

## ETAAC Advanced Technology Development Report

### Part C – Program Updates for ETAAC report

The purpose of this section of the report is to update information about programs to overcome barriers and promote technology development. Major changes to the programs listed in specific sections of the original ETAAC report (and also Appendix 10) include the American Recovery and Reinvestment Act and the activities by the Carbon Trust in the United Kingdom. Please see Appendix X of this report for an updated summary of selected local, state, national, and international advanced technology development programs.

#### *UK Carbon Trust Report*

The UK Carbon Trust recently issued a report “Focus for success: A new approach to commercializing low carbon technologies.”<sup>1</sup> This report finds that commercialization of low carbon technologies is necessary to achieve 2020 and 2050 goals. The report outlines the evolution of technology development philosophy from a policy of picking specific hardware and companies, which resulted in expensive “white elephants” such as Concorde and specific nuclear technology. In response a “free market” technology neutral approach was adopted, such as general renewables obligation, but did not succeed in developing new technologies. As a result, the report recommends a “technology-focused” approach, of selecting promising sectors but not individual companies.

The report recommends a technology assessment framework based on the need to achieve GHG goals and also the potential business case for national technology development. In some cases, technologies will make a lesser contribution to GHG goals (flow cell batteries); or technologies must be created but will be available to be imported without UK technology development policy support (solid-state lighting, cellulosic ethanol). In these cases, the important question is whether there is a business case for investing resources to develop the technology in the UK. In other cases, some technologies must be created to meet GHG goals, and must be developed in the UK or they will not be available to meet the UK GHG goals (wave, off-shore wind energy).

The UK Carbon Trust report also recommends the following steps to implement a “technology-focused” approach. (One example technology assessment covers solid state lighting, which is addressed in more detail in chapter X of this report)

- Identify priority low and zero GHG technologies for commercialization through systematic and transparent assessments – the demonstration stage allows a better assessment of prospects that during R&D, and there is also a

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<sup>1</sup> “Focus for success: A new approach to commercializing low carbon technologies”, July 2009 <http://www.carbontrust.co.uk/default.ct>

- need to differentiate at this stage because capital cost is 40 times higher than R&D for the technologies studied by the Carbon Trust for this report
- Designing a customized range of policy support for each of the prioritized technology families
- Recognizing the differences between earlier and later lifecycle stages & the different policies needed for each
- Create strong competition for support between companies within a technology family
- Carefully monitor against milestones to keep waste to a minimum.

The report also recommends a focus on “sunrise” instead of “sunset” industries. In the past, a policy focus on “sunset” industries – which are very visible due to the loss of existing jobs - was an expensive mistake that merely prolonged their demise.

#### *The American Recovery and Reinvestment Act*

The American Recovery and Reinvestment Act (ARRA) provides a major pulse of resources that can potentially overcome capital cost, demonstration, and other barriers to manufacturing and commercialization of many low and zero GHG advanced technologies (in addition to “shovel-ready” projects). The ARRA contains some elements that are similar to the “technology-focused” approach recommended by the Carbon Trust. For instance, a general incentive for renewable energy is also coupled with funding to develop and demonstrate several advanced technology elements. It also includes call for significant investment in specific companies selected through a competitive process.

This section of the ETAAC Advanced Technology report provides an overview of resources related to advanced technology development from the ARRA. Technology-specific discussions later in this report will identify what barriers will likely be overcome by ARRA spending for specific technologies and what barriers will most likely require additional attention by California policy-makers at the state level or in cooperation with federal and/or other partners.

#### National Programs

The Department of Energy’s Office of Energy Efficiency and Renewable Energy is administering \$16.8 billion in ARRA funding. While much of this funding (such as weatherization of low-income homes) focuses on “shovel-ready” projects it also contains a number of aspects that can also help advanced technology development. Technology development funding opportunities announced in June and July of 2009 include but are not limited to:

- Solid-state lighting (see ETAAC recommendation 5-B) and energy efficiency technology development for buildings
- Solar market development & high deployment rate (ETAAC chapter 5-H)
- Development of algal/advanced biofuels
- Wind turbine development (ETAAC chapter 5)
- Carbon capture and storage (ETAAC chapter 5)

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- Smart grid technology (ETAAC chapter 5-C)
- Heavy duty truck technologies (ETAAC chapter 3)

The ARRA also provides \$2 billion for domestic battery manufacturing for vehicles to fund up to five facilities capable of delivering 20,000-100,000 batteries per year as well as drivetrains and components (US DOE EERA ARA plan p 6) and also contains workforce development that may help overcome some information barriers, with awards announced August 5th. This wave of funding and later “Clean Cities” awards are also expected to provide resources for infrastructure and demonstrations including market development by funding transitions to cleaner government fleets (recommended in ETAAC chapter 3). In addition to the ARRA, the “Advance Technology Vehicle Manufacturing Program” recently announced \$8 billion in awards for both advanced conventional vehicles (Ford) and plug-in vehicles (Ford, Nissan, and Tesla) and federal support of General Motors and Chrysler will likely be targeted to move them in that direction.

