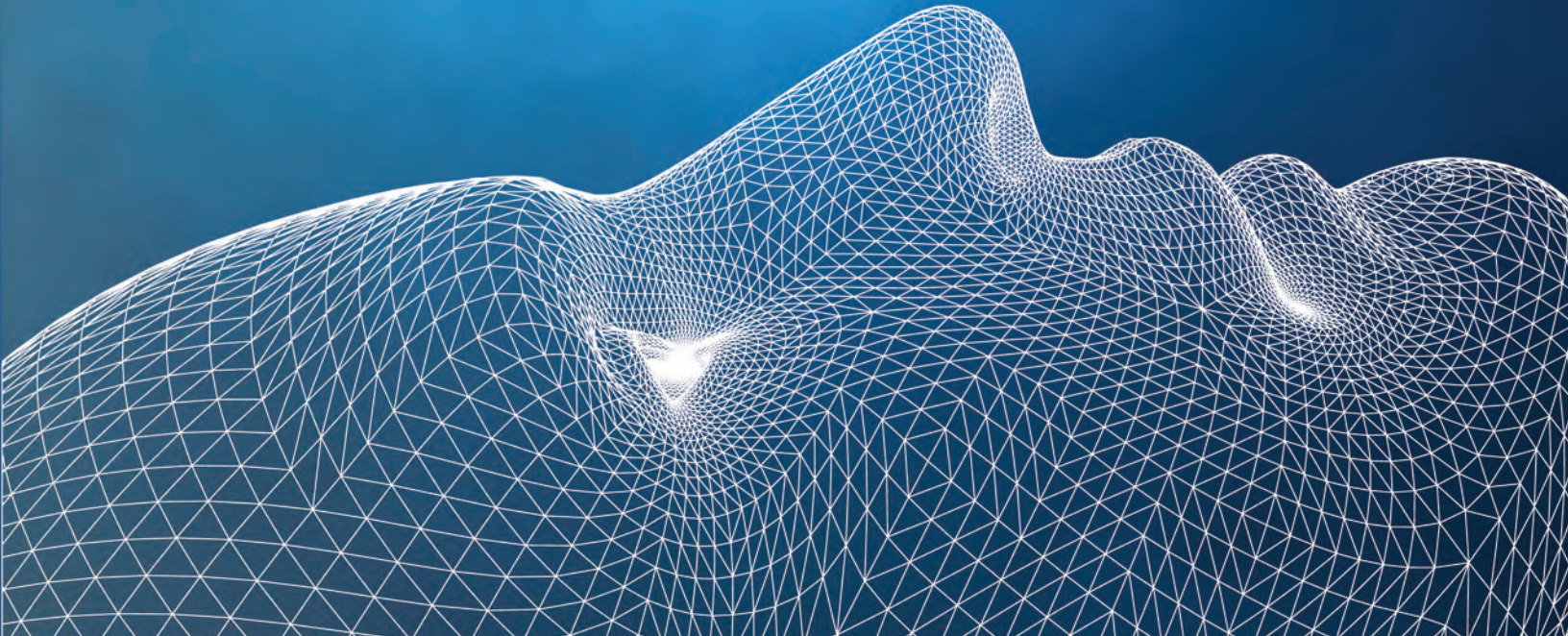
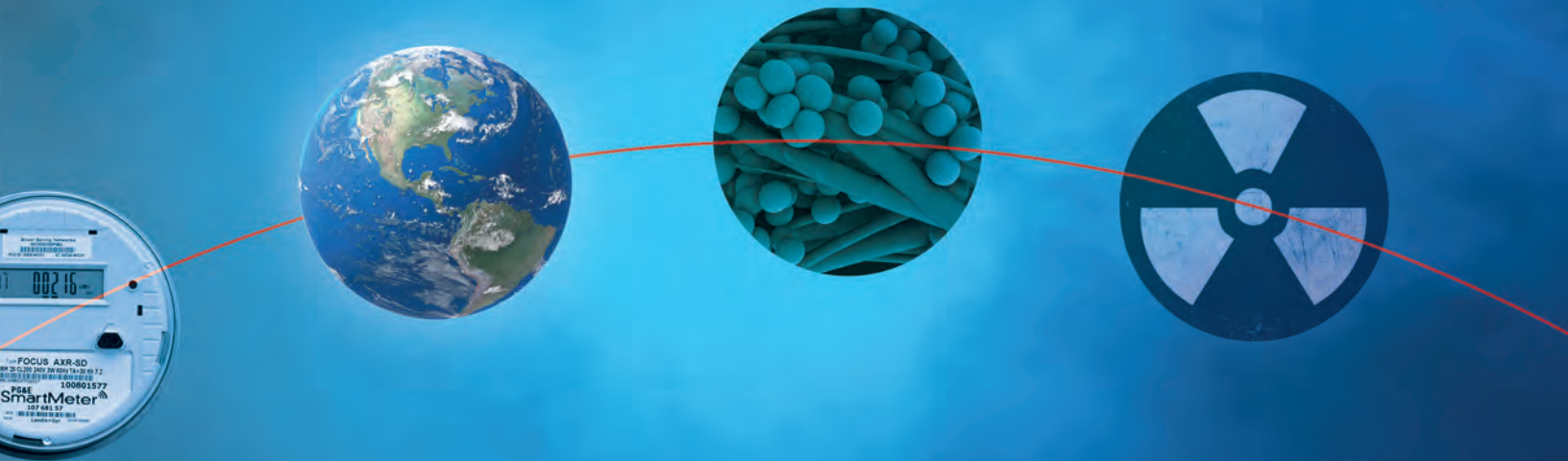


