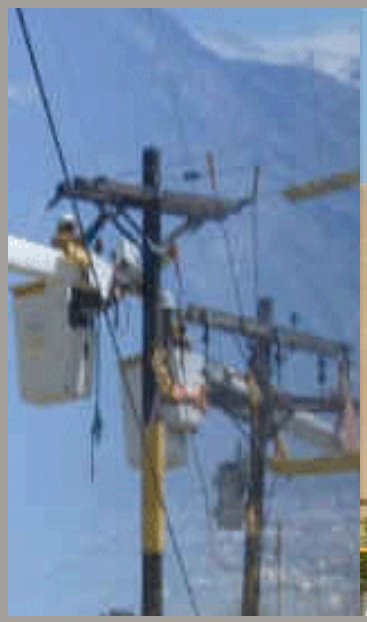
Smart Grid and Beyond
How Broadband Can Enable Energy Efficiency in Rural America
Kit Carson Electric Cooperative Initiative for Smart Grid and Broadband



Presented to the 2011 Agriculture Outlook Forum
February 25, 2011 by Luis A. Reyes Jr., CEO

History & Background

Kit Carson Electric Cooperative Inc. (KCEC), is a non-profit organization incorporated in 1944 for the purpose of distribution of electricity. Currently we serve 28,163 electric users inclusive of Taos, Rio Arriba and Colfax Counties. KCEC has also expanded its business to include Propane (3,796 consumers) and Telecommunication (1,953 consumers) Division. Our electric territory consists of approximately a 50 mile radius centered around our headquarters located in the Town of Taos. Our terrain is about 70% mountainous and 30% small canyons and high plains. Within our service territory we service six municipalities which include; The Town of Taos, The Village of Taos Ski Valley, Village of Questa, Town of Red River, Village of Eagle Nest and Village of Angel Fire.

For the last 5 years KCEC has implemented and constructed approximately 60 miles of fiber optic for broadband, SCADA and Smart Green Grid communications and future applications. KCEC would like to expand this "last mile" fiber infrastructure to connect to the State for use by the educational and business community. Through this connection KCEC and its partners in Northern New Mexico would expand their capabilities in Education, Telemedicine, Emergency Response, Cyber Security and enhance KCEC's commitment to affordable clean energy in its service area.

KCEC is a member of the Tri-State Generation and Transmission. We have approximately 1000 kW solar PV systems scheduled for deployment in 2010. The design is modular allowing integration of 1.8, 3.3 and 3.8 kW residential and small commercial systems as well as larger scale solar PV systems of up to 500kw. At this time KCEC has constructed a 1MW solar array site at UNM Taos Klauer Campus. We have completed four solar projects at KCEC Headquarters, KTAOS Radio Station, KXMT Radio Station which will total an additional 250kw. We are also working with partners in the State of New Mexico to place a 10MW solar array on Taos Pueblo lands and with Chevron Mining for a 1 MW demonstration plant in Questa New Mexico.

USDA Rural Utilities Service Administrator Jonathan Adelstein announced on August 16, 2010 that The Kit Carson Fiber to Home Project was awarded 63.8 million dollars to deliver affordable broadband service to 29 communities comprised of approximately 20,500 households, 3,600 businesses and 183 critical community institutions, two Native American Pueblos within a 2,951 square mile, rural underserved area in Taos, Colfax and Rio Arriba counties. The network spans 2400 miles. Kit Carson Electric had the funding of a Recovery Act broadband infrastructure project in northern New Mexico that will create jobs and provide thousands of rural residents access to improved service.

