San Diego Regional Energy Technology & Needs Synopsis:

Based on regional characteristics, several insights emerge as criteria to help prioritize the existing California Energy Commission EPIC funding initiative areas and to identify possible additional categories. These insights will be taken into consideration when selecting startup companies for the San Diego Regional Energy Innovation Cluster program.

Growing Population in Climate Zone 10 (Inland Valley)
The majority (54%) of the SD-REIC project region's population is currently located in climate zone 10 (CZ 10) and much of the growth in population and housing is expected in this same climate zone. In addition, climate scientists expect temperatures to increase over the coming decades, which is likely to increase electricity consumption in this zone. There likely will be an increased need for energy efficiency in both new and existing buildings including efficient HVAC, lighting, plug loads, and envelope and demand management. Key regional priorities and needs arising from this insight include the following:

- o Increase use of efficient HVAC, lighting, plug loads and envelope in existing buildings
- o Increase use of demand management strategies
- o Increase use of energy project financing
- o Enhance software and models to identify and optimize efficiency investments

High Penetration of Customer-Sited Photovoltaics
The SD-REIC project region accounts for over 1,100 MW of customer-sited photovoltaics. San Diego County has one of the highest concentrations of PV in the U.S. Innovation is needed to help integrate photovoltaics more effectively into electric distribution networks and to optimize performance on the customer side of the meter. Key regional priorities and needs arising from this insight include the following:

- o Higher efficiency modules to increase production per area of installed capacity
- o Advanced inverters to increase conversion efficiency and address possible power quality issues
- o Energy storage solutions to couple with onsite photovoltaics
- o Software and optimization control schemes for managing energy in a home or business

Need for Higher Penetration and Integration of Electric Vehicles
The transportation sector accounts for over 40% of overall GHG emissions in the region. There are many solutions to reduce emissions from the transportation sector, but for the purposes of identifying priority technology areas, advancing the use of electric vehicles is a key strategy (particularly as the carbon intensity of grid power declines with the

implementation of the Renewable Portfolio Standard). Key regional priorities and needs arising from this insight include the following:

- o Innovative energy storage technology to increase driving range
- o Vehicle to grid technology
- o Smart charging technologies and strategies

Need for Efficiency and Decarbonization of the Water Cycle

Each aspect of the water cycle uses energy from supply and conveyance to treatment and distribution and waste water management. Because the SD-REIC region is one of the furthest from water sources in the North and East, the embedded energy and carbon in a gallon of water consumed in this region is higher than other areas in the state. Key regional priorities and needs arising from this insight include the following:

- o Reduce energy intensity of water by increasing efficiency of pumps and the entire water cycle
- o Reduce energy inputs for desalination
- o Improve the efficiency of inline hydropower production
- o Improve the efficiency of water-associated appliances (e.g., washing machines, dishwashers, etc.)

Increasing Attention on Climate Action Planning

There has been significant climate planning within the SD-REIC project region. Most of the largest jurisdictions have completed climate action plans with targets to reduce greenhouse gas emissions. The largest emissions category is generally transportation, followed by electricity and natural gas. Key regional priorities and needs arising from this insight include the following:

- o Increase energy efficiency of existing building stock
- o Electrify the on-road transportation fleet
- o Deploy energy storage to help integrate high penetration of renewable electricity supply
- o Integrate high levels of distributed renewable electricity from photovoltaics

Large Military Presence & The Military has Significant Efficiency and Renewable Energy Goals

The SD-REIC region has a high concentration of military bases and employment. The federal government has set ambitious energy efficiency and renewable energy targets for military-based development. Energy technologies relevant to military operations should serve an important role in helping meet federal targets and can create a significant market for innovative energy technologies. Key regional priorities and needs arising from this insight include the following:

- o Increase building energy efficiency

- o Increase on-site renewable electricity production
- o Develop microgrids and associated systems

High Concentration of Large-Scale Renewable Energy Projects and Potential for More

The SD-REIC region has significant renewable energy resources. About 30% of the renewable energy capacity installed in California is located in Riverside, Imperial, and San Bernardino Counties. As California increases it supply of renewable electricity, it is likely that more renewables will be installed in this region. Key regional priorities and needs arising from this insight include the following:

- o The role of water in certain renewable generation technologies
- o Efficiency of renewable energy technologies
- o Integrate large percentages of large-scale renewables into the grid
- o Higher efficiency modules to increase production per area of installed capacity
- o Advanced inverters to increase conversion efficiency and address possible power quality issues

Based on the key regional insights described above, the SD-REIC project technology priorities in each of the four categories are presented below.

Technology Priority Areas by Category

Energy Efficiency and Demand Response	Clean Generation
Envelope Efficiency HVAC Efficiency Plug Load Efficiency Pump/Other Equipment Efficiency Lighting Efficiency Energy Management Software	Hydroelectric and Related Technology Wind and Related Technology Solar and Related Technology Geothermal and Related Technology Wave and Related Technology
Smart Grid-Enabling Clean Energy	**Clean Transportation**
Mechanical Energy Storage Electrochemical Energy Storage Electrical Energy Storage Thermal Energy Storage Smart Grid/Metering Hardware, Software, and Data Analytics Microgrids	Battery Electric Vehicle Technologies Hybrid Electric Vehicle Technologies Electric Vehicle Charging Infrastructure Software Platforms