CCST Annual Report

**SCIENCE AND THE  
PUBLIC TRUST**

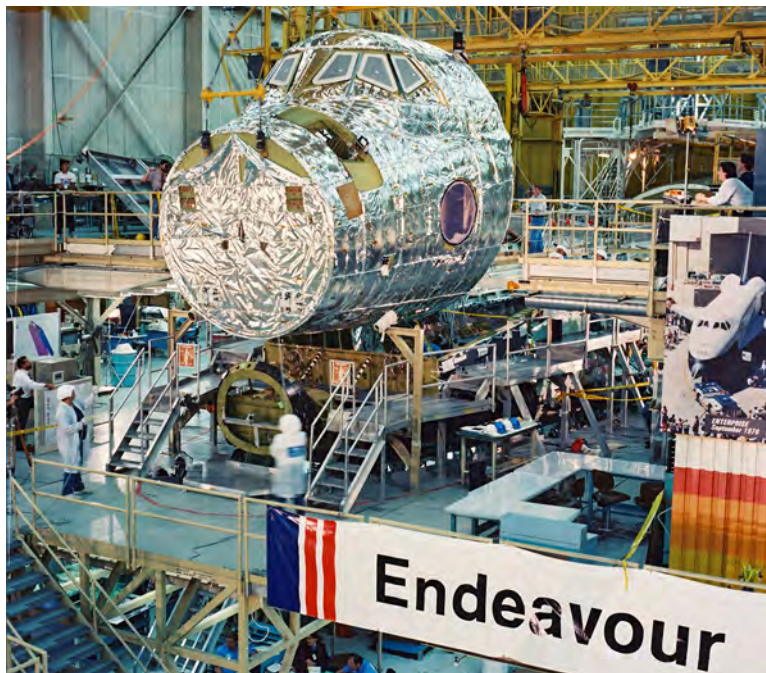
2011



California Council  
on Science  
and Technology

2011

ANNUAL REPORT



SEPTEMBER 2011

## SCIENCE AND THE PUBLIC TRUST



Karl S. Pister  
*Board Chair*



Miriam E. John  
*Council Chair*



Peter Cowhey  
*Council Vice-chair*

Public policy issues involving science and technology are often daunting in scope and complexity. Many of the most important problems facing state government and business leaders can only be effectively addressed by drawing on scientific and technological expertise. CCST was created by the California Legislature in 1988 to help provide this expertise, tapping into distinguished experts from California's academic and industrial communities for nonpartisan information and analysis.

Over the past two decades, the state has turned to CCST time and again for input on issues ranging from the global – such as climate change – to the local, such as smart meters. We have been asked to provide analyses on intellectual property rights, nanotechnology, agriculture, and education, to name just a few: science and technology pervade many facets of public policy. In fact, it is hard to think of a component of our lives that is not affected by science and technology. Having access to a source of independent and unbiased perspectives on these issues is an important asset for California, and one which enables state policymakers to make more informed decisions.

CCST has played a valuable role in California's S&T policy discussions for many years. It is not our role to advocate on behalf of specific industries or sectors of the state, but to help assemble and analyze all of the relevant data available on a given topic of discussion, so that government decision-makers may evaluate their options with accurate and reliable information. Upon occasion, there is insufficient data available to make a definitive statement or projection about the ramifications of specific technologies, programs or policies. In those cases, we are careful to articulate what the scientific community knows and what is not known, along with areas needing further study.

CCST has worked hard to fulfill its original mandate of providing impartial expertise to the state. We are proud of the legacy of reliable and trustworthy information that we have provided during the past 23 years, and will continue to provide California with the best science and technology related input possible in the years to come.

*Karl S. Pister*

*Miriam John*

*Peter F. Cowhey*



CCST is a nonpartisan, impartial, not-for-profit 501(c)(3) corporation established via Assembly Concurrent Resolution (ACR 162) in 1988 by a unanimous vote of the California Legislature. It is designed to offer expert advice to the state government and to recommend solutions to science and technology-related public policy issues.

CCST is modeled in part on the National Research Council, and has developed a close working relationship with the National Academies. More than half of CCST's members and senior fellows are members of the National Academies, and several are Nobel Laureates.

Since its creation, CCST has worked directly with the governor's office, state and federal legislators, and agencies to recommend policies that will maintain California's role as a leader in generating science and technology innovation and maintaining a vigorous economy.

### Sustaining Institutions

The strength of CCST lies in the support and resources provided by its sustaining institutions, the University of California system, the California State University system, California Institute of Technology, Stanford University, University of Southern California, and the California Community Colleges, as well as its affiliate members, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratory in California, SLAC National Accelerator Laboratory, and NASA Ames Research Center and Jet Propulsion Laboratory. CCST also has strong connections to industry through its membership.

### Board and Council

A board of directors and council volunteer their time to govern and guide CCST. The board, which meets twice a year, is made up of 17 leaders from industry and academia. Karl S. Pister, UC's former vice president for educational outreach and chancellor emeritus of UC Santa Cruz, serves as CCST board chairman.

The council, which meets three times a year, currently includes 29 corporate leaders, academicians, scientists, and scholars of the highest distinction. Miriam E. John, former vice president, California Division, Sandia National Laboratories, is the chair, and Peter Cowhey, dean of the School of International Relations and Pacific Studies at the University of California, San Diego is the vice-chair.

The board establishes CCST's policies and provides oversight, while the council translates those directives into programs and projects that will ensure the state's science and technology leadership. The council is divided into subcommittees that manage and plan specific projects and studies.

### Senior Fellows

CCST senior fellows are a select group of distinguished scientists, engineers, and technical experts who volunteer their time to address specific projects or conduct reviews. CCST created the program in 1997; since then, CCST has appointed 135 senior fellows who are engaged in all aspects of CCST's work addressing important science and technology issues facing government, education, and industry.

### California Teacher Advisory Council (Cal TAC)

Cal TAC is a group of 12 outstanding K-14 science and math classroom teachers and is modeled after the successful National Teacher Advisory Council, established in 2002 by the National Academies. Cal TAC works to provide a valuable connection between the teaching community and the educational experts and policymakers who are shaping California's educational system. Ann Marie Bergen, teacher in residence at Cal Poly, San Luis Obispo, is the chair, and Brian Shay, Secondary Mathematics Teacher, Canyon Crest Academy is the vice-chair.

### Staff and Offices

Susan Hackwood is CCST's executive director and provides overall day-to-day leadership; she also sits on the board and council. CCST has two offices. One is in Southern California adjacent to UC Riverside; another is one block from the State Capitol in Sacramento.

## SLOW SCIENCE IN A FAST WORLD

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Susan Hackwood  
*Executive Director*

Good science takes time. This is an unfortunate truth in a world increasingly accustomed to the instant dissemination of news and information, and one that is not always apparent to policymakers or the general public, which may at times lack the ability to discern between competing perspectives on complex science and technology issues. It is also not always apparent to the media, which often find that sensational or controversial claims make good stories. The damage from misinformation, however, whether intentional or not, can be long-lasting.

Take the now-discredited link between autism and the measles, mumps, and rubella (MMR) vaccine. This link was given credence by a single study published in 1998. The original article was later discredited by the medical community. However, this process – thorough, deliberate, peer-reviewed and complete – took twelve years. During that time, the original claim had become virtually accepted by many people; a poll conducted this year found that nearly half of Americans – 48 percent – either think that vaccines cause autism or aren't sure whether they do or not. For the medical community, the issue may be essentially resolved, but for the public it is clearly not.

