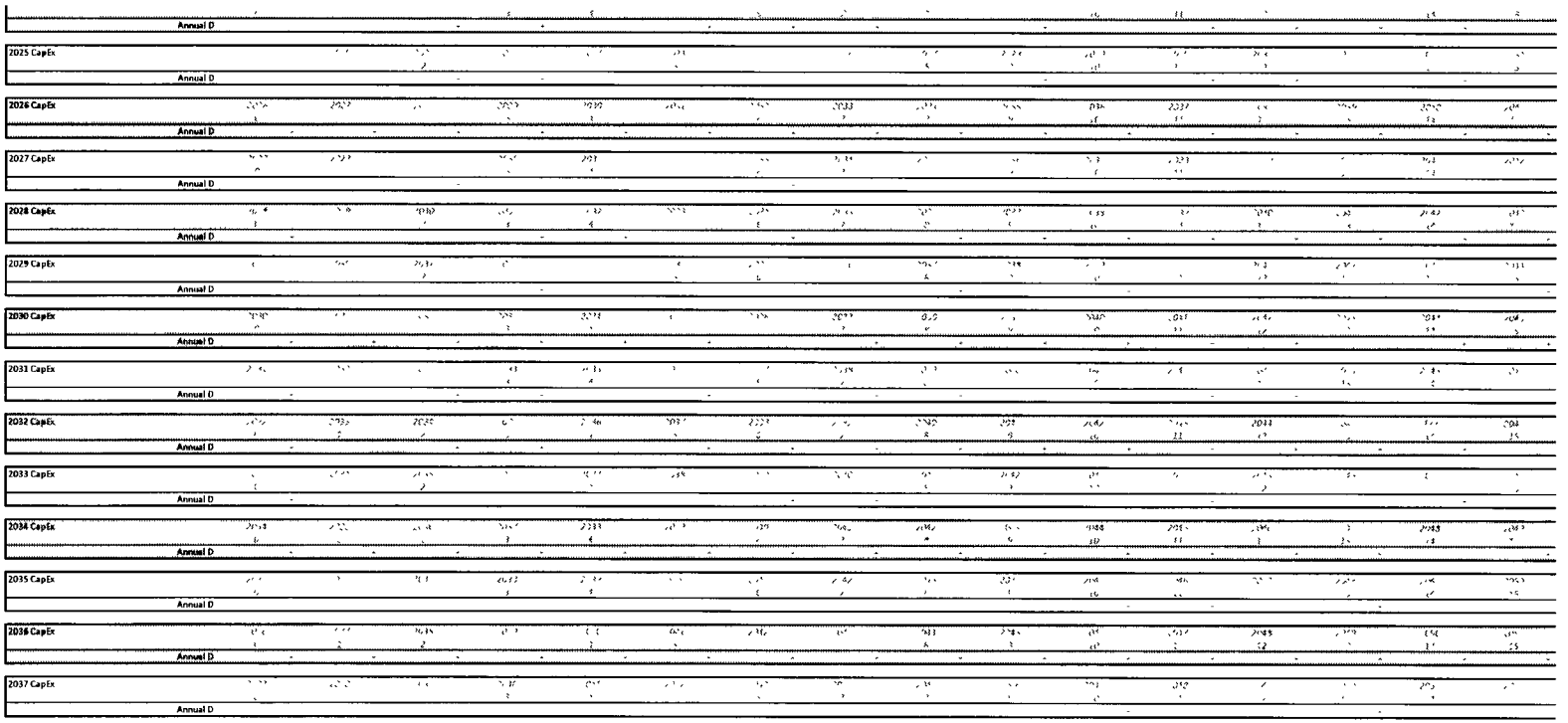
2033 CapEx														
	Annual D													
2034 CapEx														
	Annual D													
2035 CapEx														
	Annual D													
2036 CapEx														
	Annual D													
2037 CapEx														
	Annual D													

Tax Depreciation Workbook

2018 CapEx														
	Annual D													
2019 CapEx														
	Annual D													
Battery														
	Annual D	571,800	979,600	699,600	499,600	357,200	356,800	357,200	178,400					
Battery														
	Annual D													
Land Improvements														
	Annual D	5,000	9,500	8,550	7,700	6,930	6,220	5,900	5,900	5,910	5,900	5,910	5,900	5,910	5,900	5,910	2,950
	0													
	Annual D													
	0													



	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2025 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2026 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2027 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2028 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2029 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2030 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2031 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2032 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2033 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2034 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2035 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2036 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2037 CapEx																
	Annual D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Modified Accelerated Cost Recovery System (MACRS)

Half-Year Convention

	3	5	6	7	10	15	20	31 5	39
0	33 33%	20 00%	20 00%	14 29%	10 00%	5 00%	3 750%	1 720%	1 391%
1	44 45%	32 00%	16 00%	24 49%	18 00%	9 50%	7 219%	3 175%	2 564%
2	14 81%	19 20%	16 00%	17 49%	14 40%	8 55%	6 677%	3 175%	2 564%
3	7 41%	11 52%	16 00%	12 49%	11 52%	7 70%	6 177%	3 175%	2 564%
4		11 52%	16 00%	8 93%	9 22%	6 93%	5 713%	3 175%	2 564%
5		5 76%	16 00%	8 92%	7 37%	6 23%	5 285%	3 175%	2 564%
6				8 93%	6 55%	5 90%	4 888%	3 175%	2 564%
7				4 46%	6 55%	5 90%	4 522%	3 174%	2 564%
8					6 56%	5 91%	4 462%	3 175%	2 564%
9					6 55%	5 90%	4 461%	3 174%	2 564%
10					3 28%	5 91%	4 462%	3 175%	2 564%
11						5 90%	4 461%	3 174%	2 564%
12						5 91%	4 462%	3 175%	2 564%
13						5 90%	4 461%	3 174%	2 564%
14						5 91%	4 462%	3 175%	2 564%
15						2 95%	4 461%	3 174%	2 564%
16							4 462%	3 175%	2 564%
17							4 461%	3 174%	2 564%
18							4 462%	3 175%	2 564%
19							4 461%	3 174%	2 564%
20							2 231%	3 175%	2 564%
21								3 174%	2 564%

12 Jan	100%
11 Feb	92%
10 Mar	83%
9 Apr	75%
8 May	67%
7 Jun	58%
6 Jul	50%
5 Aug	42%
4 Sep	33%
3 Oct	25%
2 Nov	17%
1 Dec	8%
Yes	
No	

22		3.175%	2.564%
23		3.174%	2.564%
24		3.175%	2.564%
25		3.174%	2.564%
26		3.175%	2.564%
27		3.174%	2.564%
28		3.175%	2.564%
29		3.174%	2.564%
30		3.175%	2.564%
31		3.042%	2.564%
32			2.564%
33			2.564%
34			2.564%
35			2.564%
36			2.564%
37			2.564%
38			2.564%
39			1.177%
40			0.000%
41			
42			
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Source

http://www.irs.gov/pub/irs-pdf/p946.pdf?source=ttcom4home1

3,030	3,030	3,030	3,030	3,030	3,030	3,030	3 030	3 030	3,030	3 030	3,030	3 030	3,030	3,030	3,030	3,030	-	-
727	727	727	727	727	727	727	727	727	727	727	727	727	727	727	727	727		
4,051,515	4,054,545	4,057,576	4,060,606	4,063,636	4,066,667	4,069,697	4,072,727	4,075,758	4,078,788	4,081,818	4,084,848	4,087,879	4,090,909	4,093,939	4,096,970	4,100,000	4,100,000	4,100,000
4,100,000	4,100 000	4,100,000	4 100,000	4,100,000	4,100 000	4,100,000	4,100 000	4,100,000	4 100,000	4,100 000	4 100 000	4 100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000
(11,636)	(10,909)	(10,182)	(9,455)	(8,727)	(8,000)	(7,273)	(6,545)	(5,818)	(5,091)	(4,364)	(3,636)	(2,909)	(2,182)	(1,455)	(727)		-	
4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100 000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000	4,100,000
3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3 030	3,030	3,030	3,030	3,030	3,030	3,030		
(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)	(3,030)		
(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	-	-
(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)	(727)		
727	727	727	727	727	727	727	727	727	727	727	727	727	727	727	727	727	-	

[redacted]