Executive Summary

KCEC's projects are as follows:

Broadband – KCEC believes that the lat mile fiber optic infrastructure (Broadband) into existing and future electric distribution and transmission facilities, this will facilitate, expand and enhance Northern New Mexico's economic development opportunities. It will also give access to our schools and our College Campuses (UNM Taos and Northern New Mexico Community College) access to the State of New Mexico Super Computer. It will expand telehealth, distance learning and be the future for assisting residential, commercial and government facility members to manage their energy (Energy Efficiency) in real time; The residential, commercial and government facilities would also be able to access broadband through the Super Computer as well. This would be the backbone and main communication link for KCEC Green Grid and Smart Grid deployment and operation;

Smart Green Grid Initiative- KCEC has begun to install smart meters, implement SCADA and distribution automation. KCEC's fiber optic network will provide the 2 way communication backbone for the Green Grid and Smart Grid integration of renewable generation with demand management and energy efficient consumers. This grid will be designed to accommodate future applications such as storage and electric vehicles.

Solar PV Program Green Grid - KCEC has set a goal to place 2015 solar Photovoltaic (PV) systems by 2015 which will include Solar Thermal Applications. KCEC plans to provide about 15- 20% of its energy from distributed solar PV or solar thermal systems (Green Jobs Initiative) by 2015. This program will be made affordable and available to all members;

Taos Regional Command-Dispatch and Homeland Security Center - KCEC has completed construction and is ready to house it's emergency services center. The center will house, 911, E-911, Forest Fire Command and all homeland security initiatives as required by each participant. This system will also be responsible for monitoring Cyber Security tied to smart grid and green grid systems and smart homes;

Consumer Smart Home –KCEC's implementation of AMR the first step towards energy efficient homes served by a Smart Grid. A power guide explaining AMI, renewable systems and other smart sensors throughout the home will be designed and communicated to its members for reduced energy usage, demand management and incorporation of distributed renewable energy systems;

Education- Through this proposal we will enhance educational opportunities to educate the public on the benefits of uses of a Smart Grid and Green Grid systems; and we will be able to utilize UNM Taos and Northern New Mexico Community College to perform the education and outreach.

Key Objectives of KCEC Programs

- **Explain the progress to date of KCEC programs relative to solar energy, smart grid, communications infrastructure and energy efficiency/weatherization;**

- **Emphasize the importance of having Broadband, Smart Grid, Energy Efficiency Weatherization and Homeland Security Initiatives in the State of New Mexico. We have formed partnerships through KCEC, the Municipalities and Counties in the service area. Through these agencies a regional approach to acquire the best opportunities to advance these programs, create and expand economic development opportunities in the communities where these projects are priorities and could be deployed;**

- **Develop programs that can be replicated anywhere in rural New Mexico and additionally create a sustainable economic development engine based on energy and communications (broadband) during the deployment of the projects and for the foreseeable future;**

- **Obtain guidance and feedback on how to best partner with the federal government and the State of New Mexico in enhancing and advancing our programs;**

KCEC's Objective to it's Members

- **KCEC is dedicated to providing reliable, affordable and safe electric service;**
- **KCEC also is dedicated in making the appropriate technological advances that will give our members the tools to better manage their energy by creating a smart grid;**
- **KCEC has recognized the value of renewable energy as a viable energy source and will deploy distributed Solar PV throughout its service territory;**
- **The infrastructure that will link these projects is a robust broadband network which will be deployed by the KCEC and also position North Central New Mexico for expanded economic development opportunities;**
- **Broadband access would strengthen KCEC's Taos Regional Command-Dispatch and Homeland Security Center;**