Policymakers are often faced with science and technology related issues that arise quickly, and which are at times controversial. News headlines about threatening technologies or scientific issues motivate people to email their representatives, protest at town hall meetings, and demand

immediate action. Sometimes they achieve it, as with the local bans on electric SmartMeter installation passed by Santa Cruz and Marin counties. Faced with an ever-changing agenda of S&T policy challenges, where policy positions or decisions are needed for technologies or issues that five or ten years ago didn't even exist, there is a tendency for state policy to become reactive instead of proactive. Policymakers focus on addressing problems in the public eye or those with an apparent near-term impact.

This is understandable, but California needs long-term vision in its policy framework. Without stifling high-tech innovation – which is crucial to the state's economic future – California needs to plan a policy framework with patience and determination to accommodate its long-term education, water, and energy needs.

The scientific community uses the media to communicate results from peer-reviewed studies and science journals to the public and policymakers. In contrast, others use the media as their principal means of communicating their conclusions, without the studies or consideration behind them. But often, both get equal play in town hall meetings, on television and in print media. Policymakers and the public alike need to discriminate between valid research and the consensus of the scientific community on the one hand, and press releases on the other. California's future is too important to act otherwise.

*Susan Hackwood*

## HIGHLIGHTS 2010 – 2011

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### *Innovate2innovation*

In May 2010, a bi-partisan, bi-cameral group of legislators asked CCST to conduct a comprehensive assessment of California's "science and technology (S&T) innovation ecosystem," analyzing and reporting current global innovation systems, and recommending to the Legislature actions that should be taken to sustain the state's role as a global leader in science and technology. CCST delivered the report to legislators using a remotely piloted medical robot in August 2011, to underscore the importance of innovation to California's future.

### *Publication: California's Energy Future (CEF) – The View to 2050*

This two-year project, released in 2011, provides an authoritative analysis of issues related to energy efficiency, transportation, heating, bio-fuels and electricity generation through nuclear power, advanced coal technologies and renewable energy. The analysis is designed to show the technical potential, costs and risks of various energy system choices. A related publication, Possibilities, Problems and Potential Envisioned for Nuclear-Powered California in 2050, was produced as input to the CEF report and was released separately in July 2011.

### *Summary Report: Personalized Healthcare Information Technology (pHIT)*

This project demonstrated how information technology may enable the integration of personalized healthcare data into an existing electronic health record system and how decision-making could be improved for individual patients, their care providers and reimbursers.

### *Publication: Health Impacts of Radio Frequency from Smart Meters*

This report compiles and assesses the evidence available to address whether FCC standards for smart meters are sufficiently protective of public health taking into account current exposure levels to radiofrequency and electromagnetic fields and whether additional technology specific standards are needed for these and other devices that are commonly found in and around homes.

### *Summary Report: Trust and Accountability in Science and Technology*

The October 2010 CCST Council began the on going Council meeting focus on trust and accountability in

science and technology. Two summary documents have been released, with overviews of the discussions from the two-day meeting.

### *S&T Legislative Policy Fellows*

The five-year pilot program, modeled after the 35-year-old Congressional S&T Fellows Program administered by the American Association for the Advancement of Science (AAAS), placed the second group of fellows throughout legislative offices in Sacramento. A third group has been selected for the 2011-12 session.

### *California Teacher Advisory Council (Cal TAC)*

Cal TAC was actively involved in the i2i report on digital education and is working with CCST on implementing a California Education Innovation Consortium. Cal TAC activities this year included a symposium in October 2010 on assessments and a summit in March 2011 on digital education, both of which led to subsequent publications (see below).

### *Publication: Digitally Enhanced Education in California Briefing Paper*

This document includes a snapshot of leading state-level digitally enhanced K-16 education programs currently in operation; a brief summary of digitally enhanced education models in operation in various locations across California and beyond; and an inventory of California laws, regulations and policies having direct impact on delivery of digital learning.

### *Summary Report: Working Toward an Assessment System with Value: Informing and Strengthening STEM Teaching and Learning*

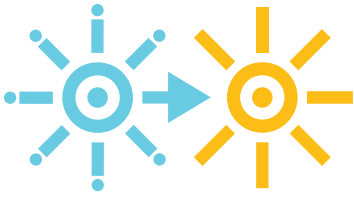
This is a summary of a symposium convened on October 21, 2010 by Cal TAC to discuss the implications of formative and summative math and science assessments for teaching and learning in California classrooms.

### *Summary Report: Imagining the Future*

Summary of a summit, held in March 2011 by Cal TAC, featuring presentations from promising initiatives on digital learning as well as conversations about what advancements are on the horizon, and their implications for teaching and learning. The summit dialogue contributed to the innovate to innovation report.



## Innovate<sup>2</sup>Innovation



### innovate<sup>2</sup> innovation

**In the face of a statewide fiscal crisis and a rapidly changing global landscape, California needs once again to do what it does best: innovate its way to innovation... The initial steps to explore these actions can be accomplished without a commitment of state funding, through reallocation of existing resources, private and philanthropic funding, and contributions of time.**

Innovation is the key driving force of economic growth, especially in developed economies such as California's. But California needs to take action, because it is facing unprecedented challenges to its legacy of innovation from other states and countries, according to CCST's assessment of California's innovation ecosystem.

The yearlong assessment was requested by a bipartisan group of legislators. In Phase I, CCST facilitated several discussions around the state and reviewed key trends. Thanks to these discussions, CCST identified three specific opportunities for action: a California Innovation Initiative, to cultivate our entrepreneurial ecosystem and translate research into job-creating products and services; a California Education Innovation Consortium, to develop and deploy digitally enhanced tools and practices for K-16 education; and a Water Innovation Road Map that engages a broad segment of the science and technology community in finding innovative solutions to the water issues facing our state in the coming decades.

To underline i2i's call for innovation, CCST deployed a remote response medical robot, RP-7, to deliver the final report to a gathering of California legislators. Remotely piloting the robot from the Santa

Barbara headquarters of InTouch Health was company founder Yulun Wang, precisely the type of high-tech entrepreneur i2i has in mind for a resurgent California.

Three Action Teams, comprised of experts from academia, industry, and the research community, worked on the project, which lays out a three-pronged strategy that would strengthen collaboration between industry and higher education, transform K-12 education into a robust and digitally-driven learning environment, and apply technology to resolving California's water issues at a level unknown today.

First, CCST proposes a California Innovation Initiative, which would establish a nonprofit Innovation Corporation to oversee the development of a comprehensive California innovation strategy and track its implementation. This corporation would be tasked with ensuring California's future competitiveness by helping to address the challenges of educating, retaining, and attracting enough scientists and engineers; ensuring that our educational institutions, research labs, and industries work collaboratively; supporting entrepreneurial leadership; and creating a consistent, innovation-friendly statewide business climate.

