

Decision No. C11-0406

**BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF COLORADO**

DOCKET NO. 10I-099EG

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IN THE MATTER OF THE INVESTIGATION OF THE ISSUES RELATED TO SMART GRID  
AND ADVANCED METERING TECHNOLOGIES.

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**ORDER STATING CONCLUSIONS AND NEXT STEPS**

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Mailed Date: April 19, 2011  
Adopted Date: March 30, 2011

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**I. BY THE COMMISSION****A. Background**

1. The Commission, through Decision No. C10-0188 (mailed on March 3, 2010), opened Docket No. 10I-099EG to explore issues related to smart grid and advanced metering technologies. Through this investigatory docket, the Commission hoped to achieve a better understanding of the potential benefits and challenges represented by smart grid technologies.<sup>1</sup>

2. Although the SmartGridCity™ project of Public Service Company of Colorado was one of the catalysts for this investigatory docket, the objectives of this investigatory docket were expanded to examine and develop an understanding of the broad scope of issues surrounding smart grid and smart metering technologies and the potential opportunities they provide to improve the performance of Colorado's electric system.

3. In 2010, during the pendency of the docket, Commission Staff held four Commission Information Meetings (CIMs) on a range of issues related to smart grid. The topics addressed included the benefits and potential limitations of smart grid technologies as a carbon abatement investment, consumer issues and concerns, advanced metering as a platform for dynamic pricing and the varying range of consumer responses in savings benefits depending on feedback technologies and methods employed, new utility business models facilitated by smart grid technologies and evolving market structures, interactions with PHEVs (and renewable generation, distributed generation, and storage technologies), smart meters as a platform for a

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<sup>1</sup> This docket did not aim to address data privacy issues. Those issues are addressed in Docket Nos. 09I-593EG and 10R-799E.

home energy management services market, and interoperability and cyber security standards issues.

4. These CIMs and research conducted by Commission Staff helped refine the focus of the docket regarding specific issues to investigate. On October 1, 2010, Decision No. C10-1077 was issued, stating preliminary conclusions and requesting public comments in response to 14 questions covering an expansive range of topics. Comments were filed by four parties (the Office of Consumer Counsel, Tendril Networks, Inc., Public Service Company of Colorado, and Black Hills Corporation) on October 27 and 28, 2010.

5. Concurrently, the General Assembly initiated an exploration into smart grid through Senate Bill 10-180. Enacted in May 2010, the bill authorized the creation of a multi-stakeholder task force to address key components of smart grid policy development. The Colorado Smart Grid Task Force convened from June to December 2010 with the final report of recommendations issued and delivered to the General Assembly and the Commission on January 20, 2011.

6. The information from the CIMs, reports reviewed and compiled in the public record of this docket, the public comments filed by parties, the Colorado Smart Grid Task Force report, and research from other states and utilities are the basis for the conclusions and next steps presented in this Order.<sup>2</sup>

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<sup>2</sup> These materials are available on the web at [https://www.dora.state.co.us/pls/efi/EFI\\_Search\\_UI.Search](https://www.dora.state.co.us/pls/efi/EFI_Search_UI.Search), under Docket No. 10I-099EG.

**B. Conclusions****1. Regulatory Oversight of Smart Grid Related Utility Investments**

7. Throughout this Investigatory Docket we are cognizant that the multi-faceted and rapidly evolving nature of smart grid yields new regulatory challenges for the Commission. We see the need to clarify how the Commission provides appropriate regulatory oversight concerning smart grid investments. We also anticipate that over time the Commission will have to address the boundary between regulated and unregulated activities, particularly as smart meter technologies cause the regulated utility to interact with its customers on the customer's side of the meter.

8. We conclude that a clear definition of "smart grid" will be essential to effective regulatory oversight. Through this docket we have identified a number of definitions in use.<sup>3</sup> In our previous Decision in this Docket (C10-1077), we presented a definition of "smart grid technologies." Our discussion in this Decision continues to be based upon that definition. We anticipate that a formal definition will be addressed in a future rulemaking, as addressed later in this Decision.