3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	3,030	-	-

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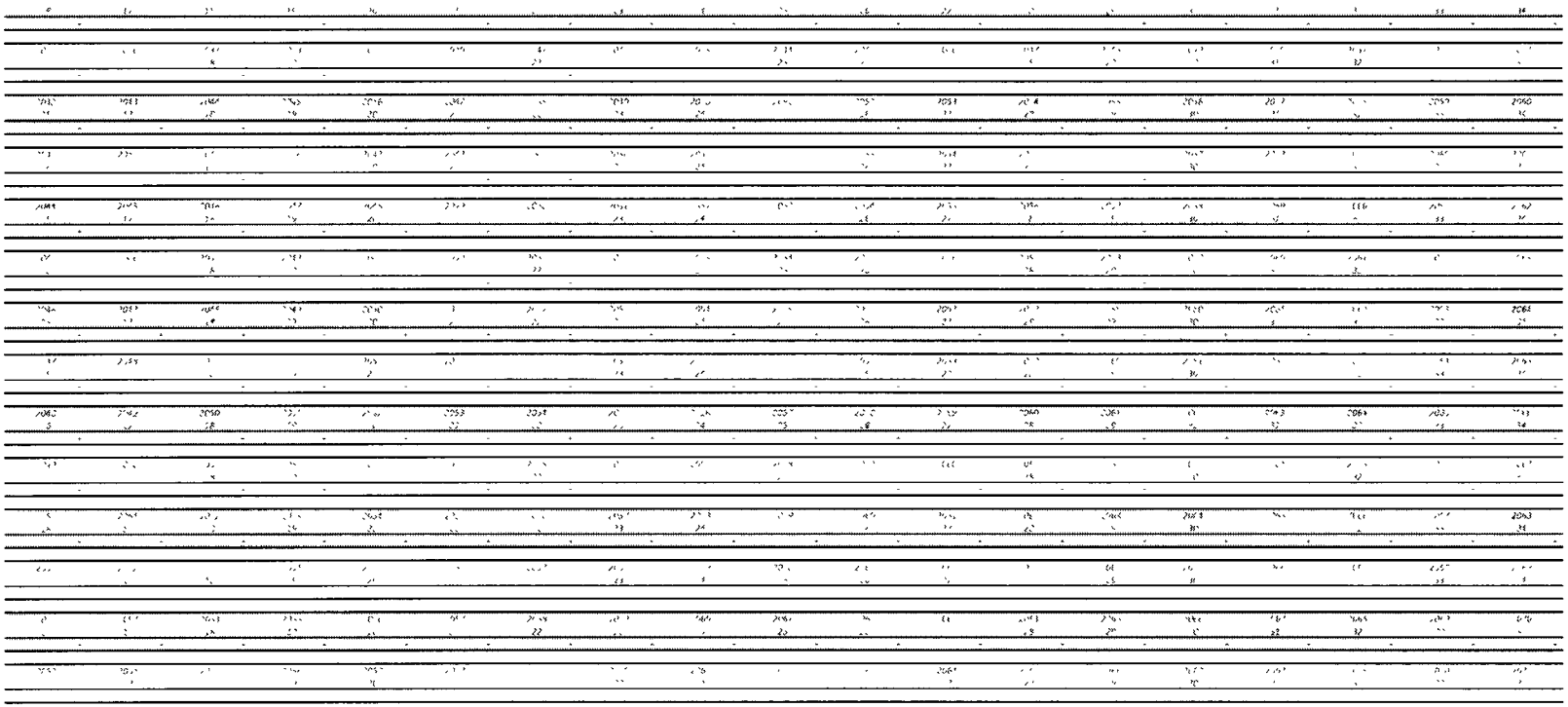
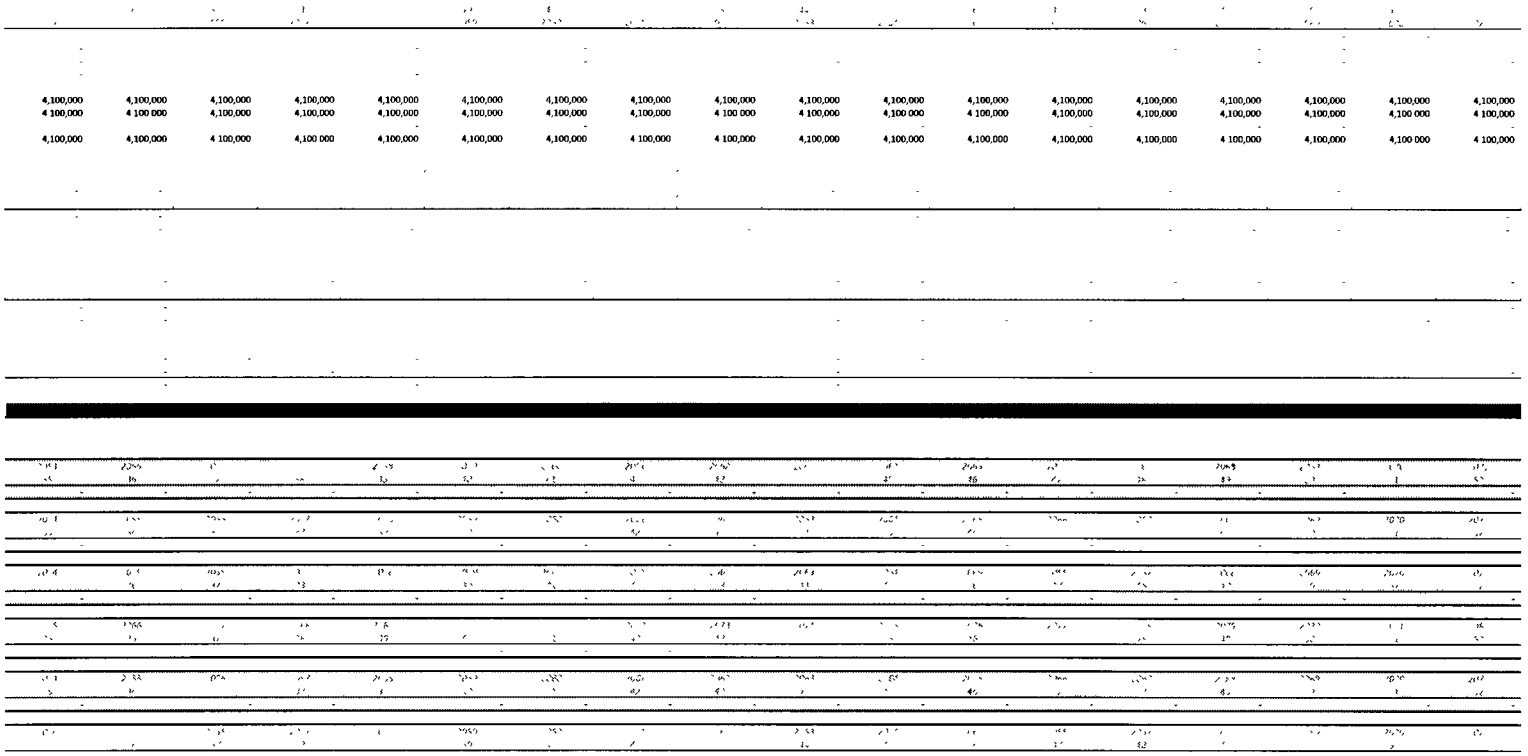


