

What's In Store For Vermont

Betts Delivers Climate Challenge at WEC Annual Meeting

The climate, in a sense, is a living machine. The component parts of the machine include energy (heat and light) from the sun, water in its various forms (crystal, liquid, vapor), carbon dioxide, and of course life. Their interplay sets forces in motion. That, in turn, sets the course of the machine.

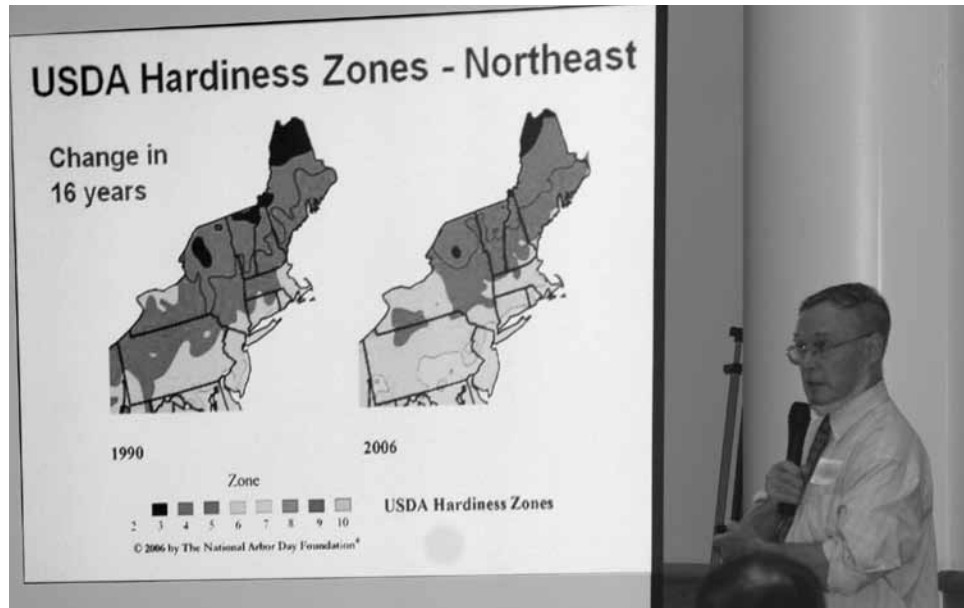
For the past several decades their interplay has increasingly been influenced by humanity's affect upon the environment – a teeming swarm now of seven billion people whose capacity for consuming and emitting has been magnified a thousand-fold by industry and technology. Consequently, the machine has been churning out warmer, shorter winters in Vermont, and measurably longer growing seasons. The latter has its benefits, but they come with a price.

In his address to the Washington Electric Cooperative members who attended WEC's Annual Membership Meeting on May 24, titled "Climate Change—What's in Store for Vermont," Dr. Alan Betts, of Pittsford, Vermont, did not use the analogy of the machine. Yet his more scholarly term, "climate feedback processes," conveyed a similar impression of forces set in motion which fuel themselves and rev the engine of climate change.

Betts contributes to scientific publications as well to publications for a general readership, including the Environment section of *The Sunday Times Argus*. Many people in his audience of Washington Electric members, staff, and guests might have had difficulty following his scientific observations, but when he described his experiences as an avid gardener in Vermont he was on more familiar ground.

"If someone had told me thirty years ago that I'd be turning my cover crop in January I would have laughed at them," said Betts, relating a recent experience. "Think of this last winter as a model for what's going to become more typical."

The 2011-2012 winter was one of the warmest on record, and was a winter,



This year's guest speaker at the Co-op's Annual Meeting was Dr. Alan Betts, of Atmospheric Research, based in Pittsford, Vermont. He described the causes and manifestations of climate change, particularly in how it affects what Vermonters see around them. Betts also has a cooperative connection: His grandparents were members of the Rochdale Society of Equitable Pioneers, in Rochdale, England – hailed as the first modern co-op, whose Rochdale Principles were adopted as what we now know as The Seven Cooperative Principles.

the Pittsford resident said, "in which we essentially had no permanent snow cover west of the Green Mountains.