Strategic Alliances, Broadband, Solar PV Energy Efficiency, Partners

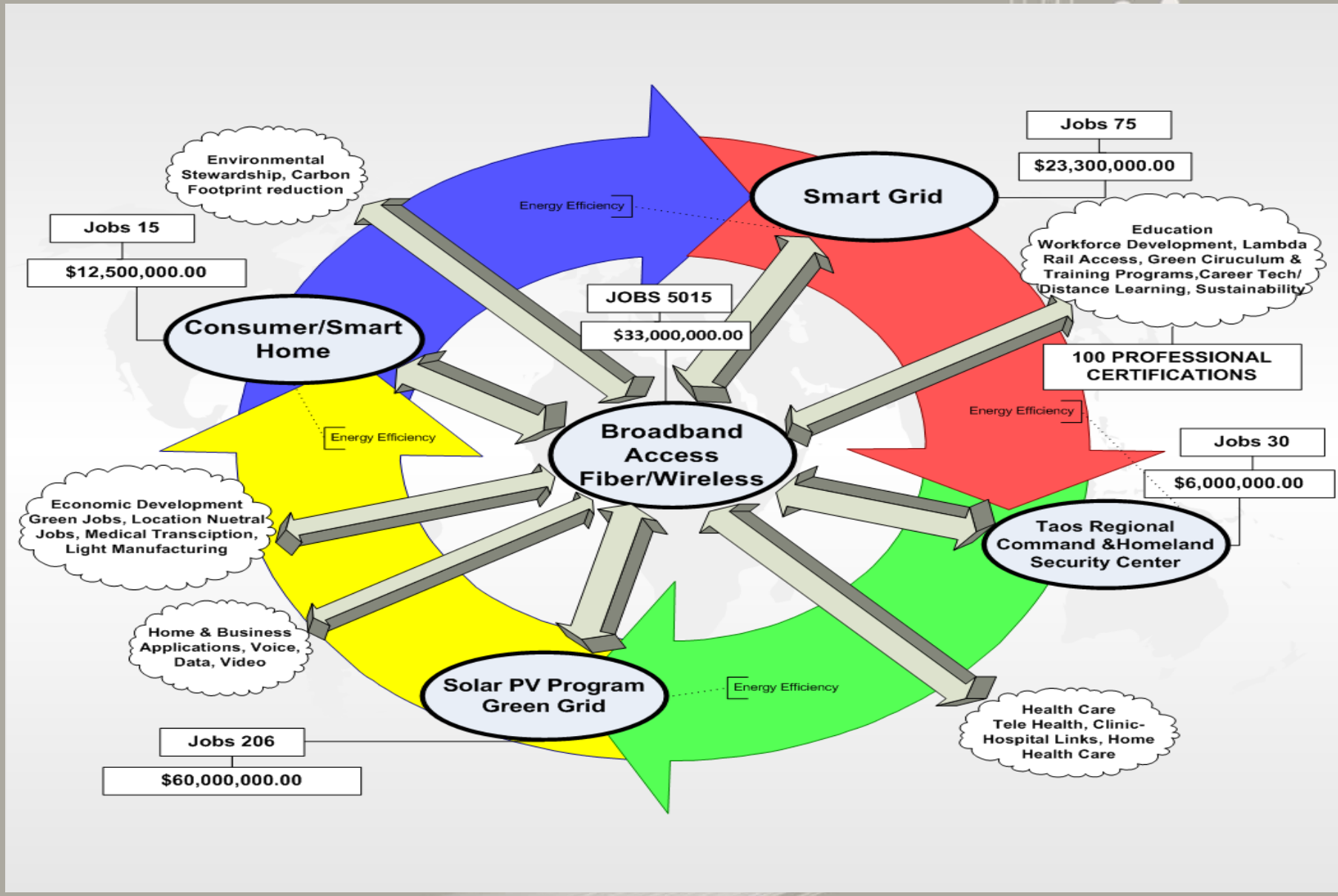
- Town of Taos
- Taos County
- Taos Chamber of Commerce
- UNM – Taos
- Taos Municipal Schools
- Taos Pueblo
- Kit Carson Electric
- Village of Taos Ski Valley
- Village of Questa
- Questa Independent Schools
- Questa Chamber of Commerce
- Town of Red River
- Red River Chamber of Commerce
- Village of Angel Fire
- Angel Fire Chamber of Commerce
- Village of Eagle Nest
- Moreno Valley Schools
- Moreno Valley Charter Schools
- Colfax County
- Village of Cimarron
- Cimarron Municipal School District