The second prong of the strategy is a California Education Innovation



Consortium, to be comprised of stakeholders from K-16 education, business, government, NGOs, and others to promote digitally enhanced K-16 education. To remain competitive and appropriately prepare California's population to support a healthy innovation ecosystem, a 21st century learning environment needs to be created grounded in digital learning. This will require redefining the classroom environment, changing to preparation and professional development for teachers, installing and maintaining adequate technological infrastructures, and encouraging public-private partnerships.

The third component of the strategy is a Water Innovation Road Map, a plan that looks 10, 25, and 50 years ahead, identifying where science and technology play an important role and covering a range of future scenarios from surplus to drought. There are serious challenges facing long-term management of California's water systems, ranging from agricultural issues to urban issues. In addition, during the past decade the nexus between water and energy has emerged as a significant challenge, with approximately 19 percent of California's electricity and a third of its natural gas used for various parts of the water systems. The Road Map would seek to encompass all these issues, seeking the best paths for optimal sustainability and environmental balance in the face of climate and population pressures.



Summer school students searching for photographs of specific animals in their assigned layer of the ocean.



(left to right) Charles Kennel, Yulun Wang and Julie Meier Wright at the i2i press conference.



(left to right) Assembly Members V. Manuel Perez, Marty Block, and Anthony Portantino at the i2i press conference.

## CALIFORNIA'S ENERGY FUTURE



“  
 ... California  
 can likely achieve  
 significant reductions  
 in greenhouse  
 gas emissions by  
 implementing  
 technology we  
 largely know about  
 now. However, a  
 combination of  
 energy strategies and  
 significant innovation  
 will almost certainly  
 be needed...”

- Jane C.S. Long and  
 Miriam John,  
 CEF Committee  
 Co-Chairs



*California's Energy Future - The View to 2050* looks a generation ahead at what's required to reach that goal and answers the call of the Governor's executive order from 2005 to reduce the state's emissions 80 percent below the 1990 level by 2050. The good news: The technology to do more with less energy and produce the electricity and fuel we need to get to the 60 percent mark is either in demonstration, or already in use. However, to achieve a full 80 percent reduction in emissions will require significant levels of research, development, invention and innovation.

The total commitment necessary to achieve this accelerated pace will require strong societal and policy backing because there are less than 40 years to make a nearly total change-over to the required technologies. Essentially, in this time period, every existing building must either be retrofit or replaced to higher efficiency standards, and 60 percent of light-duty vehicles must use electricity, so that the average fuel economy will be roughly 70 miles per gallon. Additionally, the electricity generating capacity of the state must be almost entirely replaced and then doubled, and all with near zero-emission power generation and storage technologies.

The report's conclusion strongly recommends the development of multiple solutions, making it clear that no single approach will take the state to a future nearly free of fossil fuel emissions.

The report examines a suite of emission-free technologies, some everyday and others exotic. Stringent energy-efficiency standards for buildings and industry are a foundation for any approach. Electric vehicles, electric heat pumps, nuclear, solar and wind power, and biofuels are among commonly known clean energy solutions described in the report. Still other methods include carbon capture and storage for fossil fuel electric generation, and eliminating emissions from hydrogen production.

The problem of getting from 60 percent to a full 80 percent reduction in emissions from the 1990 level will require technologies that are not currently on the market, or even in demonstration. Further, California would require a combination of several strategies to make the target that might include, for example, new energy storage technology, advances in the smart-grid, advances in biofuel technology, new ways to provide low carbon fuels that are not based on biomass, as well as behavior changes that would reduce demand.

California is also a leader in the development of breakthrough, game-changing technology that could dramatically change outcomes, especially beyond 2050. The state leads the world in developing fuel from sunlight and in the prospect of using fusion to produce safe, clean, and secure energy.

## CEF RECOMMENDATIONS

### Recommendation #1:

Strengthen existing AB32-related laws and rules to accelerate innovation and advance commercialization of cost-effective, advanced low-carbon technologies.

### Recommendation #2:

Address potential policy gaps that need to be considered in order to achieve the technically feasible 60 percent reduction outlined in the report:

1. Require rapid implementation of high efficiency standards for buildings, appliances, equipment and vehicles, to reduce energy consumption in new buildings by 80 percent relative to 2010.
2. Effect rapid and ubiquitous electrification of all technically feasible transportation and heat. Electrify all bus and rail transportation, and 70 percent of domestic heating and cooking.
3. Ensure that new clean electricity is being developed at a rate of about 1.5 GW/yr (baseload) or 4.5 GW/yr (intermittent), so that by 2050 we have the capacity to meet twice the demand we have today from sources that all have extremely low life-cycle emissions.
4. Decide whether to develop this de-carbonized electric generation system with, or without, nuclear power. To provide 67 percent (about 44 GW) of our electric power in 2050 with nuclear facilities would require about 30 new nuclear power plants.
5. Fill the low-carbon fuel gap with multiple strategies, including, but not exclusively, those based on biomass.
6. Advance carbon capture and storage, especially as a technology that supports low-carbon fuel production
7. Develop a plan for emission-free reliable electric load balancing.

### Recommendation #3:

Monitor the rate of actual implementation for efficiency, electrification, clean electricity generation and de-carbonized fuel production, and provide an annual report of progress against plan, with a listing of the specific actions that are required to keep progress on target.

### Recommendation #4:

Support the innovation needed to achieve an 80 percent reduction.

### Recommendation #5:

Put in place the structure needed to inform future portraits. Consider the potential utility of the energy system-wide analytical tools (such as those developed for this project) in strategic planning and evaluate how to manage the future use of such tools to inform strategic decisions and investments.

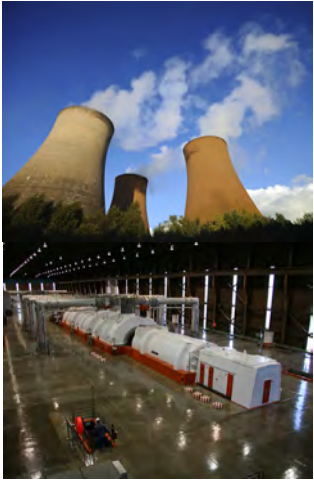
### Recommendation #6:

Maintain a long-term plan.

The Governor should direct the key agencies (CEC, CARB, CPUC, etc.) to jointly examine a range of pathways to determine the most desirable 2050 energy system configurations from a combination of economic, policy and technology perspectives.



