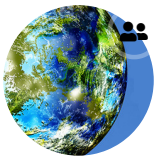

The Energy Collective Group

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POST

"51 Billion to Zero"

CHARLES BAYLESS
Retired CEO Tucson Electric Power
Mr. Bayless is a retired Utility Executive and a lecturer on Energy Policy, Climate Change and Ocean Acidification. Until June 30, 2008 Mr. Bayless was President and Provost of the West Virginia...
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By Andy Bennett, CEO of mPrest, Inc. & Charles E. Bayless, Board Member at the Puerto Rico Electric Power Authority

Bill Gates opens his new book, "How to Avoid a Climate Disaster," with this provocative thought: The world is emitting 51 billion tons of greenhouse gases annually; to avoid a climate disaster, we need to reduce that to zero. To get there, changes in the electricity sector will undoubtedly need to occur – and occur rapidly – to avoid catastrophic climate change in the next decades.

Fossil fuels account for approximately 60% of electricity generation in North America, according to the U.S. Energy Information Adminstration. In their "Statistical Review of World Energy 2020" report, BP says that 84% of global energy consumption was comprised of coal, oil, and natural gas generation. CO_2 emissions from energy production declined slightly to 31.5 gigatons in 2020 due to the COVID-19 pandemic, according to the In-

ternational Energy Agency. But in 2018, they accounted for about 27% of global CO_2 emissions, per the Environmental Protection Agency. This is only slightly less than emissions caused by the second-largest source of greenhouse gas, transportation. Concerns about climate change, the falling prices of wind and solar generation and the declining costs and greater capacities of batteries, have all driven rapid growth in grid-connected renewable energy resource installations. We expect this growth in smaller, renewable energy resources to continue, partially displacing large, centralized generation centers to meet electricity supply requirements.

Currently, there are more than one million electric vehicles (EVs) on the roads in the U.S., with estimates that there will be almost 20 million more by 2030, representing 90% of all vehicles sold by 2040. These vehicles can act as storage or a load, enabling a higher degree of load shaping and additional energy supply during critical peak periods. The move from natural gas to electricity for heating water and homes also creates a potential resource pool that can be utilized to shape demand, reducing electricity production during peak periods while not affecting customers' comfort levels at home.

While the move to vast amounts of "greener" energy is good news, there are many additional political, economic, social, and technical obstacles that need to be addressed. Political challenges include finding the right mechanisms to encourage reduced use of fossil fuels and increased use of emissions-free energy, such as changes to fuel subsidies and taxes on carbon. These mechanisms can rapidly impact the economics of the continued use of fossil fuels versus zero-emitting alternatives. Social issues may include addressing barriers such as "range anxiety" for EVs and concern over possible increased costs for electricity consumption. All of these are complex, multi-faceted opportunities that need to be recognized by governments, regulators, and private businesses to facilitate the shift to non-emitting electricity generation.

In the future, distributed generation and batteries, demand-side management (DSM), EVs, and an overall significant increase in producers will bring a new complexity to the grid, requiring new solutions for monitoring, data analysis, reliability, and control of the grid. Today's grid is comparable to a system with one hundred 1000 MW elephants. Tomorrow's grid will be similar to millions of 1 MW cats, albeit greener cats, but still cats.

In the short-term, new market designs, connection rules, operational protocols, and software will enable the grid and operate these new elements within the existing grid designs and limitations. In the long term, new tools will be needed. These tools would support receiving millions of inputs per second and make optimum economic decisions while preserving system reliability and security of what has been called "the most complex machine in the world" - our electric grid.

In the future, such an optimized grid will allow lower-cost generation in one service territory to support customers in other service territories across the U.S. It will enable peer-to-peer transactions, automatic peak shifting, and optimization of battery and EV charge and

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discharge. It will allow renewable energy to be placed in areas such as the Desert Southwest and transferred to metropolitan load centers on a nationwide HVDC Grid, and will do so while continuing to maintain reliability in an increasingly complex system.

Today's grid and electricity markets rely on software systems and tools built over the last several decades to support the grid of the past. The future grid, whose design and requirements are apparent today, will require grid topology-aware platforms with analytics-based orchestration and control. Thus, the future grid will bring optionality and value to producers and customers, allowing producers to sell across distance and time and consumers to access many producers and products.

Some argue that "There aren't enough distributed energy resource (DER) renewable generation facilities, batteries, etc., today to cause a problem, so why invest in tools to manage that now?" NASA did not wait until the Apollo Spacecraft was built until it designed the control system; Boeing and Airbus do not wait until the plane is designed to consider the control system. Neither should we.

Today many of these newer software tools address specific areas and, therefore, a subset of the issues. To achieve a genuinely optimal result, we need programs that can consider the totality of the problem. An example is the human body. If we start by enhancing each component, by making the heart beat as fast as possible and the adrenal gland produce adrenalin as quickly as possible, it is unlikely that we would consider the result to be the most ideal. A true optimum can only be obtained by considering all of the variables.

Further, only a coordinated program can assess the reliability parameters that individual plans cannot. Anyone who has ever tried to site a plant knows of the years of stability studies that can result. Transmission operators understand that a failure on one line can affect operations several states away, and as complexity grows, N-1 conditions will also grow. Only a big picture program, aware of all the decisions, can adequately ensure economic optionality and reliability.

We must invest today in tools to comprehensively analyze, forecast, and optimize the dispatch of DER load-shaping programs, battery storage and discharge, weather analysis, load forecasting, optimization, reliability, and more.

Distributed energy resource management systems (DERMS) are currently under development and in early commercialization. DERMS are rapidly evolving to help manage the emerging resources that minimize new investments in the existing grid while providing fairness to customers with DERs, batteries, DSM and more, as well as those without DERs. While there may only be a relatively small number of distribution and transmission systems impacted today, the rapid acceleration of change in our grid requires us to continue to develop for tomorrow with solutions we can deploy today.

"The dogmas of the quiet past are inadequate to the stormy present. The occasion is piled high with difficulty, and we must rise with the occasion. As our case is new, so we must think anew and act anew." Abraham Lincoln

About the Authors

Charles E. Bayless is a member of the Board of Directors of the Puerto Rico Electric Power Authority and a retired Utility Executive and University President.

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AS MOMENTUM BUILDS FOR A CLEAN ENERGY STANDARD, UTILITY TRADE GROUP GETS ON BOARD - WITH PUSH FOR PARTIAL GAS CREDITS - MORNING CONSUCLT

Totally agree with EEI on this proposal. We need all of the clean/green (zero emission) resources in the fleet to help combat climate changes. Even pumped hydro should count toward decarbonization goals, IMO.

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