9. The information gathered in this Docket, particularly about the experiences of other state commissions and utilities that are farther along in the implementation of smart grid technologies,<sup>4</sup> indicates that the smart meter is likely to be the most contentious aspect of smart grid, concerning consumer reaction and cost-benefit justification of the investment. We thus identify the need to address the "smart meter" distinct from all other smart grid technologies.

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<sup>3</sup> There are many varying definitions of "smart grid" in circulation including that offered by Title XIII of the Energy Independence and Security Act of 2007, modified definitions from other states (Illinois and California), and Colorado Senate Bill 10-180 authorizing the Colorado Smart Grid Task Force, among others.

<sup>4</sup> These states include California, Illinois, Ohio, Texas, and Maryland. In total, we researched smart grid deployment projects in 32 states and the District of Columbia.

10. We conclude that electric utilities should be directed, through a rulemaking, to file periodic smart grid plans with the Commission. We envision these plans addressing anticipated investments in smart grid technologies associated with the utility's entire system, from generation to the customer meter. We envision that a smart grid plan would explain the function, cost, and objectives of each smart grid investment, including direct benefits and anticipated and synergistic benefits. We look forward to these ideas being expanded upon and responded to in a future rulemaking proceeding. It is in such a proceeding that we also envision that the Commission's rule will incorporate a formal definition of smart grid, taking into consideration the definitions cited above.

11. Separate and distinct from the smart grid plan discussed above, we conclude that when utilities anticipate upgrading automated meters to smart meters, they should submit to the Commission a smart meter plan in the form of an application. We envision this as a component of the future rulemaking discussed in paragraph 10, above. Without limitation, we offer the following as possible components of such a plan: number and type(s) of meters to be installed; quantified goals associated with the meters (over time), such as impact upon usage, peak load, demand side management (DSM) participation, etc.; minimum consumer participation levels required to achieve the goals; cost/benefit analysis calculations and underlying assumptions; a detailed consumer education and outreach plan, including underlying consumer segmentation study; and an assessment of potential detrimental impacts on low-income and other vulnerable consumer groups.

## **2. Smart Meters as a Platform for Implementing Dynamic Pricing**

12. Our investigation of smart meters indicates that one of the primary benefits of their installation is as a platform for dynamic pricing. To date, most wide-scale implementations

of smart meters have occurred concomitantly with pilot tests of more dynamic pricing rate structures.

13. We observe from the SmartGridCity™ pilot, as well as from smart meter installations in other states, that the residential customer class is far from homogeneous in terms of usage, attitudes, values, and interest level relative to energy service needs and expectations. We note that this diversity is a significant factor affecting how residential customers are likely to respond to a smart meter, particularly if this meter is installed concurrently with a change in rate design. We conclude that system-wide smart meter implementation concurrently with system-wide changes in rate design is likely to elicit negative customer reactions, regardless of the quantity and quality of the associated customer education undertaken.

14. We also note that the “diffusion of innovation”<sup>5</sup> concept, which explains how product acceptance occurs in a market, is applicable to smart meter implementation. The targeting of smart meters and dynamic pricing to the segment of residential customers most receptive, while limiting the short-term benefits to the overall system, also limits the negative customer reactions that, if unabated, can preclude achieving any long-term benefits.

15. We are also aware that strategies such as customer segmentation, product targeting, and the related marketing and communications tactics have not been core competencies expected of a regulated utility operating as a monopoly. Yet, these strategies and tactics are very relevant to effectively implementing smart meters and dynamic pricing.

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<sup>5</sup> See the explanation of Everett Rogers' 1962 Diffusion of Innovations model and its relation to achieving greater levels of consumer adoption of smart meters and dynamic pricing in the Smart Grid Consumer Collaborative's “2011 State of the Consumer Report” filed in the Investigatory Docket.