## NUCLEAR POWER



“Expansion of nuclear power in California requires growth in public acceptance, which has been eroded by the Fukushima incidents. The question is will relatively low energy costs, nearly zero greenhouse gas emissions, and the need for energy reliability change this position over time?”

– Jane Long



*California's Energy Future - Powering California with Nuclear Energy* was produced as input to the CCST report, *California's Energy Future*. The nuclear power report estimates that roughly 30 new nuclear power plants could provide two-thirds of California's electric power in 2050.

*Powering California with Nuclear Energy* looks at a highly charged issue from a range of perspectives, from realistic to extreme scenarios. Population growth and energy demand will eventually force a decision on California's energy strategy, especially with the requirement for drastic reduction in emissions.

California's law requires at least 33% of electricity generation be provided with renewable energy. However, while clean, many renewable energy sources produce power intermittently: if there's no sunlight and no wind, there's no power. However, a constant base output of nuclear power could make it much easier to deal with the highly variable power levels from renewable sources.

In exploring nuclear power, the new report makes an assumption that any large-scale growth in nuclear energy in California will reflect large-scale nuclear growth worldwide, which is expected to reduce construction costs. The report points out that there are no technical barriers to large-scale deployment of nuclear power in California. There are, however, legislative barriers and public

acceptance barriers that have to be overcome to implement a scenario that includes a large number of new nuclear reactors.

The report clearly acknowledges current, well-known hurdles to any expansion in nuclear energy production. Spent fuel storage and safety in light of tsunami and earthquake damage to Japanese plants last winter in Fukushima are outlined, along with a brief discussion of global weapons proliferation. One section of “Powering California with Nuclear Energy” encapsulates point by point what must happen on a state and national level to make a large expansion of nuclear power practical.

An expansion of nuclear power will require loan guarantees and progress toward a resolution to waste disposal, the subject of a soon-to-be-released federal Blue Ribbon Commission interim report. Other points look ahead to 2020, when current California regulations demand that 33% of electricity generation come from renewable sources, and other new generation is limited to low-carbon sources.

The report notes that the Department of Energy needs to develop a long-term strategic plan for nuclear research that would lead to safer and more efficient reactors that would ease the waste disposal problem. A version of such a plan has been submitted to Congress.

## PERSONALIZED HEALTHCARE INFORMATION TECHNOLOGY (pHIT)

Information technology is becoming increasingly embedded in all aspects of society, including healthcare, where digitization of patient medical records and greater connectivity between patients and their physicians are centralizing and standardizing the ever-wider array of information associated with each person's medical files. Simultaneously, advances in biomedical sciences provide an expanding array of molecular diagnostics and genomic tests to inform personalized care for patients, from indicating predispositions to familial disease to predicting benefits of therapeutic treatment regimens. However, although a number of genetic/genomic tests are currently available to patients with, for example, breast cancer, the current healthcare system lacks a standardized means of assimilating information from these tests to inform personalized care for patients.

The Personalized Health Information Technology (pHIT) Task Force pilot study was designed to apply cutting-edge information technology resources to the integration of molecular and genetic/genomic data with health records of breast cancer patients, thus enabling rapid adoption and meaningful use of new information in the course of decision-making and clinical care of breast cancer patients, across socioeconomic boundaries, in all care settings.

The pHIT pilot study aimed to develop a system to translate clinical and basic research results into comprehensible information for use by both patients and clinicians to support their decision-making in the midst of the data deluge. During the past year, the pHIT pilot study completed development of an ontology, or knowledge representation for breast cancer care in the context of molecular and genetic/genomic information. The intention was to expand this to be open-source and publically available, and developed in such a manner as to be easily scaled to include additional sources of information (i.e. new tests, emergent findings from clinical and basic research, new treatment guidelines, new resources, etc.).

In addition to generating new, accessible knowledge resources, the pHIT pilot study leadership plans, upon availability of sufficient funding for this purpose, to extend these resources into decision support tools that interpret diverse sources of data, providing patient-centric knowledge to both the individual with breast cancer and the healthcare provider. The pilot study is now under the administration of the California Institute for Telecommunications and Information Technology (Calit2), UCSD Division.



“ Unless we can collect appropriate data, store it and share it, personalized medicine will not see its potential as an industry... CCST's pHIT Task Force... distinguishes itself from other efforts ongoing in the State by being a real world pilot that can be tested to validate the effectiveness of personalized health care data elements.”

- Former Business, Transportation and Housing Deputy Secretary  
Kathryn Lowell

## SMART METERS



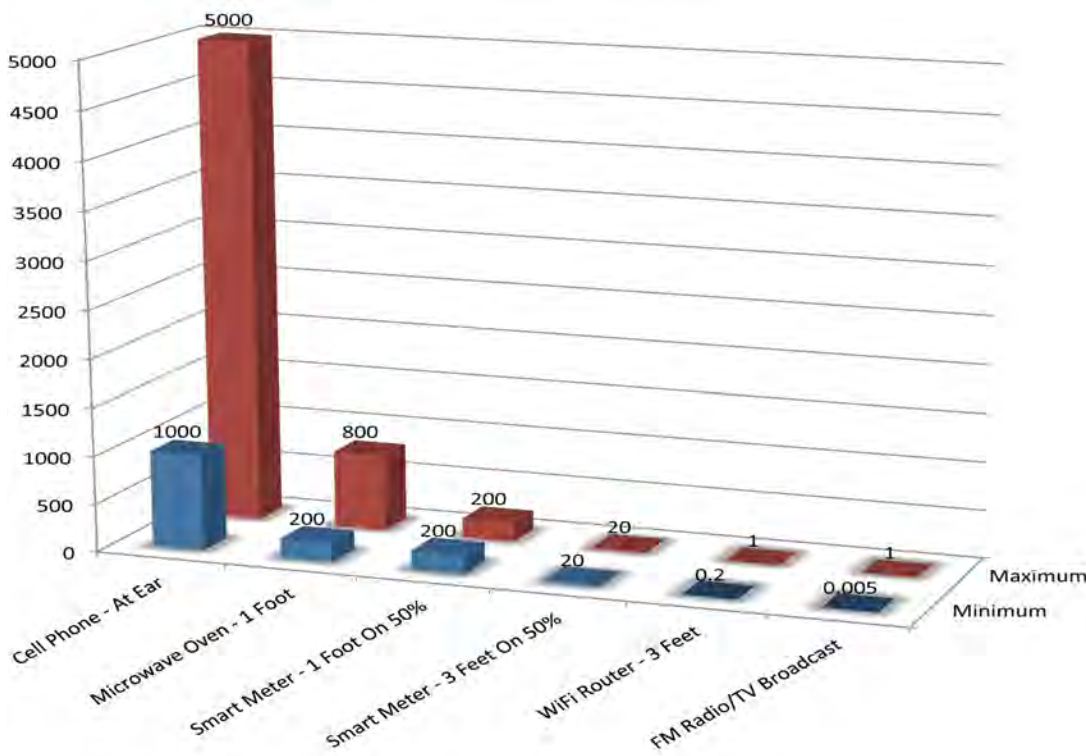
Smart meters are electronic monitoring devices that continuously measure the electricity output from each household and business. They communicate on a regular basis back to the utility. The goal is to enable power companies to better understand patterns of power consumption throughout the day and adjust power generation accordingly. Consumers, however, have raised concerns about the technology. As a result, in 2010, Assembly Member Jared Huffman (Marin) and Assembly Member Bill Monning (Santa Cruz) asked CCST to provide an assessment of the safety of smart meters.

