User-centric Sustainability

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The past few columns of Energy Viewpoints have discussed a range of topics related to decarbonization of the grid and various types of infrastructure such as cloud data centers. In this column, I'd like to delve into how individuals can make a difference by contributing to various decarbonization efforts.

As individuals, our carbon footprint comes from our daily activities—how we commute to work, how much electricity we consume, and what goods and services we buy or use. Reducing our carbon footprint will require us to change how we perform some or all of these daily activities and opt for greener choices. Making these changes will often require us to change our behavior and greener choices may come at a monetary cost, not unlike buying organic produce that tends to cost more. In some cases, greener choices may also impose an inconvenience, which may not always be acceptable to the user.

Let's consider some examples. A switch to electric vehicles has been underway in parts of the world, which substantially reduces emissions when compared to using gasoline or diesel-based automobiles. However, electric cars still cost more than their gasoline counterparts and range anxiety of not finding a charging station when needed remains a big barrier. Similarly, a switch to green electricity has meant either installing solar arrays on home roofs or buying electricity from a provider who sources green energy from solar or wind generators. Installing solar arrays requires a large upfront investment and is not an affordable option for many individuals. Buying electricity from providers who source green energy is an easier option for many—if the option is available to them—but there is often a surcharge for this option.

In the meantime, real-time knowledge of when the electricity supply is green is becoming widely available. For example, Apple has included this functionality into their iOS operating system recently through a feature called grid watch, which shows a prediction of when clean energy will be available at that location over the next 12 hours. Apple devices also offer a green charging option to charge phones and other devices based on these estimates. It is interesting to consider how a user should use such information to reduce their carbon emissions. One option is to perform certain chores during periods when energy supply is green. For example, one could postpone their laundry to periods when green energy is available. This requires a change of behavior where routines may need to be changed to do the chores at an inconvenient time—e.g., if the predicted window of green energy is late at night. Since users may not always be willing to make such changes to their routines, a better option is to build more intelligence into devices and appliances. For example, one could load the laundry as per their normal routine and leave it to an intelligent washing machine to choose the most opportune green time slot to start the laundry cycle. In this case, the user does not change their routine and only has to deal with a somewhat longer wash cycle before their laundry is done. Designing intelligent approaches that automate greening of various chores while reducing the burden for the end user is a rich and open area of research. Some of these ideas are being explored in the domain of greening EV

charging but much more remains to be done. As researchers, providing end-users with easy-to-use sustainability solutions will go a long way to gaining broad adoption of these ideas.

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