16. Based upon our assessment of available information concerning smart meter and dynamic pricing implementations, we adopt the following as guiding principles concerning how such implementation should occur in the regulated markets of Colorado:

- i. Utilities should incorporate the “diffusion of innovation” concept into smart meter and dynamic pricing implementation planning; initially, smart meters and dynamic pricing should be optional and their promotion targeted.
- ii. Through customer segmentation and targeted marketing, those customers most desirous of these changes should be engaged first, gradually moving outward through the segments.
- iii. As smart meter implementation is expanded across a service territory, some customers may be interested in staying with the current rate. Such an option makes sense in the near term to reduce negative customer reactions, yet, over time these customers should be “nudged” toward increased interaction with the smart meter, by gradually making the default option more dynamic.
- iv. Utilities are encouraged to develop the core competencies of customer segmentation and targeted marketing associated with offering products into a diverse and dynamic market. Such skills, which are integral to the success of a smart meter/dynamic pricing implementation, should be secured as either internal resources or by engaging outside expertise.

### **3. Smart Meters and Consumer Education**

17. Our assessment of smart grid related consumer surveys and market studies indicate that there is a general lack of consumer awareness and understanding of smart grid technologies, including smart meters.<sup>6</sup> Since the cost justification for smart meters will likely rely, at least in part, on benefits resulting from expected shifts in consumer behavior, we note that significant consumer education efforts are critical. Consumer education is necessary to mitigate

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<sup>6</sup> The Smart Grid Consumer Collaborative’s “2011 State of the Consumer Report”, filed in the Investigatory Docket, cites numerous consumer studies speaking to this knowledge gap. In one recent market study by Market Strategies International, only one in five could claim an understanding of the benefits of a smart grid and less than a quarter could claim an understanding of the benefits of smart meters.

the risk that these benefits will not be realized due to lack of consumer awareness, knowledge, or interest.

18. We conclude that detailed consumer education plans should be filed in the smart meter applications developed via formal rulemaking as discussed in paragraphs 10 and 11. These plans should determine the most effective, cost-controlled consumer engagement methods and strategies to achieve minimum participation necessary to realize expected benefits. Thorough consumer segmentation studies need to underlie these consumer education plans. Consumer education plans should also involve a plan for stakeholder collaboration and propose multiple channels for consumer engagement.

19. Furthermore, through the formal rulemaking, we envision developing performance metrics specifically tied to consumer education and engagement that could include quantifications of consumer awareness, understanding, interest, participation, and satisfaction. The rulemaking discussed above should address whether the achievement of performance benchmarks using these performance metric targets related to consumer education and engagement should ultimately be connected to cost recovery.

20. Given consumer diversity, the traditional mass single channel educational and marketing strategies are likely to be insufficient to achieve desired rates of consumer understanding, participation, and satisfaction. Some utilities in other states<sup>7</sup> have begun to implement stakeholder involved, multi-channel consumer education and engagement

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<sup>7</sup> See presentations filed in the Investigatory Docket on strategic approaches to consumer engagement from Southern California Edison and AEP Ohio.

plans rooted in underlying consumer segmentation analyses. Such an approach takes full advantage of the diversity in consumers' energy usage profiles and attitudes, values, and interests relating to electricity service needs and expectations.

21. As with consumer segmentation and product targeting discussed above, we acknowledge that consumer education of the scale and scope required for smart meter deployment and dynamic pricing implementation has not been a traditional responsibility of utilities. We encourage utilities to incur the costs necessary to access these capabilities--either developing these capabilities for the long-term or seeking external assistance and expertise where needed.

#### **4. Smart Meters and Low-Income and Vulnerable Customers**

22. As smart meters are deployed, low-income customers are a unique customer group with special needs and there are other vulnerable customers groups that will also likely need special protections, such as the elderly, those medically assisted by electric-powered devices, and the homebound.

23. We note three areas of concern regarding smart meters and low-income and vulnerable customer groups: potentially adverse financial impacts from dynamic pricing programs facilitated by smart meters; the potential erosion of consumer rights and protections from remote disconnections or installed service limiters; and the limited access that low-income customers may have to advanced technology devices, such as in-home displays (IHDs), that may mitigate potentially adverse financial impacts from dynamic pricing programs.