In January 2011, CCST released the preliminary version of *Health Impacts of Radio Frequency from Smart Meters*, with the final revised version published in April after a period of public comment and review. The long-awaited report indicated that the meters meet

current FCC standards for safety and generate less EMF emissions than other household devices such as cellphones and microwave ovens.

CCST compiled and assessed the evidence available to address the following two issues:

- Whether FCC standards for smart meters are sufficiently protective of public health taking into account current exposure levels to radiofrequency and electromagnetic fields.
- Whether additional technology specific standards are needed for smart meters and other devices that are commonly found in and around homes, to ensure adequate protection from adverse health effects.



### Instantaneous Radio Frequency Power Density Levels of Common Devices (in microWatts/cm<sup>2</sup>)

About this figure: This figure was developed by the CCST project team. Quantities for different distances calculated using Inverse Square Law. Assumes distances in far-field, where power density reduces as the square of the distance from the source. The source for the various starting measurements came from Electric Power Research Institute (EPRI), Radio-Frequency Exposure Levels from Smart Meters: A Case Study of One Model (February 2011)

The report concluded that wireless smart meters, when installed and properly maintained, result in much smaller levels of radio frequency (RF) exposure than many existing common household electronic devices, particularly cell phones and microwave ovens, and that the current FCC standard provides an adequate factor of safety against known thermally induced health impacts of existing common household electronic devices and smart meters. However, to date, scientific studies have not identified or confirmed negative health effects from potential non-thermal RF emissions, and not enough is currently known about potential non-thermal impacts of RF emissions to identify or recommend additional standards for such impacts.

The report generated considerable media coverage, which was divided on whether the evaluation established that smart meters were safe or not. The conclusion that further research is warranted on the effects of non-thermal radiation led some critics to assert that opposition to the meters is justified despite the CCST's assertion that the meters' output is well within FCC guidelines. The CPUC is exploring the feasibility of allowing consumers to opt for hard-wired meters instead, a move consistent with the report's recommendations.

The Pacific Gas and Electric Company (PG&E) and other utility service providers have been installing wireless smart meters statewide in California since November 2006 under the authority of the California Public Utilities Commission (CPUC), which is seeking to guide the development of a "smart grid" power system in California that can facilitate integration of new technologies such as distributed generation, storage, demand-side technologies, and electric vehicles. PG&E plans to complete implementation of the devices statewide throughout their service regions by 2012; as of the beginning of October, over 6.5 million meters had been installed, of a total planned 9.8 million meters.



Radio frequency reader measuring smart meter radio frequency levels during briefing for Assembly Member Huffman.

“

The study gives a fair assessment of the existing scientific literature on potential health effects... While it is reassuring regarding the remote potential for thermal effects, it also calls for more research to determine whether potential non-thermal effects of prolonged exposure to RF devices can be scientifically established.”

– Assembly Member Jared Huffman

## CALIFORNIA TEACHER ADVISORY COUNCIL (CAL TAC)



Summer school students utilizing the internet to obtain the latest information on species of the ocean.



High school students teaching elementary students, their parents about microscope imaging using a monitor and screen for projection.

The California Teacher Advisory Council (Cal TAC) has worked throughout the year to help shape and inform the education component of CCST's Innovate 2 Innovation project, convening meetings in October 2010 and March 2011, summaries of which were also published separately.

The October meeting, *Working Towards an Assessment System with Value: Informing and Strengthening STEM Teaching and Learning*, focused on innovative formative assessments both in the state of California and in other states, including Oregon and Minnesota. Formative assessments are those where students and teachers use immediate evidence of learning to adapt educational practices to meet learning needs minute-to-minute and day-to-day. In contrast, summative assessments occur at a specified period of time and have three purposes: to rank, certify, and provide grade level information and placement. The goal of the symposium was to highlight innovative practices of both types of assessments, clarify the purposes and appropriate uses of each, and engage in a discussion of how quality assessments can be used to inform teacher professional development.

The second document, *Digitally Enhanced Education in California*, is a white paper prepared as part of

Cal TAC's initiative "The Digitally Designed Classroom Without Borders." The mission for that initiative is to create a dialogue between teachers and companies producing digital materials and tools as well as academia, federal laboratories, neuroscientists and others to identify newly emerging technologies offering promising innovations in digitally enhanced education and online learning.

The third document, *Imagining the Future*, is a summary of proceedings from the March 2011 meeting. As part of the process to help develop specific legislative ideas for enhancing digital education, Cal TAC convened a group of teachers and administrators, representatives from technology companies, philanthropies, policy groups, STEM networks and publishers on the grounds of Cogswell Polytechnical College in Sunnyvale, California to discuss digital education. The summit focused on:

- What does a digitally designed and enhanced classroom look and feel like?
- How will it transform teaching and learning - the culture of a school?
- What is the toolkit to accomplish this type of transformation?

“  
One thing we know with absolute certainty is that in 5 or 10 years, the classroom of the future will look nothing like what we have today.”

- Susan Hackwood,  
Executive Director, CCST



These documents and discussions served as a prelude to the education component of CCST's i2i project, *Digitally Enhanced Education*. Cal TAC Chair Anne Marie Bergen was co-chair of the i2i Education Action Team, which offers recommendations on K-16 education that could have a widespread and dramatic difference in day-to-day life in California. Among other things, it calls for every California child to have access to broadband capability and for students to study math and science in groundbreaking new courses that would depart from traditional teaching methods, in order to prepare them for life in the mid 21st century. Achieving this would require updating California's Education Code, which, according to the i2i report, works to block advances in digitally enhanced education.

In the coming year, Cal TAC is poised to help implement the next steps recommended by the i2i report, working to help better prepare California's students compete and succeed in the digital age.



Cal TAC member Lewis Chappellear and his robotics students.