In addition, the ETAAC recommended (ETAAC report page 10-46) extension of tax credits for renewable energy projects through the end of 2013 worth \$16 billion (over 10 years) will help overcome capital-cost and externality barriers identified by ETAAC as frequent and serious. The IRS is accepting applications for this program now. In addition to the scale-up of existing technologies like wind and PV solar, this financing will help develop technologies such as the thermal solar demonstration projects (see ETAAC report p. 10-40) that are in the pipeline in California ([http://www.energy.ca.gov/sitingcases/all\\_projects.html](http://www.energy.ca.gov/sitingcases/all_projects.html)).

The ARRA also provides manufacturing tax credits that will help address the capital cost of manufacturing low and zero GHG technologies. The ARRA provides \$2.3 billion in tax credits equal to 30% of the cost of manufacturing facilities for renewable energy; plug-in vehicles and batteries and fuel cells; carbon capture and sequestration renewable energy storage & transmission; renewable fuels refining; energy conservation technologies (including lighting); and other technologies that are certified to reduce greenhouse gases. A number of these technologies were identified as priorities in the 2008 ETAAC report and will contribute to meeting 2020 AB32 GHG goals as well as long-term GHG reduction objectives. The lower cost of manufacturing would presumably also trickle down to help consumers afford these technologies, as up-front costs to consumers have been identified as a prevalent and severe barrier to low and zero GHG advanced technology development.

The bill also contains \$6.9 billion for transit capital construction, \$4.5 billion for green buildings and over \$14 billion in other building renovations that can include energy efficiency improvements. While these projects will rely on off-the-shelf technologies, some of them could also incorporate demonstrations of energy efficiency & renewable energy advanced technologies.

California government awards

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California was awarded \$90 million to provide a statewide energy efficiency retrofit program and cost effective clean energy systems for residential, commercial, and industrial buildings and facilities under the State Energy Program. The revenue savings from these efficiency measures will be recycled for additional efficiency measures. In addition to deployment of existing technologies, this funding could also be used to help overcome market-development barriers for advanced technologies that are close to commercialization.

California also plans to develop and implement a public education, marketing, and outreach effort to ensure the benefits and value of energy efficiency are well understood (Information barriers are sometimes a major barrier to low/zero carbon technology development in California). The California Energy Commission will expand its \$15 million investment in alternative fuel and advanced vehicle technology needs through its Green Jobs Training Program with \$20 million in ARRA to also include energy efficiency and clean energy sources, including wind and solar energy (ETAAC Cleantech Workforce Development recommendation 2-D). After successful implementation the state will receive more than \$113 million in additional funding, for a total of \$226 million for the entire program. (<http://www.energy.ca.gov/recovery/sep.html>)

California is also expecting \$351.5 million in ARRA block grants via US DOE, with \$49 million received at the state level with the goals of 1) saving 61.2 million kWh of electricity; 2) save 207897 therms of natural gas; 3) reduce CO2 emissions by 22,541 tons; and 4) save local jurisdictions in excess of \$9.0 million per year (<http://www.energy.ca.gov/recovery/blockgrant.html>). The purposes are very broad and can include developing programs (such as ETAAC on-bill financing recommendation 2-G) that encourage the adoption of low and zero carbon technology as well as potentially implementing projects for distributed generation (which could include distributed solar and digester-gas-to-energy, ETAAC recommendations 4-D and 6-A). The remaining \$301 million will be distributed to large cities and counties for energy conservation. In addition, California has been issued \$74 million for weatherization with an additional \$92 million promised upon successful implementation.

Additional awards are likely to come through the \$300 million Clean Cities program for areas including alternative fueled vehicles infrastructure and vehicle demonstrations.

#### California facility funding

Several significant awards have been issued for California facilities. Two are related to ETAAC recommendations for low GHG new vehicles (chapter 3-E) and plug-in electric drive vehicles (chapter 5-F&G). Tesla Motors will receive a \$465 million loan to finance a manufacturing facility for the Tesla Model S sedan. Tesla intends to begin production of the Model S in 2011 and ramp up to 20,000 vehicles per year by the end of 2013, creating 1,000 jobs in Southern California. The loan will also support a facility to manufacture battery packs and electric drive trains to be used in Teslas and in vehicles built by other automakers, including the Smart For Two city car by Daimler. Early pilot battery pack production is expected to begin in 2011, reaching about 10,000 by 2012 and 30,000 packs in 2013 with 650 workers in Northern California. In addition, the Electric Transportation Engineering Corp. received a \$100 million grant to manufacture with

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partner Nissan 5,000 electric vehicles in Phoenix Arizona and Northern California for deployment along with charging station in California and five other states.