24. There is currently an ongoing debate regarding the potential negative financial impacts that dynamic pricing programs may have on low-income and vulnerable customer groups. We acknowledge the need for further research and analysis on the impacts of dynamic

pricing on any low-income and vulnerable customer groups in a regulated utility's particular service territory before the implementation of a dynamic pricing program that could adversely affect these consumer groups.

25. We note that some low income issues may be addressed in the Low Income Energy Assistance Docket (11R-110EG). With the conclusion of that docket, we will likely need to determine what issues presented remain to be resolved.

26. We anticipate opening an investigatory docket to address some of the noted issues affecting low-income and vulnerable customers. We offer the following as possible areas of investigation:

- i. The degree to which assumptions about the impacts of dynamic pricing on low-income and vulnerable customer groups from existing pilots are relevant to such customer groups in the regulated utility service territories in the state;
- ii. Whether existing disconnection rules provide adequate consumer protection from remote disconnections during critical weather events (cold winters, hot summers), on weekends and holidays when local utility offices may be closed, and for customers reliant on electric-powered medical assistance technologies;
- iii. Consideration of a weather moratoria rule regarding disconnections;
- iv. Whether in-person visits prior to a service disconnect should be required practice;
- v. Guidelines as to when utilities should be allowed, if at all, to require customers to prepay for service or have service limiters in place; and/or
- vi. Whether low income access to advanced feedback technologies such as in-home displays (IHDs) can mitigate potentially adverse financial impacts from dynamic pricing and, if so, how costs can be lowered to increase access to such technologies.<sup>8</sup>

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<sup>8</sup> Some examples of utilities that have launched pilots in which increasing low income access to more advanced, expensive technologies such as IHDs is a significant focus include SDG&E, CenterPoint Energy, and Entergy.

## 5. DSM Issues and Smart Grid

27. As we noted in Decision No. C10-1077, “Demand response, or the ability to shape the load curve, is a foundational element of smart grid.” In that same Order it was also noted that “[t]wo smart grid technologies enable consumer energy efficiency: feedback to consumers and time-based pricing.” Our further investigation into smart grid, particularly smart meters, affirms those preliminary conclusions and accentuates the value of smart meters as a platform for furthering demand response (DR) and DSM objectives.

28. Our inquiry into the role of smart grid/meters within DR and DSM also raises critical regulatory questions, such as: the cost-effectiveness of smart meters as a DR and DSM platform; the relative value of smart meters as a feedback strategy as compared to alternatives; and the attribution of system efficiency improvements resulting from smart grid technologies toward DSM goals. The record in this docket has provided new insights into these questions, and has identified what is still unknown. At this time we defer commenting on these questions in recognition that these questions are part of Docket No. 10A-554EG which is still before us.

## 6. Smart Grid and New Technologies – Electric Vehicles, Distributed Energy

### a. Resources and Storage

29. We acknowledge that, at some future point, a “critical mass” penetration of electric vehicles (EVs) will have a significant and potentially adverse impact upon the electric grid, particularly regarding peak demand. A clear price signal will be critical to shaping this new demand and making it a net benefit to the system by “filling valleys” instead of exacerbating peak demand.

30. We anticipate opening an investigatory docket to begin to address potential impacts and regulatory implications of significant EV penetration in the state. In such a docket, the Commission could begin to adopt guidelines and principles concerning EV charging and investigate potential system impacts, tariff structures, and additional infrastructure and regulatory needs related to charging points, along with attendant potential privacy concerns depending on the market structure of charging points.

31. We also find that smart grid technologies can facilitate more efficient use and integration of distributed generation, renewable energy, and storage technologies. However, the record in the Investigatory Docket did not provide sufficient content to offer any particular recommendations for regulatory actions at this time. This is an area of ongoing research and investigation.