“

Processes devised to hold teachers and schools accountable for ‘learning’ are only valuable if they provide data that support improvement. The tests emphasize the accumulation of facts, instead of the application of thinking processes or problem solving necessary for today’s work force and citizens.”

- Cal TAC Chair  
Anne Marie Bergen



Cal TAC members 2011

(top row left to right)  
Jeffrey Foote, Lewis Chappellear, Margaret “Peg” Cagle, Diana Herrington, Anne Marie Bergen, Katrina Williams, Caleb Cheung, and Susan Pritchard

(bottom row left to right)  
Jennifer Howard, Heidi Haugen, and Jeff Bradbury

Not pictured: Brian Shay

## SCIENCE AND TECHNOLOGY POLICY FELLOWS

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Peter Cowan (left) and Kenneth Spence (right) with Lieutenant Governor Gavin Newsom

“

We want to thank all of the science fellows for a marvelous year... It's been tremendously productive.”

- Senator Joe Simitian  
(Palo Alto)

The second class of California Science + Technology + Policy Fellows began their terms in Sacramento in November 2010, with the outgoing first class receiving recognition for their service from both houses of the California Legislature within their respective chambers.

The program places professional scientists and engineers in the California State Legislature for one-year appointments. These professional development opportunities enable fellows to work hands on with policymakers to develop solutions to complex scientific and technical issues facing California through their interaction with the legislative process. They assist their respective legislators and committees in formulating and evaluating S&T policy for California on issues ranging from healthcare to energy to water resource management.

The 2010-11 group of fellows began their terms in Sacramento in the beginning of November with a three week intensive “boot camp” training covering the Legislative process, the effective translation of science for policymakers, and tips for success in the legislative environment.

Areas of consultation over the initial years of the program included legislation related to pressing issues and challenges, such as healthcare, bioethics, energy and water resource management. The program, adapted for California from the 36-year old American Association for the Advancement of Science (AAAS) Congressional Science and Technology Fellowship program, is the first in the nation to place Ph.D. level scientists and engineers in a state legislature.

Participants in the 2009-10 group of fellows successfully transitioned to new positions with industry, a national laboratory, academia, a public health department, a state agency, and, in at least one case, a permanent staff position in the State Legislature.

The program is funded by a coalition of foundations including the Gordon and Betty Moore Foundation; Stephen Bechtel Fund/S.D. Bechtel Jr. Foundation; Kingfisher Foundation; The Heising-Simons Foundation; TOSA Foundation, and the Gen-Probe Fund.



2010-11 Science and Technology Fellows

(Left to right) Michelle Leinfelder, Hillary Q. Thomas, Peter Cowan, Kenneth Spence, Anthony Marino, Michael Bedard-Hearn, Newsha Ajami, Malaika Singleton Duran

## Senate Offices

**Newsha Ajami**, with the Senate Natural Resources & Water Committee. Ajami received a Ph.D. in civil and environmental engineering from the University of California, Irvine, a M.S. in hydrology and water resources from the University of Arizona and a B.S. in civil and environmental engineering from Tehran Polytechnic.

**Peter Cowan**, with the Senate Environmental Quality Committee. Cowan received a Ph.D. from the Department of Integrative Biology at the University of California, Berkeley, a M.S. in biological sciences from Stanford University and a B.A. in biology (magna cum laude) from Kalamazoo College.

**Malaika Katrina Singleton Duran**, with the Senate Office of Research. Singleton Duran received a Ph.D. in neuroscience from the University of California, Davis and a B.A. in biology and psychology that was jointly awarded from Rutgers University-Newark College of Arts & Sciences and the New Jersey Institute of Technology.

**Michelle Leinfelder**, with the Senate Transportation & Housing Committee. Leinfelder received a Ph.D. and M.S. from the Department of Horticulture at Cornell University and a B.S. in crop science and management from the University of California, Davis.

## Assembly Offices

**Michael Bedard-Hearn**, with the Assemblymember Nancy Skinner. Bedard-Hearn received a Ph.D. from the University of California, Los Angeles in physical chemistry, specializing in energy transfer, and a B.S. in chemistry from Santa Clara University.

**Anthony Marino**, with Assemblymember Jerry Hill. Marino received a Ph.D. in chemistry from the University of Chicago and a B.A. in English and chemistry from Davidson College.

**Kenneth Spence**, with Assemblymember Nathan Fletcher. Spence received a Ph.D. in entomology from the University of California, Davis and a B.S. in biology and Spanish language from Morehouse College.

**Hillary Q. Thomas**, with Assemblymember Fiona Ma. Thomas received a Ph.D. and M.S. in entomology from the University of California, Davis, and a B.S. in environmental sciences from the University of California, Berkeley.

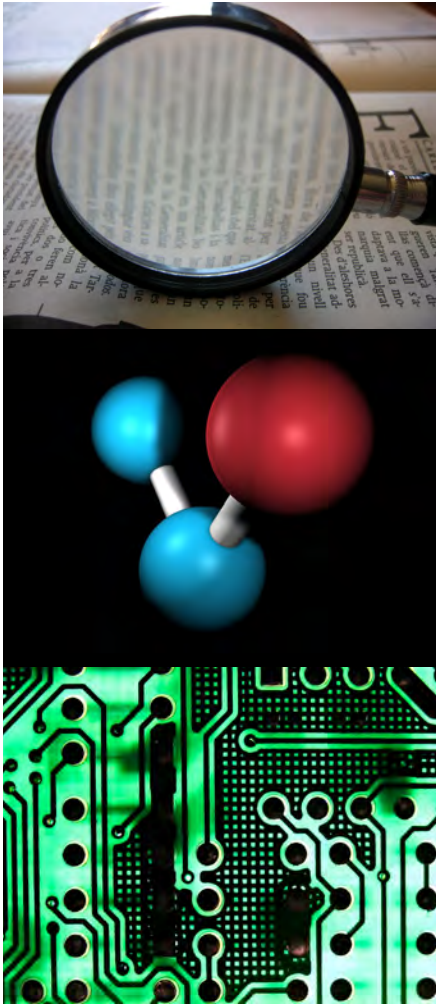


## COUNCIL MEETING SUMMARIES

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October 2010

### **Trust and Accountability in Science and Technology**



The October 2010 CCST Council meeting focused on trust and accountability in science and technology.

“Issues of trust and accountability in science are both timely and long-standing,” CCST then Chair Charles Kennel said in his opening remarks at the meeting. “It shouldn’t come as a surprise that scientific authority is subject to questioning by the larger society, but when that authority is undermined – as illustrated by the ‘Climategate’ scandal in 2009 – overall trust in scientific methods and recommendations can falter as well.”

