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Scott Hubbard and Charles Kennel: The opportunity in climate change

**By Scott Hubbard and Charles Kennel -
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California is in a powerful position to take a leading role on the pressing issue of climate change.

The recent report on global climate by the Intergovernmental Panel on Climate Change states that "the rate of warming between now and 2030 is likely to be twice that of the previous century." The panel is 90 percent certain that we humans are responsible for the climate change we have seen, and says that more is on the way -- from polar ice cap melting to increasingly extreme weather events.

The California Energy Commission has already begun forecasting how climate change will affect California. That forecast led to Gov. Arnold Schwarzenegger's actions on greenhouse gases. Soon, in every part of our state, citizens, businesses and governments will be called upon to decide how we should deal with the coming decades of change. California will need to think globally, predict regionally and act locally.

Global warming will produce many different local effects. Extreme temperatures in different regions may be much higher or lower than normal. Rainfall may be more or less than 100-year extremes. Snowpack in the Sierra Nevada may vary from year to year even as it declines on average. The frequency of wildfires will change.

Sometimes small changes can have large effects. In Yellowstone Park, a slight rise in average temperature may have opened vulnerable ecosystems to predation from insects and diseases, but we need more data to be sure.

Sometimes two things might act together. A storm surge off the Northern California coast could combine with unusually heavy downpours to swamp our aging levee system, threatening the 6 million Californians who live nearby. The risks from such "perfect storms" will slowly increase year by year as sea level rises in the background.

Without global data, everyone is at risk of flying blind as the climate changes. The federal government and our elected officials must provide funding to extend the life of the current Earth Observing System, design a new system and get it built. But that alone is not sufficient.

Regional climate studies are the next frontier of climate research. California should proceed to build specialized computer models and measurement systems covering every part of California and not rely on the few data points from global models.

We need to develop our own measurements of mountain snowpack, river flows, coastal ocean circulation, air pollution and circulation, earthquakes, soil moisture, fire hazard, fish populations and many other things. It may be necessary for us to build and launch a "Cal-Satellite" that could collect specific data to fill in the gaps from the NASA and NOAA missions.

Finally, we must connect what we learn with what we know about our economy and society, to support decisions about insurance, agriculture, finance, tourism and basic infrastructure. (How

high should we build those levees so they will be good 50 years from now?)

California has all the tools for this effort. The University of California, Stanford, Cal Tech, the University of Southern California and the state's other world-class universities provide the breadth of expertise needed to understand the human as well as the environmental impacts of climate change. From the UC San Diego Supercomputing Center in the south to NASA Ames and Lawrence Livermore National Laboratory in the north, we have a huge and growing supercomputing capacity.

California industry built, among others, the Earth observing flagship satellites Terra and Aqua, and launched them from Vandenberg Air Force Base. The Jet Propulsion Laboratory in Pasadena designed many important Earth science instruments. Institutions such as the Scripps Institution of Oceanography build major observing systems on land and in the ocean.

Our business climate will be important as well. Despite gloomy predictions that caps on greenhouse gases will lead to job loss, California entrepreneurs are betting that huge new markets for technologies and services are about to emerge. According to a recent study by Joint Venture Silicon Valley, California's investment in clean technology grew 266 percent from 2005 to 2006. "Greentech and cleantech" will provide a new job boom.

By building the climate system we need, California can lead the world in the next phase of climate study and action. Our efforts can keep our state beautiful and our bountiful economy the envy of the world.

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