ANALYSIS
CONTINUES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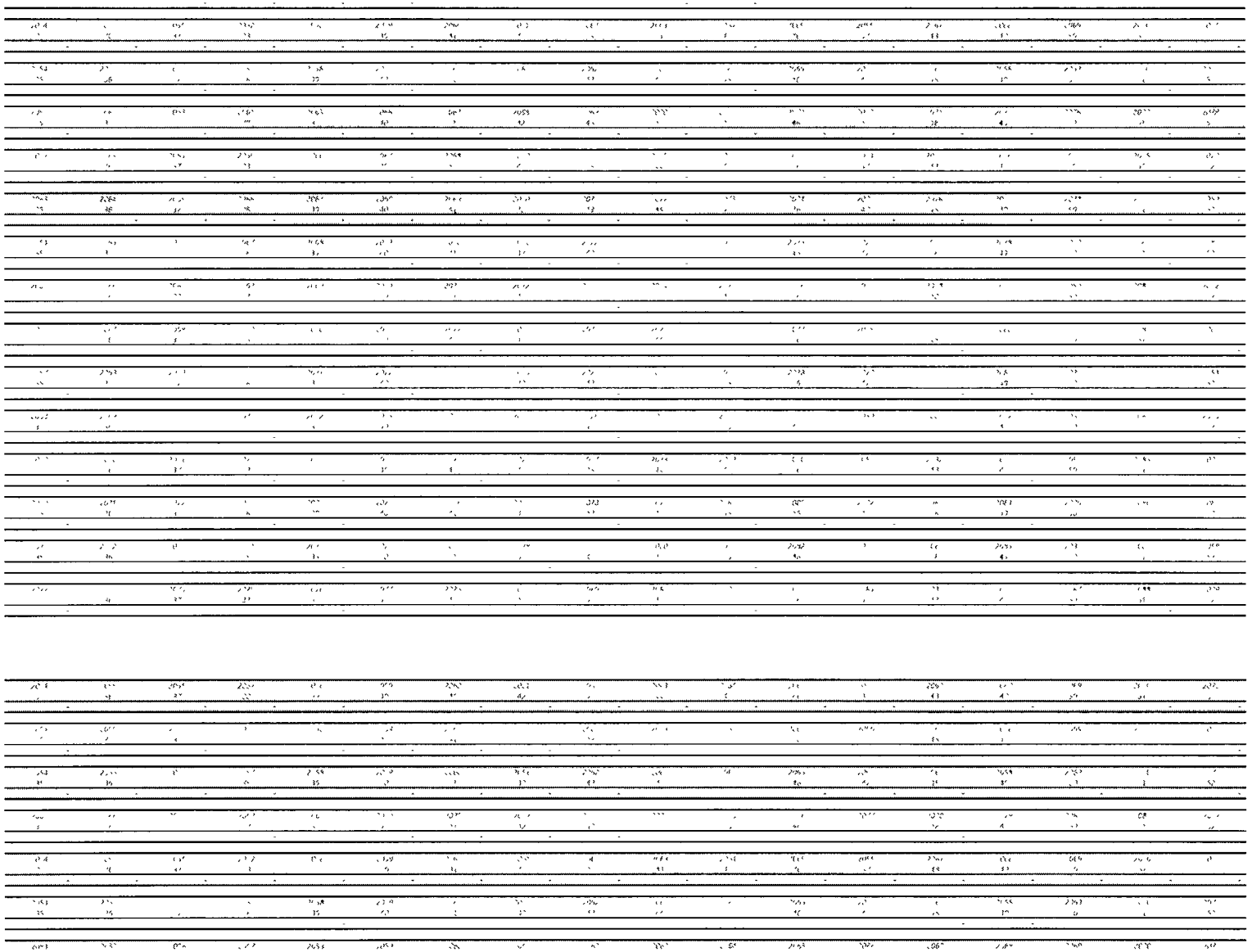
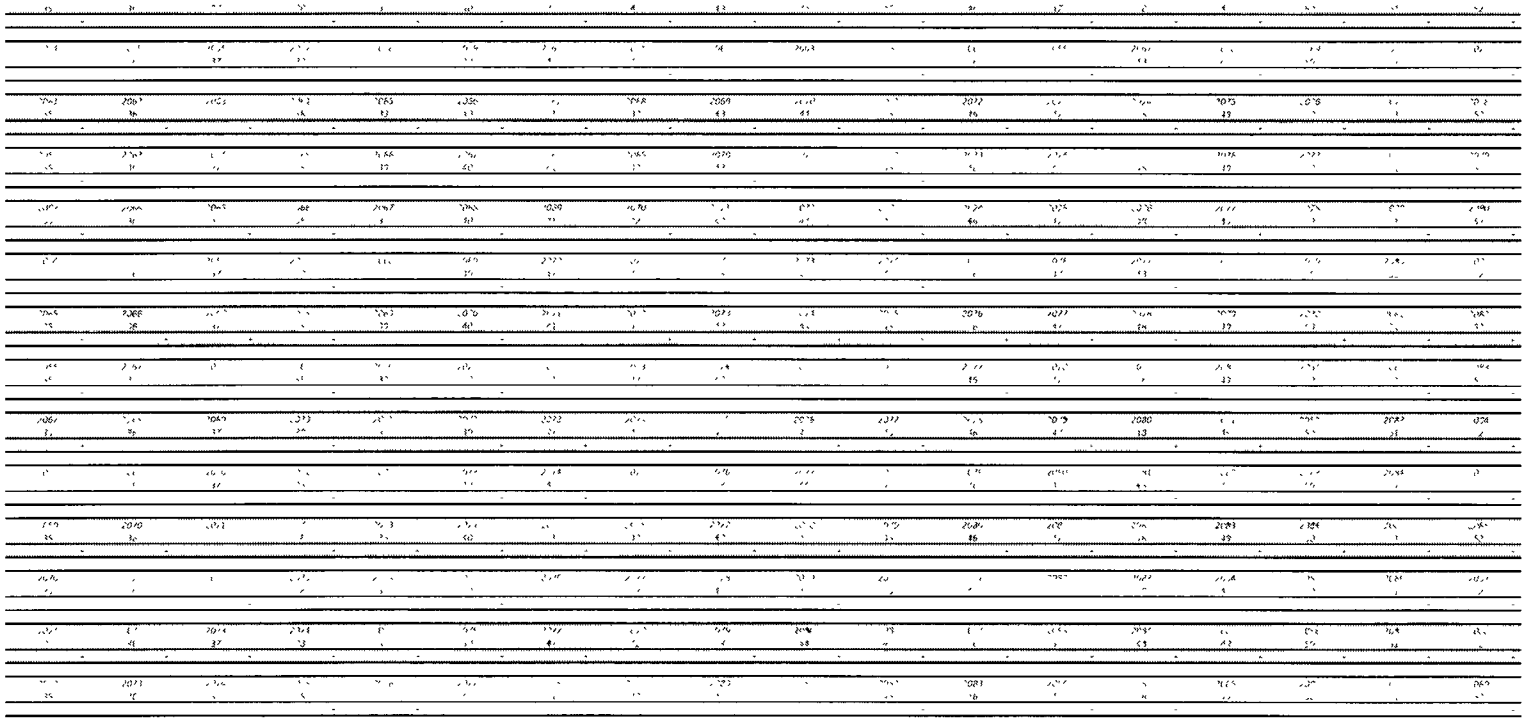




WP JPS-3-CONFIDENTIAL DER MAP

IS CONFIDENTIAL

A copy of this material will be provided only after execution of a certification to be bound by the draft protective order set forth in Section VII of this Rate Filing Package or a protective order issued in this docket.

APPLICATION OF CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC FOR AUTHORITY TO CHANGE RATES	**§ § §**	**PUBLIC UTILITY COMMISSION OF TEXAS**

DIRECT TESTIMONY

OF

JOHN R. HUDSON

ON BEHALF OF

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC

April 2019

TABLE OF CONTENTS

LIST OF EXHIBITS

GLOSSARY OF ACRONYMS AND DEFINED TERMS

1. AMS – Advanced Metering System. AMS is a system, including Advanced Meters and the associated hardware, software, and communications devices, that collects time-differentiated energy usage and is deployed pursuant to 16 TAC § 25.130, *Advanced Metering*. In 2009, the Company began deployment of advanced or smart meters in its service territory.

2. ARO – Accounts Receivable Other. The Business Risk Management Group manages ARO invoices for services provided to third parties that transact commercial business with CenterPoint Houston.

3. CRIP – Competitive Retailer Information Portal. This is a secure site that contains Texas retail electric market transaction data available only to the REP of Record that is serving a customer's premises, and provides automated requests for historical usage for a premise, which is offered to REPs and other parties utilizing a Letter of Authorization from the customer.

4. CenterPoint Houston or the Company – CenterPoint Energy Houston Electric, LLC. This is the entity that filed the rate case.

5. Commission or PUCT – The Public Utility Commission of Texas.

6. CR – Competitive Retailer. Retail Electric Provider (REP) as defined in 16 TAC § 25.5, *Definitions*; or a Municipally Owned Utility or an Electric Cooperative that offers Customer Choice and sells electric energy at retail in the restructured electric power market in Texas.

7. CIS – Customer Information Systems.

8. Customer – An Entity that purchases electricity for its own consumption.

9. DEIS – Demand and Energy Information System. DEIS is an automated system that is utilized by end-use retail customers to access usage information about their specific personal premises.

10. EDI – Electronic Data Interchange. Participants in the Texas retail electric market communicate all customer-related enrollment and service orders, all premise information, and meter reading and usage data through EDI transactions that are processed using TX SET guidelines.

11. ERCOT – Electric Reliability Council of Texas. ERCOT is the independent system operator that manages the flow of electric power to Texas customers and manages financial settlement for the competitive wholesale bulk-power market and administers customer switching for Texans in competitive choice areas. ERCOT is the organization approved by the FERC to perform the electric reliability organization functions described in the Electricity Modernization Act of 2005 (16 U.S.C § 824 *et. seq.*).

12. ERCOT Protocols – Body of procedures developed by ERCOT to maintain the reliability of the regional electric network and account for the production and delivery of electricity among resources and market participants. The procedures, initially approved by the Commission, include a revisions process that may be appealed to the Commission, and are subject to the oversight and review of the Commission.

13. ESI-ID – Electric Service Identifier. The basic identifier assigned to each point of delivery used in the registration system and settlement system managed by ERCOT.

14. IDR – Interval Data Recorder. Metering Equipment that is designed to provide Interval Data and does not otherwise qualify as a Standard Meter or an AMS-M Meter.

15. JDOA - Joint Development and Operations Agreement. CenterPoint Energy Houston Electric, LLC, Oncor Electric Delivery Company, AEP Texas Central Company, AEP Texas North Company, and Texas-New Mexico Power Company are the parties under a JDOA that contract with IBM for the design, development and operation of SMT portal.