The council meeting focused on the role CCST should take with regards to the erosion of public trust in science and ways to address both real and perceived lapses in scientific accountability. CCST was created as an independent, impartial organization by the Legislature to advise the state on policy matters relating to science and technology.

The meeting focused on broader issues, including:

- Scoping the issues of trust and accountability,
- What modeling of complex systems – from climate change to engineering to public education pipelines – can and cannot tell us,
- The science of trust (as illustrated by a neuroscientist’s research on oxytocin), and
- From the cosmos to the legislative chamber – highlights from the experiences of CCST’s first cohort of science and technology fellows completing a year in various legislative offices in Sacramento.

Because of interest in and the importance of the meeting focus, a two-volume summary of the meeting was published in January 2011.



## February 2011 Council Meeting Summary

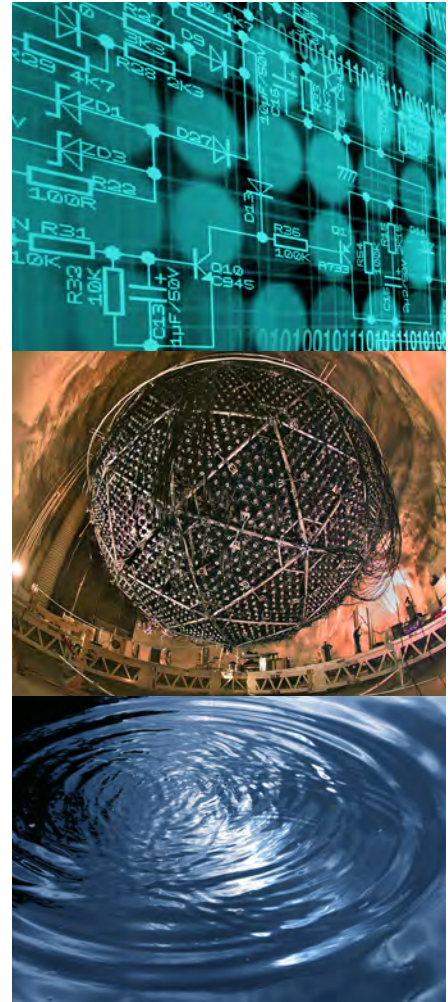
### **Innovate 2 Innovation**

The February 2011 meeting highlighted the release of the preliminary Innovate 2 Innovation report, offering a specific list of recommendations for legislators to enhance the state's ability to foster and benefit from innovation.

The document was produced in response to a request from a bipartisan group of California Legislators, which asked CCST to perform the assessment. The preliminary response coincided with the opening of the 2011 Legislature and the gubernatorial transition. A more detailed set of recommendations have been prepared by teams focusing on the innovation process, digital education, and water respectively.

“We need to focus on enlisting California’s S&T community in promoting digitally enhanced education and addressing California’s critical challenges related to water,” said Doug Henton, chairman and chief executive officer, Collaborative Economics. “California needs to improve its critical innovation infrastructure by developing and sharing best practices. We also need to develop and leverage public-private partnerships linking California’s assets in education, research, technology, finance, and philanthropy to create social and technical innovations that competitors with less complete infrastructure cannot match.

In addition to the report, summaries of the roundtables convened in late 2010 as part of the i2i project were released in a separate volume.



May/June 2011 Council Meeting Summary  
**Risk, Uncertainty and Trust in Scientific Data  
 and Analyses**



The June, 2011 CCST Council meeting explored the erosion of public trust in science and ways to address both real and perceived lapses in scientific accountability. While the public assumes and expects that the government will apply science to ensure our safety and protect us, in fact there are many inherent limitations in the government's ability to do so.

The inherent uncertainty of science poses a dilemma for policy-makers, who often seek much more definitive answers than data and analytic tools can provide. In some cases, we even have different branches of the same government agency arriving at opposite conclusions. Moreover, policy-makers sometimes look to science to insulate decision makers from the courts or other challenges. When science is asked to resolve questions that are more political or ethical in nature, expectations are not met.

These concerns and more were discussed at the meeting, including conflicts of interest (both real and perceived); the social and ethical concerns raised by the advent of new technologies, which often fall outside the realm of health and safety and have more to do with moral, religious, and ethical issues; and the rapid pace at which science and technology advance – a pace that is difficult to match by ethicists and regulators. In some cases, problems may be obsolete before they can be addressed.

The dinner speaker was Luann Brizendine, Lynne and Marc Benioff Endowed Chair in Psychiatry and Clinical Professor, UCSF Department of Psychiatry. She is the author of the *Female Brain and the Male Brain*.

## THE VALUE OF INDEPENDENCE

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When the National Academy of Sciences was incorporated in 1863, Congress was careful to state that the Academy was to function as an independent organization, one with the power to craft its own bylaws and staff itself as it saw fit. Furthermore, the Academy was, apart from appropriations specific to each investigation, to receive “no compensation whatever for any services to the Government of the United States.” The nation did not seek to build a new government agency, but rather a free-standing body of members capable of providing independent expertise as needed. The later creation of the National Research Council, National Academy of Engineering, and Institute of Medicine served to expand the scope and capabilities of the Academy, but did not change its essential core functions.

The reports of these Academies are viewed as being valuable and credible because of their reputation for providing independent, objective, and nonpartisan advice while maintaining high standards of scientific and technical quality. The system relies on transparency, with checks and balances applied at every step in the study process to protect the integrity of the reports and to maintain public confidence in them.

CCST was similarly formulated as an independent entity, created as an organization designed to work with – but remain separate from – California’s state government. In structuring CCST’s articles of incorporation thus, the farsighted sponsors of the

original legislation gave California an institution that is even today virtually unique among state-level organizations. Nationwide, nearly all state entities that advise governors, state legislatures, or other state agencies in the area of S&T policy planning and recommendation have government representation on their governing bodies. Many involve the Governor directly, either with membership of the Board or Council or with the power to appoint members; most such organizations are sponsored directly by the government.

How does this make a difference? The lack of government involvement in CCST’s governance and core funding means that CCST is free to pursue an agenda based on pressing issues as determined by its Board and Council, rather than by an administration. It means that CCST is free to tackle long-term challenges, returning to issues such as education and innovation over a span of many years without concern for specific political affiliation or agendas. It means that CCST is able to craft reports and counsel that are not dependent upon a political point of view, and incorporate input and feedback from as wide an array of experts as possible. In short, it means that CCST is able to offer input that is based on the best available information and expertise, and looks to the best long-term interests of the state. It is a time-tested model that has worked well for the nation since the 1860s. California is fortunate to have a similar system in place for itself.



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