"Over the next twenty to thirty years climate change in Vermont is going to accelerate. If we keep it up Vermont is going to have a climate like northern Georgia," said Betts. "If we moderate the burning of fossil fuels we'll be more like Pennsylvania."

Neither scenario included Vermont staying like Vermont. As Betts revealed, in comparisons of winter durations of frozen soil and of ice-out dates at Joe's Pond in West Danville and Stile's Pond in Waterford, it already doesn't.

"This winter we only had 67 days of frozen soil where I live," he said. "First and last frost dates are changing. The frost-free period used to be much shorter than the period when frost was likely, but they have been converging over the last decade."

Betts' essays have made several observations: that Stiles' Pond these days is frozen four weeks less, on average, than it was 40 years ago (by

extension, similar changes have taken place for other small lakes); that the growing season for frost-sensitive plants has increased by two weeks during that period; that mean winter temperatures in Vermont have risen by about 4.5° Fahrenheit over the last 50 years. As for Vermont's beautiful Lake Champlain, Betts' 2011 publication,

"Vermont Climate Change Indicators," describes a startling difference between "then" and "now":

"During the nineteenth century," he wrote, "the main lake remained open in winter only three times, but it remained open for almost half of the years between 1970 and 2007."

Reving the machine

The reason for these climate changes is the accumulation of greenhouse gases (GHG) in the atmosphere. Burning fossil fuels for industry, for energy, for heating and cooling, and for transportation, increases atmospheric carbon dioxide (CO₂) by about two parts per million per year, according to Betts, and while that impact itself is not enormous it accelerates the accumulation of water vapor, the dominant GHG, in the atmosphere.

This blanket of greenhouse gases reduces the natural radiant cooling of the earth so overall warmth increases, Betts explained. In winter, over much of the north (Vermont included) snow cover cools the earth by reflecting the sun's heat back into space, but the pattern of warming melts some of the snow. The "machine" is now fully

engaged. Greater warmth melts snow and then thaws the earth's surface, leading to more evaporation and increased water vapor.

Betts explains: "As Vermont's climate warms, and the length and chill of the cold season decreases, this is likely to lead to reduced snow cover. The first heavy snow is coming later in the year, sometimes even shifted into January." Indeed, Vermonters commonly remark on this phenomenon – no snow for tracking deer in November, snow machines sitting idle until after Christmas.

Related trends that Betts describes in his speeches and writings show the effect of warming on other seasons. As moisture in the air increases, heavy rains and flooding become more frequent. Our communities then become more vulnerable to the potential destruction of storms like those of May and August of 2011.

Long odds

"I don't know what it's going to take to get our attention," Betts said at the WEC Annual Meeting. "Maybe extreme weather. There were 32 weather disasters costing more than \$1 billion in 2011. Texas and New Mexico have experienced the most extreme drought in more than a century."

Meanwhile, China and India are fueling their manufacturing growth predominantly on coal, the most egregious of the fossil-fuel GHG emitters. And Betts cited perhaps the most powerful force against climate-change action:

"There's more than \$20 trillion of fossil fuel resources that have yet to be exploited," he said, "and with growing competition for them their value is increasing."

There is no easy remedy – no way to reconstitute the atmosphere as it was prior to the Industrial Revolution. But Betts advocated a course of action, potentially attainable, which might forestall the worst-case scenario of Vermont's climate becoming like Georgia's, weather becoming almost a mortal enemy, and life forms disappearing all over the globe.

The step we need to take, he said, "is to rather drastically decrease the burning of fossil fuels, by 80 percent by 2050."

Better to know that now than waiting until 2020, when the numbers will only be worse and the clock will be running out.

For further information from Dr. Betts on climate change, see <http://alanbetts.com/writings>.



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