16. Load Profile – A representation of the energy usages of a group of Customers, showing the demand variation on an hourly or sub-hourly basis.

17. O&M – Operations and Maintenance. The Company seeks the recovery of the O&M costs associated with Market Operations.

18. MarkeTrak – The MarkeTrak tool is used throughout the market and is a web-based database application used to track, manage and store data utilized by ERCOT and the Market Participants.

19. MDM – Meter Data Management. A component in the smart grid infrastructure that serves as a repository for data from AMS meters, and manages the timely flow of service order transactions to and from the AMS meters.

20. Premise – A Service Delivery Point or combination of Service Delivery Points that are assigned a single ESI-ID for purposes of settlement and registration.

21. Retail customer – The separately metered end-use customer who purchases and ultimately consumes electricity.

22. Regulatory Asset – Pursuant to 16 TAC § 25.107, *Certification of Retail Electric Providers (REPs)*, a TDU shall create a regulatory asset for bad debt expenses, net of collateral posted, resulting from a REP's default to pay delivery charges to the TDU. Upon a review of reasonableness and necessity, a reasonable level of amortization of such regulatory asset shall be included as a recoverable cost in the TDU's rates in its next rate case or such other rate recovery proceeding as deemed necessary.

23. REP – Retail Electric Provider. A person that sells electric energy to retail customers in this state.

24. SMT – Smart Meter Texas. A website sponsored by a coalition of Transmission and Distribution Service Providers (TDSPs). The site stores daily, monthly and 15-minute intervals of electric energy data recorded by digital electric meters (commonly known as smart meters), and provides secure portal access to that data to customers and authorized market participants. SMT enables customers to better manage their energy consumption to lower their monthly electric bills, and benefit from new products and services offered by REPs and Third Parties.

25. SRC – System Restoration Charge. Bond issuance related to Hurricane Ike.

26. TDSP – Transmission and Distribution Service Provider. An Entity that is a TSP, a DSP or both, or an Entity that has been selected to own and operate Transmission Facilities and has a PUCT approved code of conduct in accordance with 16 TAC § 25.272, *Code of Conduct for Electric Utilities and Their Affiliates*.

27. Test Year – The most recent 12 months for which operating data for an electric utility, electric cooperative, or municipally-owned utility are available and shall commence with a calendar quarter or a fiscal year quarter. The Test Year for the period ending December 31, 2018, is the period upon which the Company's costs are based in this Cost of Service Rate Filing case.

28. TMH – Transaction Management Hub. All Texas retail electric market transactions are processed using the central TMH, which is a complex electronic transaction processing system.

29. TC – Transition Charge. Charges established pursuant to a financing order issued by the PUCT.

30. TX SET – Texas Standard Electronic Transaction. The electronic data transactions, implementation guides, and applicable external standards that enable and facilitate the retail business processes in the deregulated Texas electric market. The TX SET Working Group at ERCOT analyzes the need for new electronic transactions or modifications to existing electronic transactions based upon changes that occur within the retail electric market that affect EDI transaction processing.

EXECUTIVE SUMMARY OF JOHN R. HUDSON

CenterPoint Energy Houston Electric, LLC's ("CenterPoint Houston" or the "Company") Market Operations manages the overall activities of the Company relating to the Electric Reliability Council of Texas' ("ERCOT") competitive retail market. Market Operations has five functional groups: Transaction Management, Electric Market Relations, Business Consulting, Program Management, and Business Risk Management. These groups handle the varying aspects of the Company's operations in the ERCOT market. These groups provide necessary services for the Company and implement budgeting and cost-control measures to ensure the reasonableness of the associated expenses. CenterPoint Houston's Operations and Maintenance expenses for Market Operations for the year ended December 31, 2018 of approximately $12.3 million are reasonable and necessary and these costs should be included in the Company's cost of service.

DIRECT TESTIMONY OF JOHN R. HUDSON

I. INTRODUCTION

Q. WHAT IS YOUR NAME AND OCCUPATION?

A. My name is John R. Hudson. I am Director of Market Operations for CenterPoint Energy Houston Electric, LLC ("CenterPoint Houston" or the "Company").

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND EXPERIENCE.

A. I hold a Bachelor of Accountancy degree from the University of Oklahoma, and a Master of Business Administration degree from the University of Tulsa. I joined CenterPoint Houston's predecessor company in 1999, and have worked as a Manager in Regulatory Affairs and as Manager of the Electric Market Relations group. I assumed my current role as Director of Market Operations in 2018.

Q. WHAT ARE YOUR JOB RESPONSIBILITIES AS DIRECTOR OF MARKET OPERATIONS FOR THE COMPANY?

A. As Director of Market Operations, I primarily oversee the processing and delivery of retail market transactions and the resolution of market and internal system issues to ensure the timely and accurate execution of those transactions. In addition, I supervise credit and risk management functions, Competitive Retailer ("CR") and Electric Reliability Council of Texas ("ERCOT") relations, as well as project management for various retail market-related projects and programs. For the purpose of this testimony, CR may include a Retail Electric Provider ("REP"), Municipally Owned Utility, or an Electric Cooperative that offers customer choice in the restructured competitive electric power market. All of these functions work together to execute CenterPoint Houston's retail market responsibilities in

accordance with Public Utility Commission of Texas ("Commission") substantive rules, ERCOT protocols and guides, and the Company's Tariff for Retail Delivery Service ("Tariff").

Q. ON WHOSE BEHALF ARE YOU TESTIFYING?

A. I am testifying on behalf of CenterPoint Houston.

Q. DO YOU SPONSOR OR CO-SPONSOR ANY SCHEDULES OR EXHIBITS?

A. Yes, I co-sponsor Schedule II-D-2.2.3 "Bad Debt Expense" with Company witness Kristie L. Colvin. I also sponsor the exhibit identified in the Table of Contents which was prepared by me or under my direct supervision.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to discuss the services provided by Market Operations and to support the reasonableness and necessity of Operations and Maintenance ("O&M") expenses for Market Operations for the Test Year. During the Test Year, Market Operations incurred approximately $12.3 million in direct O&M expenses. Capital expenditures related to Market Operations are sponsored by Company witness Shachella D. James. I will support the Market Operations' Test Year costs by describing the processes Market Operations employs to accomplish its objectives in an efficient, effective, and cost-conscious manner.

Q. HOW DOES YOUR TESTIMONY RELATE TO THE TESTIMONY OF OTHER WITNESSES IN THIS RATE FILING PACKAGE?

A. Several of the specific issues that I address in my direct testimony are also supported by other CenterPoint Houston witnesses. First, my testimony addresses the planning and budgeting for Market Operations, the bad debt expense, and Smart Meter Texas ("SMT") costs. Other aspects of those topics are addressed and supported by Ms. Colvin. Company witness Robert B. Hevert discusses the overall risk profile of CenterPoint Houston and discusses the risks associated with the Company's CR customer base, which I also discuss briefly below.

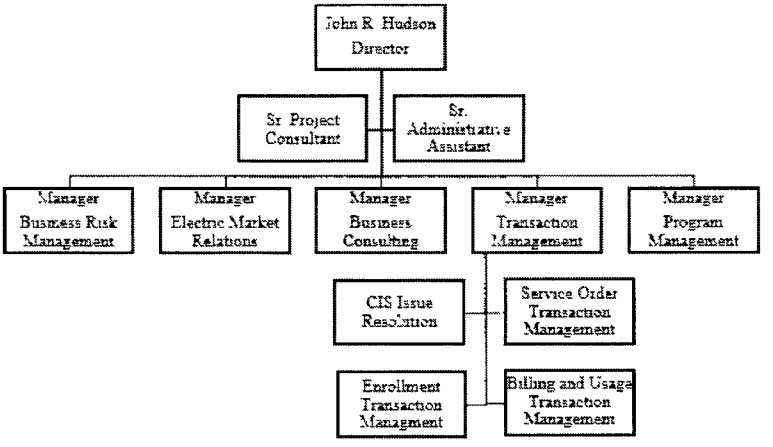
II. FUNCTIONS, COSTS AND ORGANIZATION OF MARKET OPERATIONS

A. Functions

Q. WHAT ARE THE FUNCTIONS OF MARKET OPERATIONS?

A. As illustrated in Figure 1, the functions of Market Operations are carried out by five functional groups: Transaction Management, Electric Market Relations, Business Consulting, Program Management, and Business Risk Management.