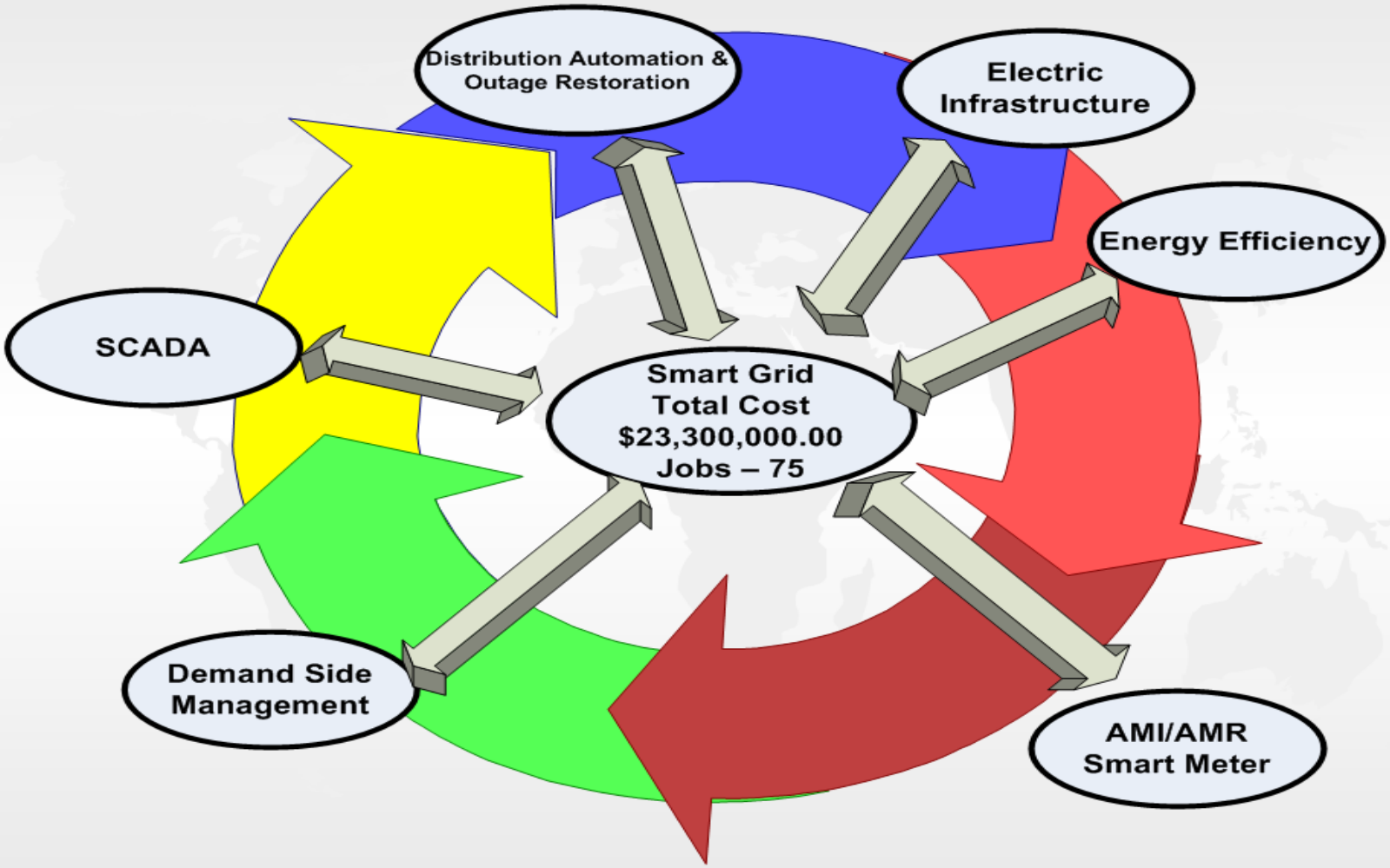
- Intergovernmental Council
- Penasco Independent Schools
- Picuris Pueblo
- City of Espanola
- Rio Arriba County
- Northern New Mexico Community College
- Mesa Vista Independent Schools
- Springer Electric Cooperative
- State of New Mexico
- Los Alamos National Labs
- Sandia National Labs
- National Rural Telecommunication Cooperative (NRTC)
- National Rural Electric Cooperative Association (NRECA)
- Regional Economic Development Initiative (REDI)