Another is related to the ETAAC carbon capture & storage recommendation (ETAAC 5-I). Hydrogen Energy International LLC, a joint venture owned by BP Alternative Energy and Rio Tinto, received \$308 million to design, construct, and operate an integrated gasification combined cycle power plant in Kern County. The plant would convert coal and petroleum coke into hydrogen burned for power and CO<sub>2</sub> separated out by the Rectisol process and injected into nearby oil reservoirs for storage and enhanced oil recovery. The project is intended to capture 90% of the CO<sub>2</sub> that would otherwise be emitted, or more than 2,000,000 tons per year of CO<sub>2</sub>. The project developer expects to begin construction in 2012 and begin operation in 2015.

As noted in the following sections of this report, these investments will help overcome some of the barriers to Advanced Technology Development but not others.

*Comments are requested on any additional programs to overcome barriers to advanced technology development that should be described in this section.*

discussion draft

**DRAFT CHART**  
**U.S. Department of Energy**  
**Energy.gov/Recovery Table**

Data is as of July 24, 2009

Program Office	Project	Authorized/ Appropriation (\$K)	Awarded/ Obligation (\$K)	Spent/ Outlay (\$K)
ARPA-E	Program Funding Level	400,000	0	0
	Advanced Research Projects Agency - Energy (ARPA-E)	0	23	0
	Program Direction - ARPA -E	0	72	39
<b>ARPA-E Sum:</b>		<b>400,000</b>	<b>95</b>	<b>39</b>
Energy Efficiency and Renewable Energy (EERE)	Program Funding Level	16,796,000	0	0
	Advanced Materials RD&D in Support of EERE Needs to Advance Clean Energy Technologies and Energy-Intensive Process R&D	0	900	0
	Battery Manufacturing	0	0	0
	Buildings and Appliance Market Transformation	0	2,899	0
	Commercial Vehicle Integration (SuperTruck) and Advanced Combustion Engine R&D	0	0	0
	Concentrating Solar Power	0	0	0
	EE Appliance Rebate Programs	0	0	0
	EE Conservation Block Grant Program	0	4,905	0
	EGS Technology R&D	0	0	0
	Enabling Fuel Cell Market Transformation	0	2,400	871
	Energy, Water & Emissions Reporting and Tracking System	0	0	0
	Enhance and Accelerate FEMP Service Functions to the Federal Government	0	0	0
	Fundamental Research in Key Program Areas	0	0	0
	Geothermal Demonstrations	0	0	0
	High-Penetration Solar Deployment	0	0	0
	Industrial Assessment Centers and Plant Best Practices	0	0	0
	Integrated Biorefinery Research Expansion	0	10,800	0
	Investigation of intermediate ethanol blends, optimization of E-85 engines, and development of transportation infrastructure	0	0	0
	Large Wind Turbine Blade Testing Facility	0	0	0
	Management and Oversight (EE Program Direction)	0	8,376	1,811
	Modify Integrated Biorefinery Solicitation Program for Pilot and Demonstration Scale Biorefineries	0	0	0
	NWTC Upgrades	0	0	0
	National Geothermal Database, Resource Assessment and Classification System	0	0	0
	PV Systems Development	0	0	0
	Renewable Energy and Supporting Site Infrastructure	0	54,400	0

	State Energy Program	0	1,265,140	10,235
	Transportation Electrification	0	0	0
	Weatherization Assistance Program	0	2,121,595	49,310
	Wind Energy Technology R&D and Testing	0	0	0
<b>EERE Sum:</b>		<b>16,796,000</b>	<b>3,471,415</b>	<b>62,227</b>
Fossil Energy	Program Funding Level	3,400,000	0	0
	Expand and Extend Clean Coal Power Initiative Round III	0	0	0
	Geologic Sequestration Site Characterization	0	0	0
	Geologic Sequestration Training and Research Grant Program	0	0	0
	Industrial Carbon Capture and Storage Applications	0	0	0
	Program Direction - FE	0	631	281
<b>Fossil Energy</b>		<b>3,400,000</b>	<b>631</b>	<b>281</b>
Loans	Program Funding Level	5,970,000	0	0
	ATVM Administrative Fees Transfer	0	4,668	542
	Administrative Fees Section 1705	0	2,263	0
<b>Loans Sum:</b>		<b>5,970,000</b>	<b>6,931</b>	<b>542</b>
OE	Program Funding Level	4,496,000	0	0
	Enhancing State and Local Governments Energy Assurance	0	0	0
	Interconnection Transmission Planning and Analysis	0	0	0
	Interoperability Standards and Framework (EISA 1305)	0	10,000	10,000
	Program Direction - OE	0	355	103
	Smart Grid Investment Grant Program (EISA 1306)	0	1,150	0
	Smart Grid Regional and Energy Storage Demonstration Project (EISA 1304)	0	40,067	0
	State Assistance on Electricity Policies	0	0	0

Authorized/ Appropriation (\$K): Funds made available to DOE in the Recovery Act.  
 Awarded/ Obligation (\$K): Funding commitments from DOE that will likely result in payments.  
 Spent/ Outlay (\$K): Amount of awarded obligated funds that have been paid.

Figure X

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