Figure 1 As of 12/31/2018



Transaction Management ensures the efficient and accurate processing of all electronic transactions related to the competitive retail electric market for CenterPoint Houston. In the Texas competitive retail electric market, all customer-related orders (Switch Request, Move-In Request, Move-Out Request, etc.), premise information (Electronic Service Identifier ("ESI-ID"), weather zones, service address, load profile type, etc.), invoicing and monthly or final usage data information is communicated through electronic data interchange ("EDI") transactions. These transactions are created and processed in compliance with standards and guidelines established by the Texas Standard Electronic Transactions ("TX SET") Working Group at ERCOT. The generation and processing of these transactions is critical in effecting timely services for the end-use retail customer, and in ensuring timely and accurate financial settlement among CRs, transmission and distribution service providers ("TDSP"), ERCOT, and other retail and wholesale market participants.

In 2018, the Company processed more than 78 million total transactions (approximately 72.2 million outbound and 5.9 million inbound) using its central Transaction Management Hub ("TMH") and other internal systems. Market Operations is tasked with reconciling these transactions, as well as handling errors or exceptions that occur with this extremely complex electronic transaction processing system. Market Operations ultimately strives for operational excellence and reliability by ensuring that transactions meet the timelines and criteria established by the Commission's substantive rules and ERCOT protocols.

Market Operations' Electric Market Relations group is a single point-of-contact for CRs and provides a liaison between CRs and all business units and functions within CenterPoint Houston. The group facilitates the resolution of issues and complex exceptions to ensure that end-use retail customer and CR needs are met. This group also provides a liaison between CenterPoint Houston and ERCOT, where CenterPoint Houston is actively involved in the stakeholder process. The Company's participation at ERCOT Subcommittees, Working Groups, and Task Forces promotes the design and implementation of efficient market processes.

Market Operations' Business Risk Management Group manages the receivables from CRs as well as the receivables for other services provided to third parties that transact commercial business with CenterPoint Houston (Accounts Receivable Other ("ARO") invoices). Additionally, Business Risk Management is responsible for administering deposits for all Transition and System Restoration Bonds pursuant to CenterPoint Houston's role as the servicer for the Trustee of the Transition Bond Companies ("Trustee"). A summary of the responsibility that Market Operations has for the $137 million in Transition and System Charge Deposits is included in a later section of this testimony.

The Business Consulting group manages projects and system changes that are necessary to comply with new Commission rules or ERCOT protocols, improve internal processes, or otherwise meet the needs of customers and market participants. The work of Business Consulting involves evaluating market rules and internal processes, defining business requirements, working with the

Technology Operations ("TO") department to design system changes, and testing system changes.

Program Management is responsible for CenterPoint Houston's participation in the SMT Joint Development and Operations Agreement ("JDOA"), the group of utilities that jointly operate the SMT portal website. The group also manages projects that enhance CenterPoint Houston's delivery service, such as the provision of daily generation data for ERCOT non-modeled generators and improvements to market processes for Light Emitting Diode ("LED") street light installations.

Q. WHY IS MARKET OPERATIONS NECESSARY FOR END-USE RETAIL CUSTOMERS AND CRS?

A. Market Operations services are necessary to ensure that the CRs and the end-use retail customers receive their service order transactions and enrollment order transactions in both a timely and accurate manner. Market Operations accomplishes high quality services through the transaction monitoring process, as well as through coordination with a multitude of internal CenterPoint Houston personnel and external market participants. Market Operations provides accurate and efficient transaction processing and timely exception resolution which are necessary to ensure that Switch Requests, Move-In Requests, Move-Out Requests, and other customer-initiated order transactions are executed in a timely manner and within ERCOT protocols. Efficient transaction processing and timely exception resolution involving monthly meter read transactions sent by CenterPoint Houston enable CRs to bill the end-use retail customer accurately, with validated usage data.

Also, the daily interval usage data enabled by advanced metering systems ("AMS") that the Company transmits to the market is also validated for accuracy according to industry standards so that all financial settlements of the wholesale market are based upon validated accurate information.

The Business Risk Management Group provides the retailers with assistance in resolving invoicing, payment verification, and payment posting issues. By responding to the CRs' questions and concerns regarding invoicing, Business Risk Management helps enable retailers to remit payments in a timely manner, which reduces additional costs such as late charges.

The role of the Electric Market Relations Group as the single point of contact for CRs facilitates the timely resolution of any problems, necessary field activities, and internal Company communications in the event of exception or special processing requirements. This allows retailers and their end-use retail customers to receive timely service and resolution of issues in these special circumstances. Electric Market Relations participation in the ERCOT stakeholder process plays a crucial role in the market so that all parties have a full understanding of the complexities involved when process changes are being discussed and protocol revisions requests are developed.

B. Cost Control

Q. WHAT HAS MARKET OPERATIONS DONE TO BUDGET, MONITOR AND CONTROL COSTS?

A. The preparation and use of Market Operations' budget is the primary way in which the Company budgets, monitors, and controls costs for Market Operations. The overall budget planning for the Company is under the direct management of

Ms. Colvin, who will further describe the overall business planning process in her direct testimony in this proceeding. Market Operations' budget is derived as part of this process. Actual expenses are monitored and managed against budgeted amounts on a monthly basis, and variances are investigated. Projections and changes to the budget are made monthly to evaluate and analyze spending levels and to maximize system-wide cost control.

Q. HAS MARKET OPERATIONS UNDERTAKEN INITIATIVES TO CONTROL COSTS?

A. Yes. Market Operations continuously works to identify and evaluate automated processes and system enhancements that can reduce the manual processing and intervention required to resolve transactional processing issues. These initiatives allow Market Operations to handle increased transaction volumes and respond to changing market requirements while maintaining stable staffing levels.

Q. WHAT ARE SOME EXAMPLES OF INITIATIVES THAT HAVE IMPROVED THE EFFICIENCY OF PROCESSES?

A. As discussed later in my testimony, Market Operations implemented functionality on our Competitive Retailer Information Portal ("CRIP") to provide historical usage data to CRs and other third parties. This automation has largely replaced the manual process of fulfilling thousands of emailed requests for usage data.

Market Operations has also automated aspects of the MarkeTrak communication tool, allowing us to receive and process certain exceptions with less manual intervention.

Finally, the full deployment of AMS has greatly improved the efficiency of meter reading and service order execution. The vast majority of service orders are now executed over the AMS network, reducing the need for Electric Market Relations personnel to facilitate the resolution of access issues or coordinate field crews to make multiple trips to execute orders.

C. Organization and Detailed Functions of Market Operations

Q. HOW IS MARKET OPERATIONS ORGANIZED?

A. Market Operations is comprised of five managed functional groups with eight independent functional groups operating under that management structure:

1. Business Risk Management
2. Transaction Management
    a. Customer Information Systems ("CIS") Issue Resolution
    b. Enrollment Transaction Management
    c. Service Order Transaction Management
    d. Billing and Usage Transaction Management
3. Electric Market Relations
4. Business Consulting
5. Program Management

The organization chart for Market Operations is presented in Figure 1 above.

Q. HOW HAS MARKET OPERATIONS' FUNCTIONS AND ORGANIZATION CHANGED SINCE THE LAST RATE CASE?

A. At the time of the last rate case, the Business Consulting group and the Program Management group were not part of Market Operations. The Business Consulting group originated as part of the Retail Markets work stream in the Company's AMS

deployment project. At the conclusion of the AMS project, the group was moved into Market Operations to provide project management and testing functions for AMS as well as other retail market related systems. The Program Management function also joined Market Operations after the AMS project, to continue its mission of supporting SMT.

1. Business Risk Management Group

Q. CAN YOU DESCRIBE THE BUSINESS RISK MANAGEMENT GROUP AND ITS RESPONSIBILITIES?

A. Business Risk Management has responsibilities in two primary areas: (1) the management of receivables from CRs and (2) ARO.

Q. PLEASE DESCRIBE THE MANAGEMENT OF RECEIVABLES FROM CRS.

A. Business Risk Management is responsible for utilizing analytical tools to evaluate the creditworthiness of CRs, monitoring credit exposure for CenterPoint Houston, and determining and collecting Transition Charge ("TC") and System Restoration Charge ("SRC") security requirements. This group works to reduce payment delinquency, to settle invoice disputes filed by CRs and to monitor CR bankruptcy proceedings.

In 2018, CenterPoint Houston's CR Tariff-related invoices totaled over $2.8 billion. Business Risk Management manages an average daily receivable balance of approximately $271 million. Additionally, this group evaluates and reconciles transactions to investigate and help prevent potential future invoice disputes. Business Risk Management also monitors each specific CR account for delinquencies and potential defaults.

This group administers more than $137 million in TC and SRC deposits on behalf of the Trustee related to the three CenterPoint Houston Transition bond issuances and one System Restoration bond issuance authorized by the Commission. TCs and SRCs are separate charges that cover the debt service on each of the bonds the Company issues.

Q. PLEASE DESCRIBE THE BUSINESS RISK MANAGEMENT GROUP'S RESPONSIBILITIES FOR ADMINISTERING TRANSITION AND SYSTEM RESTORATION BONDS.