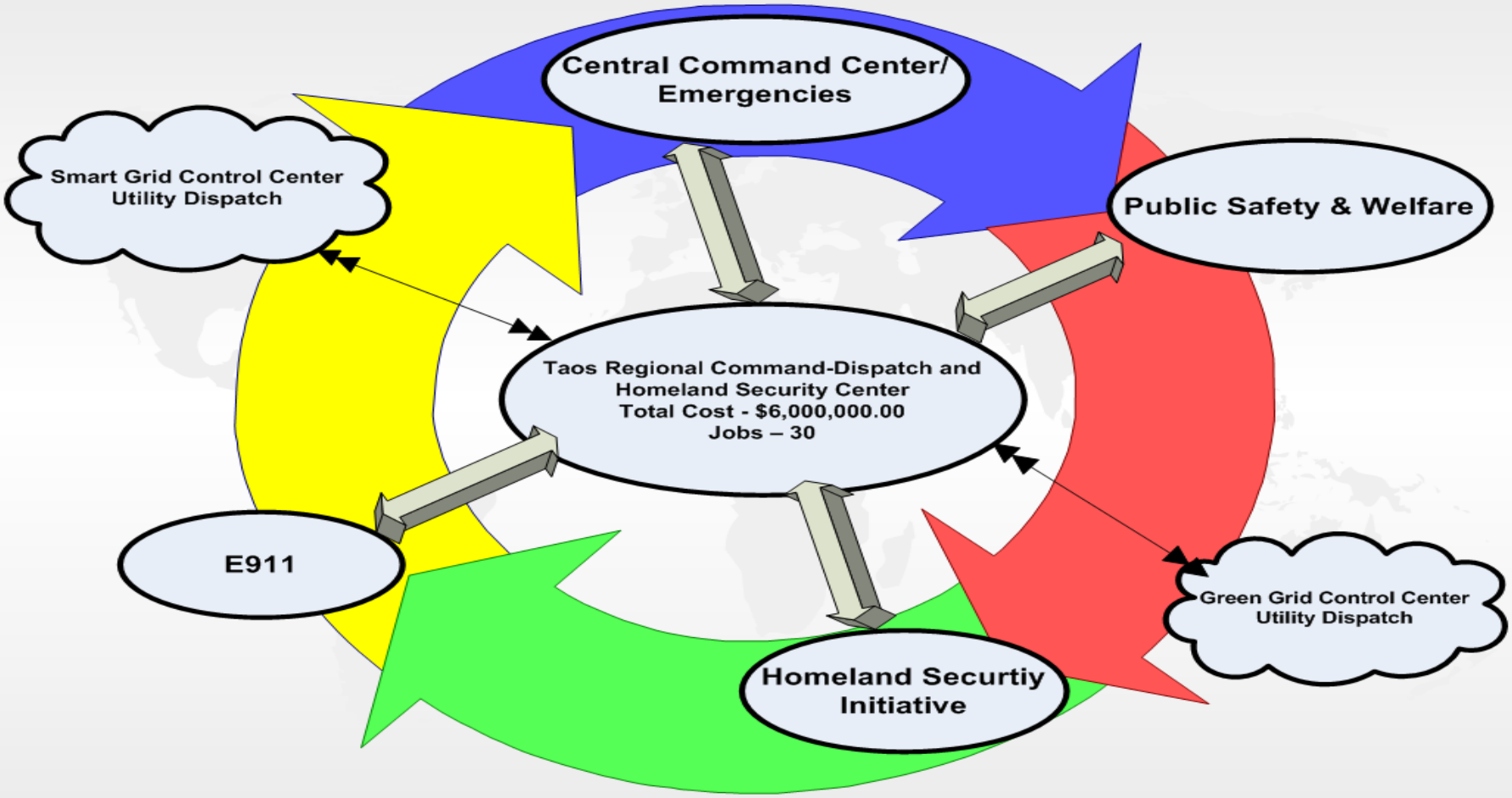
Local Advantages