#### **7. Articulating Specific Learning Opportunities Related to SmartGridCity™**

32. In Decision No. C11-0139 (mailed February 8, 2011) of Docket No. 10A-124E approving a SmartGridCity™ certificate of public convenience and necessity, the Commission stated that “the Company needs to “re-boot” the SGC project and restore some of the promise [the] concept originally held” and that “[i]f the Company demonstrates in a future application<sup>9</sup> that the SGC project has a coherent and valuable future, we may allow the Company to recover the balance of the investment disallowed in this case.” We note that SmartGridCity™ can function as a valuable learning platform in many areas presented herein where further

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<sup>9</sup> The Decision notes that at minimum such future strategic plans should “summarize how advisory groups are being engaged, identify smart grid investments and how such investments (or the Knowledge gained) will benefit customers and grid operations.” The Decision further states that advisory groups should be comprised of academics, researches, and customers.

information and knowledge are needed. We articulate here some specific learning opportunities of interest to the Commission that SmartGridCity™, as a live pilot, could take advantage of:

- i. Consumer segmentation and behavioral analyses with insights into consumer interests and motivations, responsiveness to dynamic prices, and assessment of relevance of results to service territory as a whole;
- ii. Comparison of various feedback strategies with varying technological complexity and cost;<sup>10</sup> and
- iii. An assessment of the effectiveness and cost of various consumer education and outreach approaches, including implementation of stakeholder involvement and multi-channel strategies.

## 8. Cyber Security

33. The introduction of smart grid information technology and telecommunications network architecture into the electric system introduces cyber security risks. We are cognizant that the National Institute of Standards and Technology has developed cyber security risk mitigation standards that are currently before the Federal Energy Regulatory Commission (FERC) for consideration and adoption. We are also aware that once adopted, these standards will assist the electric energy industry with mitigation of these types of threats.

34. In the interim, we advocate the electric utilities deploy industry “best practices” on cyber security risk mitigation. Such practices should include, for example, updating of risk mitigation software as Colorado’s electric utilities rollout smart grid components and as utilities expand their use of the latest information technologies and communication networks.

35. Following FERC’s adoption of standards, we anticipate soliciting the counsel of cyber security experts concerning the adoption or modification of these national standards along

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<sup>10</sup> A range of options should be explored, such as feedback vehicles requiring minimal technology available and downloadable information on the Internet, and more advanced technologies like IHDs.

with recommendations for policy development and practical application of these technical requirements.

## 9. Smart Meter Issues on the Horizon

36. Finally, we note an additional issue on the horizon related to smart meters. This relates to the market for smart meter data. At the conclusion of the Data Privacy Docket (10R-799E), we anticipate, via a future rulemaking proceeding, needing to provide regulatory certainty around access, and use, of this data. This future rulemaking may result in rules addressing the following issues: data access and sharing, utility asset usage and cost allocation issues, valuing of the data when it enters the market (in aggregated form) as a “product,” who benefits when such “products” yield revenues for the utility, and overall policy regarding the opening and development of this marketplace.

37. As noted in Decision No. C10-1077, this investigatory Docket was opened to “understand the scope and the potential for smart grid and smart metering technologies to improve the performance of Colorado’s electric system.” Having received comments from parties, received presentations from external experts, and conducted extensive research on a broad range of topics related to smart grid and smart metering technologies, via this Investigatory Docket, the Commission has achieved a better understanding of the potential benefits and challenges represented by smart grid technologies. The Commission deems the objectives of the Investigatory Docket to have been achieved, identifies appropriate next steps, and now orders this Investigatory Docket to be closed.

**II. ORDER**

**A. The Commission Orders That:**

1. The "Conclusions" section above serves to summarize the conclusions, observations, and appropriate next steps resulting from this Investigatory Docket.

2. This Investigatory Docket, having achieved its objectives, is now closed.

3. The 20-day time period provided by § 40-6-114, C.R.S., to file an application for rehearing, reargument, or reconsideration shall begin on the first day after the effective date of this Order.

4. This Order is effective upon its Mailed Date.

**B. ADOPTED IN COMMISSIONERS' WEEKLY MEETING  
March 30, 2011.**

(S E A L)



ATTEST: A TRUE COPY

THE PUBLIC UTILITIES COMMISSION  
OF THE STATE OF COLORADO

JAMES K. TARPEY

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MATT BAKER

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Commissioners

Doug Dean,  
Director

CHAIRMAN RONALD J. BINZ VOTED TO  
ADOPT THIS ORDER BUT RESIGNED  
EFFECTIVE APRIL 8, 2011.