A. Business Risk Management conducts a thorough review of each CR's bond deposit each quarter. All TC and SRC deposits are forwarded to and held by the Trustee. The review is performed to determine if the amount held by the Trustee is sufficient to cover the requirements of 16 Texas Administrative Code § 25.108 ("TAC"), *Financial Standards for Retail Electric Providers Regarding the Billing and Collection of Transition Charges,* and the various securitization financing orders. In these cases, the deposit amounts are adjusted up or down to reflect changes in the CR's load or changes to the various TC rates.

Q. PLEASE DESCRIBE THE MANAGEMENT OF ACCOUNTS RECEIVABLE OTHER RECEIVABLES.

A. Business Risk Management is also responsible for the collection of delinquent ARO invoices. These invoices are for services provided to third parties that transact commercial business with CenterPoint Houston. The group is responsible for assessing the creditworthiness of third parties that utilize the ARO System for invoicing prior to the service being provided.

The significant financial responsibilities for administering and collecting the majority of the revenue stream for the Company requires a competent, efficient staff to professionally handle these complex duties.

Q. WHAT WAS CENTERPOINT HOUSTON'S BAD DEBT EXPENSE RELATED TO ARO FOR THE TEST PERIOD YEAR 2018?

A. The Company's unadjusted test year bad debt expense for 2018 was approximately $65,000 consisting primarily of uncollectible ARO, which was written off. This is detailed in Schedule II-D-2.2.3 "Bad Debt Expense" which I co-sponsor with Ms. Colvin.

Q. WHAT ARE CENTERPOINT HOUSTON'S CREDIT AND BUSINESS RISKS ASSOCIATED WITH THE TEXAS RETAIL ELECTRIC MARKET?

A. The major credit risk that CenterPoint Houston encounters is CR delinquency and default. In the Texas competitive retail electric market, this risk is substantial because a TDSP's receivables are more concentrated over a much smaller customer base. In CenterPoint Houston's case, its customer base entails roughly 83 CRs, as opposed to having the receivables dispersed among millions of end-use retail customers.

Q. HOW DO THE COMMISSION'S RULES PROVIDE FOR MITIGATION OF BAD DEBT RELATED TO TRANSITION OR SYSTEM RESTORATION CHARGES?

A. In Commission rule 16 TAC § 25.108, the Tariff for Retail Delivery Service, and the various securitization financing orders require REPs to provide security for TCs

and SRCs. This security may be in the form of a cash deposit, letter of credit, affiliate guarantee, or other form of security. In lieu of security, REPs may show that they have an investment-grade credit rating; however, only three of the approximately 83 CRs active in CenterPoint Houston's service territory currently have an investment-grade credit rating.

Q. HOW DO THE COMMISSION'S RULES PROVIDE FOR MITIGATION OF BAD DEBT RELATED TO OTHER DELIVERY CHARGES?

A. The Tariff for Retail Delivery Service allows the Company to collect deposits to secure non-securitization related Delivery Charges only after a CR defaults, and for two years after the default. While this provision provides limited mitigation for bad debt exposure after a CR default, the Tariff itself provides no mitigation for the original default.

Commission rule 16 TAC § 25.107, *Certification of Retail Electric Providers (REPs)*, provides for a TDSP such as CenterPoint Houston to create a regulatory asset for bad debt expense related to REP default on other Delivery Charges, the amortization of which is to be included as a recoverable cost in the utility's next rate case.

Since CenterPoint Houston's last rate case, three REP defaults have resulted in bad debt of approximately $0.5 million being accumulated in a regulatory asset. The accounting treatment and amortization of this regulatory asset is discussed in the testimony of Ms. Colvin.

Q. HOW DOES CENTERPOINT HOUSTON CONTROL DELINQUENCIES AND MITIGATE THE EFFECT OF CR DEFAULTS AND BANKRUPTCIES?

A. Business Risk is responsible for mitigating bad debt for CenterPoint Houston. Business Risk has assigned Business Risk Analysts who monitor CR account activity on a daily basis, looking at the incoming invoice payments to detect potential CR financial distress. Business Risk Analysts communicate with CRs to resolve invoice disputes and/or collect outstanding invoices to reduce or eliminate delinquencies, which ultimately mitigate defaults.

Business Risk Analysts also conduct quarterly TC and SRC evaluations that involve analysis of a CR's credit rating. The rating of each CR is regularly analyzed to determine whether there has been a significant change since the previous analysis, and to determine if a change in the amount of any TC and SRC security deposit is warranted at the time of the review. The Business Risk Group regularly reviews rating agency information to monitor CR financial performances during the period between quarterly credit rating reviews.

Since CenterPoint Houston is not currently permitted by the Commission's substantive rules or its Tariff to charge any deposit amount or require other security in relation to the non-TC and non-SRC delivery charges except under limited circumstances, the Company is limited in its options for mitigating CR risk in the current market. Thus, it is absolutely imperative that Business Risk remains actively involved in managing the real-time CR account activity for the limited TC and SRC security deposits available for the Company's protection, as well as the

day-to-day payment activity for outstanding delivery charge invoices, in order to minimize the impact of a CR default and reduce the size of the resulting regulatory asset. Business Risk Analysts engage in daily open communication with CRs when they are delinquent in their payments, in order to resolve issues before a default situation occurs. Business Risk Analysts also communicate with new CRs to ensure that payment obligations under the Company's Tariff are clearly understood.

2. Transaction Management

Q. CAN YOU DESCRIBE THE TRANSACTION MANAGEMENT GROUP AND ITS FUNCTIONS?

A. Transaction Management is responsible for the processing and delivery of all of the electronic transactions related to CenterPoint Houston's role in the competitive retail electric market, including billing and usage transactions, enrollments, and service orders. As shown in Figure 1, the work of Transaction Management is accomplished by four teams: Billing and Usage, Enrollments, Service Orders, and CIS Issue Resolution.

Q. WHAT IS THE BILLING AND USAGE TRANSACTION MANAGEMENT GROUP AND WHAT ARE ITS RESPONSIBILITIES?

A. Billing and Usage Transaction Management manages all matters regarding billing and usage transactions, including delivering the accurate usage and invoice transactions for Tariff-based retail delivery charges that are rendered to CRs and monitoring to ensure that the usage transactions are loaded into ERCOT's system. In 2018, CenterPoint Houston delivered approximately 62.7 million monthly billing and usage transactions to the market. Since the deployment of CenterPoint Houston's AMS meters, the group is also responsible for the daily delivery of

15-minute interval usage data to ERCOT and SMT from more than 2 million AMS meters. The 15-minute interval data is used by ERCOT for the settlement of the wholesale power market. SMT provides the interval data to CRs and authorized third parties for the use in delivering pricing plans and services to end-use customers. In 2018, CenterPoint Houston delivered more than 1.8 billion AMS interval usage records to ERCOT and SMT.

While CenterPoint Houston's systems process transactions at a highly accurate and efficient rate, exceptions and errors do occur. In 2018, the Billing and Usage group resolved approximately 20,678 transaction processing exceptions and approximately 7,127 involving missing or disputed monthly and interval usage or billing transactions.

Q. WHAT IS THE ENROLLMENT TRANSACTION MANAGEMENT GROUP AND WHAT ARE ITS RESPONSIBILITIES?

A. Enrollment Transaction Management is responsible for monitoring and reconciling enrollment transactions as well as exception reporting. An enrollment transaction is a transaction that results in the change of the CR of Record and includes Switch Requests, Move-In Requests, Move-Out Requests, and any subsequent date changes, cancellations, or inadvertent orders. This group also handles premise-level transactions for updates for premise information, address, meter exchanges and load profile changes.

Enrollment Transaction Management personnel are responsible for ensuring timely processing of enrollment transactions through the CenterPoint Houston systems as well as root cause analysis and correction of overdue market

transactions relating to enrollment requests. This group works to address and ensure timely resolution of inquiries from CRs regarding end-use retail customer accounts and reconciles market exceptions relating to enrollments, including inadvertent switches or disputed enrollments.

Q. WHAT OTHER RESPONSIBILITIES DOES THE ENROLLMENT TRANSACTION MANAGEMENT GROUP HAVE?

A. Enrollment Transaction Management also works closely with the TO department and Market Operations' Business Consulting Group in the development of system enhancements by creating new project requirements, participating in the design, performing the user testing for these projects, and verifying the production implementation. This group is also responsible for translating new market rules into actual internal system requirements for CenterPoint Houston to ensure the Company's compliance with these standards.

Additionally, Enrollment Transaction Management handles load profiling validation for ESI-IDs in the CenterPoint Houston service territory. While the vast majority of ERCOT settlement is now based on actual usage data given the proliferation of AMS, ERCOT still maintains load profile curves that represent the expected average usage for each customer class. Enrollment Transaction Management coordinates with ERCOT and the Company's TO department to continually ensure that the profile model is accurate for each premise in CenterPoint Houston's service territory by having the appropriate transactions sent to ERCOT for corrections.

Q. WHAT IS THE SERVICE ORDER TRANSACTION MANAGEMENT GROUP AND WHAT ARE ITS RESPONSIBILITIES?

A. Service Order Transaction Management is responsible for the monitoring, reconciliation and exception reporting for the service order transaction functions. Service Order Transaction Management serves as the counterpart to Enrollment Transaction Management.

Service Order Transaction Management personnel are responsible for monitoring delivery and completion of transactions relating to the disconnection and reconnection of service at a customer's premise, meter tests, meter re-reads, meter exchanges, and a variety of over 30 additional service-related orders. Monitoring is a 24/7 requirement in order to verify that all reconnect transactions are handled in a timely manner. Service Order Transaction Management uses the MarkeTrak tool to address and ensure timely resolution of inquiries from CRs regarding end-use retail customer accounts and reviews and reconciles market exceptions and disputes relating to service order transactions

Like Enrollment Transaction Management, Service Order Management also works closely with the TO department and Business Consulting in the development of enhancements related to service order transaction processing and new project requirements, design and testing. This group's efforts reduce the need for manual intervention processes, which in turn creates a more effective and efficient operation. Service Order Transaction Management is also responsible for leading and coordinating the Company's participation in external retail market testing. This end-to-end market wide testing is performed three times a year with ERCOT,

TDSPs, and CRs to both support the certification of new CRs entering the retail electric market as well as test any new or updated EDI TX SET transactions and other system process changes.

Q. PLEASE DESCRIBE THE MARKETRAK TOOL.

A. The MarkeTrak tool is a web-based database application used to track, manage and store data utilized by ERCOT and the market participants. Several of the functional groups within Market Operations use MarkeTrak to track and resolve certain types of retail market transaction issues and data discrepancies, including usage and billing issues, CR of Record discrepancies, and missing transactions, among others. CenterPoint Houston resolved 41,704issues in MarkeTrak during the Test Year 2018.

Q. WHAT IS THE CIS ISSUE RESOLUTION GROUP AND WHAT ARE ITS RESPONSIBILITIES?

A. The CIS Issue Resolution group is primarily responsible for the back-end exception processing required for transactions received inbound from the market into CenterPoint Houston's internal CIS. CIS is the system of record for all residential and small commercial premises in CenterPoint Houston's territory, and contains all relevant data related to each premise, including CR of Record, enrollment history, and usage history. While each of the Transaction Management groups process various types of system exceptions, CIS Issue Resolution focuses on exceptions related specifically to CIS. CIS Issue Resolution is tasked with clearing inbound pending orders (such as Move-In Requests) as well as analyzing and processing orders that require manual intervention to resolve errors or exceptions. An example

of an exception that this group might encounter is the receipt of a Move-In Request for a premise where the meter has been previously removed. In that event, the electronic Move-In Request transaction would fail in CenterPoint Houston's CIS, and an issues resolution analyst is required to review and resolve this issue. Additionally, this group identifies system issues that may prevent the automated transfer of transactions from the CIS to our field workforce management system.

Q. HOW DOES CENTERPOINT HOUSTON MEASURE THE EFFICIENCY OF TRANSACTION PROCESSING?

A. The Company reports a variety of transaction-related metrics on a quarterly basis to the Commission as prescribed by 16 TAC § 25.88, *Retail Market Performance Measure Reporting*. CenterPoint Houston's Performance Measure Reports encompass metrics regarding many facets of transactional activity, including the Company's end-use retail customer enrollment and meter reading success rates.

ERCOT, independent of any report that CenterPoint Houston provides to the Commission, files a quarterly Performance Measures Report as defined in Project No. 36141, *Retail Performance Measure Reports Pursuant to PUC Subst. R. § 25.88 Beginning 3rd Quarter 2008*, to provide the market and CenterPoint Houston with information concerning the timeliness of the delivery of transactions to the market. ERCOT analyzes CenterPoint Houston's transaction data to calculate a compliance percentage according to relevant ERCOT protocols. Of the market-initiated Move-In Request and Switch Request transactions processed in the TMH in 2018, ERCOT determined that CenterPoint Houston responded to these transactions at a 100% accuracy level in accordance with ERCOT protocol

standards, Transaction Management's efforts to monitor and ensure the efficiency of daily transaction processing, along with timely exception resolution and the manual work-around efforts regarding these Move-In Request and Switch Request transactions, directly improve customer enrollment and meter-reading success rates.

ERCOT provided quarterly assessments measuring the Company's monthly performance concerning transactions received by ERCOT from CenterPoint Houston in 2018. These measurements are summarized in Figure 2 below.

Figure 2

Transaction Description	Measure	Transaction Quantity (Annual)	Transaction Percentage Within Protocol	Protocol Performance Requirement
Switch Notification Response	B-1a)	401,864	100%	98%
Historical Usage Request	B-2	393,954	100%	98%
Move-In Notification Response with No Permit Requirement	B-1b)	456,293	100%	98%
Historical Usage Request	B-2	355,822	100%	98%
Move-In Notification Response with No Permit Requirement	B-1c)	472,941	100%	98%
Historical Usage Request	B-1c)	425,319	100%	98%
Move-Out Response	B-1d)	257,414	100%	98%
Ad-hoc Historical Usage Response	B-2a)	25,749	100%	98%
Historical Usage Request	B-2a)	21,628	100%	98%
Monthly Meter Reading	B-2b)	29,355,999	Not Calculated	No Requirement

As the figure shows, CenterPoint Houston exceeded the required performance level for each transaction type.

3. Electric Market Relations

Q. WHAT IS THE ELECTRIC MARKET RELATIONS GROUP AND WHAT ARE ITS RESPONSIBILITIES?

A. The Electric Market Relations group utilizes a broad range of experience, knowledge and specialized skills to provide an effective interface between the Company and CRs, third-party service providers, ERCOT, the Commission, and other market participants.

Electric Market Relations' personnel provide a single point of contact and accountability for CRs, with 24/7 availability to answer questions, resolve issues and facilitate necessary field activities. In addition, this group provides an effective liaison between CRs and all business units and functions within the CenterPoint Houston organization to ensure that CRs' needs for timely service and resolution of issues are being addressed by the appropriate internal parties.

Electric Market Relations also works to continuously implement and execute communication strategies designed to provide CRs with significant and timely information concerning CenterPoint Houston system issues, significant service interruptions, emergency operations events, weather-moratorium events, Tariff changes, and other relevant market information as required.

In addition, Electric Market Relations acts as a liaison between CenterPoint Houston and ERCOT, providing leadership and participation to multiple subcommittees, working groups and task forces in the ERCOT stakeholder processes.

Through involvement in the ERCOT working groups, Electric Market Relations plays an active role in keeping CenterPoint Houston aware of market rules and ensuring compliance with those rules. Additionally, in coordination with CenterPoint Houston's Regulatory Group, the team actively monitors rulemakings at the Commission to ensure that the Company complies with any new requirements.

Q. HAS THE ELECTRIC MARKET RELATIONS GROUP EMPLOYED AUTOMATED SYSTEMS TO IMPROVE A CR'S EXPERIENCE WITH MARKET OPERATIONS?

A. Yes, Electric Market Relations has implemented and maintains several initiatives that serve its primary mission of enhancing the customer experience by advocating and executing actions that increase operational efficiencies, lower operating costs, and increase customer satisfaction.

Competitive Retailer Support website. Electric Market Relations actively manages the CenterPoint Houston CR portion of the CenterPoint Energy, Inc. ("CNP") corporate website. The CR Support website includes relevant information related to starting a business as a CR in CenterPoint Houston's service territory, as well as other useful retail market related information, forms, and links. The availability of the website allows CRs to obtain the information they need without having to call an Account Manager or the CenterPoint Houston call center. The website is also used to provide critical information to CRs regarding CNP's operations during Emergency Operations events such as Hurricane Harvey in 2017.

CRIP. CRIP is a secure site that contains data available only to the CR of Record serving a particular customer's premise. This data includes premise specific information concerning rate class, permit requirements, service voltage, meter information and more. In addition, CRIP provides specific transactional status data for service order and enrollment transactions, usage data, and usage and invoice transaction information. Having this data available to the CRs in a secure manner on a 24/7 automated basis has eliminated many e-mails and telephone calls from CRs to Electric Market Relation's Account Management Staff and the CenterPoint Houston call center that would have otherwise been required to obtain this information necessary for daily CR operations.

CRIP also provides a usage history request function, which allows CRs and third party service providers to obtain usage history for prospective customers. This function is essentially an online version of the market's Letter of Authorization and since implementation in 2016, it has greatly reduced the volume of manual usage requests fulfilled by CenterPoint Houston. In 2018 the CRIP usage history function fulfilled 332,832 requests for usage history.

The Demand and Energy Information System ("DEIS"). DEIS is another automated system that is utilized by end-use retail customers, including Interval Data Recorder ("IDR") customers whose interval data is not on SMT, to access usage information about their specific premises. In 2018, DEIS was utilized 90,219 times to obtain this usage information. DEIS is designed for and utilized by end-use retail customers, and empowers those customers to obtain usage

information from CenterPoint Houston's automated system without the need to contact CenterPoint Houston or their CR.

4. Business Consulting

Q. WHAT IS THE BUSINESS CONSULTING GROUP AND WHAT ARE ITS FUNCTIONS?

A. The Business Consulting group is responsible for designing and implementing system and process changes to improve the functioning and efficiency of CenterPoint Houston's transaction processing systems. The group also manages system and process changes that are necessary to comply with changes in Commission rules, ERCOT protocols, or other market rules. The business analysts in Business Consulting evaluate rule or protocol changes and then define business requirements that internal processes and systems must meet. Once the system changes are designed and programmed by TO, Business Consulting tests the changes to ensure that the requirements are met and that the system functions as designed. Business Consulting also leads the testing effort related to upgrades to the various transaction systems to ensure that the upgrades are implemented without impairing transaction processing.

In 2018, the majority of Business Consulting's efforts were directed toward a major project to replace CenterPoint Houston's CIS. The CIS project is discussed in more detail later in my testimony.

5. Program Management

Q. WHAT IS THE PROGRAM MANAGEMENT GROUP AND WHAT ARE ITS FUNCTIONS?

A. The Program Management group primarily manages CenterPoint Houston's responsibilities related to the SMT portal. SMT is an ERCOT-wide website that provides access to smart meter data to end-use retail customers, CRs, and other customer-authorized third parties. SMT is jointly owned and operated by CenterPoint Houston, Oncor Electric Delivery Company, AEP Texas Inc., and Texas New Mexico Power Company, under a JDOA. The parties to the JDOA contract with IBM for the design, development, and ongoing operation of SMT. Program Management works with the parties to the JDOA to ensure that SMT meets the requirements set out by the Commission and market, and that SMT interfaces seamlessly with CenterPoint Houston's systems.

Q. WERE THERE CHANGES TO SMT IN 2018?

A. Yes. In 2018, the Commission issued a final order in Docket No. 47472[1] which set out the required functionality for "SMT 2.0." The JDOA parties then began working with IBM to develop the detailed requirements for the changes to SMT that were necessary to comply with the Commission's Order. SMT 2.0 is expected to go live in December 2019. The revised business requirements for SMT 2.0 are included as an attachment to my testimony in Exhibit JRH-1.

[1] *Commission Staff's Petition to Determine Requirements for Smart Meter Texas*, Docket No. 47472, Final Order (Jul. 12, 2018).

Q. HOW ARE THE COSTS RELATED TO SMT TREATED IN THIS CASE?

A. The costs associated with the original version of SMT were recovered and reconciled in CenterPoint Houston's AMS surcharge proceedings. Since the final reconciliation of CenterPoint Houston's AMS costs in Docket No. 47364,[2] SMT costs have been accumulated in a regulatory asset for recovery in a future rate case. The regulatory asset and associated recovery is discussed by Ms. Colvin.

Q. HOW ARE CENTERPOINT HOUSTON'S SMT COSTS DIFFERENT FROM OTHER ONGOING EXPENSES?

A. Because SMT is operated in conjunction with the JDOA parties under the contract with IBM, CenterPoint Houston does not have the same ability to manage and reduce costs associated with SMT in the same way that we manage the costs of our internal operations.

Q. ARE THE SMT COSTS EXPECTED TO CHANGE IN 2019 AND BEYOND?

A. Following the final order in Docket No. 47472,[3] the contract between the JDOA parties and IBM was amended to cover the changes necessary to comply with the SMT 2.0 requirements, and to extend the term of the contract through 2024. CenterPoint Houston's share of the anticipated annual SMT costs for 2020 through 2024 is $3.6 million. The costs in 2019 are higher than they are anticipated to be in 2020 and after because they include the IBM costs associated with the changes being made to SMT to comply with the SMT 2.0 requirements from Docket

[2] *Application of CenterPoint Energy Houston Electric, LLC for the Final Reconciliation of Advanced Metering Costs*, Docket No. 47364, Final Order (Dec. 14, 2017).
[3] Docket No. 47472, Final Order (Jul. 12, 2018).

No. 47472.[4] The treatment of the SMT costs for the adjusted test year are also discussed in Ms. Colvin's testimony.

Q. WHAT OTHER FUNCTIONS DOES PROGRAM MANAGEMENT PERFORM?

A. Program Management also manages projects to deliver new processes or functionality necessary to meet customer and market needs. For example, in 2018, Program Management led a project to deliver daily AMS generation data for non-modeled generators in ERCOT. The availability of this daily generation interval data will help facilitate the installation of distributed generation facilities in the Houston area and ensure proper settlement at ERCOT. In addition, the group worked with CenterPoint Houston's street light department to design and implement a streamlined process for the installation of LED street lights.

III. MAJOR ONGOING MARKET OPERATIONS PROJECTS

Q. DOES MARKET OPERATIONS HAVE ANY ONGOING MAJOR PROJECTS?

A. Yes. Market Operations is or will be involved in several major projects continuing in 2019 and beyond.

Q. PLEASE PROVIDE EXAMPLES OF THE TYPES OF PLANNED MAJOR PROJECTS FOR WHICH MARKET OPERATIONS WILL BE RESPONSIBLE.

A. Market Operations is or will be implementing the following major projects:

[4] *Id.* at Ordering Paragraph No. 2.

CIS Replacement. CenterPoint Houston is currently in the midst of a major project to replace our mainframe CIS. The current CIS functionality will be migrated to the SAP platform. Market Operations personnel are involved in several significant aspects of this project, including requirements development, testing, and business readiness. It is anticipated that transition to the new system will take place in late 2019. CenterPoint Houston's current CIS dates to the 1980s, and has been significantly modified since 2002 to handle the requirements of the deregulated Texas market. Migrating from a mainframe environment to SAP will provide a system that is more easily supported than the current mainframe.

Meter Data Management ("MDM") Upgrade. After the completion of the CIS to SAP conversion, CenterPoint Houston will upgrade our MDM system to the vendor's latest version. The MDM is the repository for data from our AMS meters, and also manages the flow of service order transactions to and from the AMS meters. The MDM is critical to our mission of providing timely, accurate, and reliable performance of our market obligations, and Market Operations will participate fully in the testing and deployment of the upgrade.

IDR Meter Replacement. CenterPoint Houston will complete the conversion of our traditional IDR meters, which serve non-transmission large commercial and industrial customers with a peak demand over 700 kW, to AMS meters. Market Operations will be involved in several aspects of this project in order to test the functionality and assure the seamless processing of transactions related to IDR customers.

TX SET Release. From time to time, the market revises and updates the Texas SET transactions and related processes to implement changes in market rules and protocols, or to further automate various processes. The last full Texas SET update or "release" was in 2012. Market Operations will coordinate CenterPoint Houston's implementation of any future release, which will likely involve requirements definition, system change design, and testing.

Q. HOW WILL THESE MAJOR PROJECTS IMPACT THE WORKLOAD OF MARKET OPERATIONS?

A. The combination of major projects and the imperative to fulfill our responsibilities in the retail electric market will certainly ensure a significant workload in the coming years. Maintaining the Company's highly skilled and experienced staff and leadership is essential to providing the extremely high level of service to CenterPoint Houston's customers, business partners, and market stakeholders in a cost-effective manner.

IV. CONCLUSION

Q. WHAT IS YOUR OVERALL RECOMMENDATION IN THIS CASE?

A. I recommend the Commission find Market Operations' costs are reasonable and necessary because of the steps that Market Operations takes to manage costs according to established budgets and because the services Market Operations provides are critical to ensure that the Company successfully handles retail market electronic transactions and executes our responsibilities in the Texas competitive retail electric market.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes.

STATE OF TEXAS §
§
COUNTY OF HARRIS §

AFFIDAVIT OF JOHN R. HUDSON

BEFORE ME, the undersigned authority, on this day personally appeared John R. Hudson who having been placed under oath by me did depose as follows:

1. "My name is John R. Hudson. I am of sound mind and capable of making this affidavit. The facts stated herein are true and correct based upon my personal knowledge.

2. I have prepared the foregoing Direct Testimony and the information contained in this document is true and correct to the best of my knowledge."

Further affiant sayeth not.

John R. Hudson

SUBSCRIBED AND SWORN TO BEFORE ME on this 19th day of March, 2019.

PANDY LIVINGSTON
NOTARY ID #547552-2
My Commission Expires
March 21, 2022

Notary Public in and for the State of Texas

My commission expires: March 21, 2022