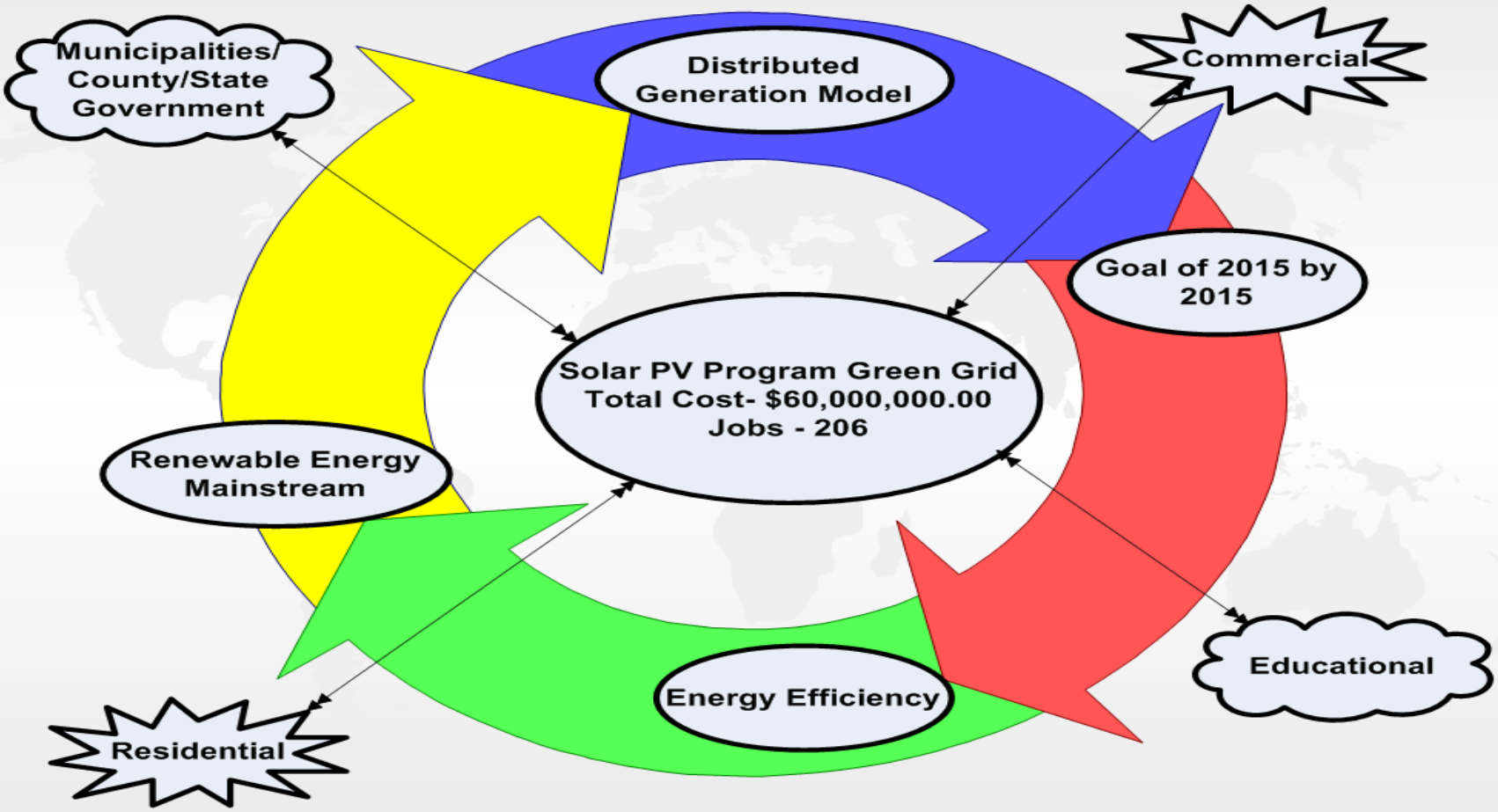
To request an alliance that will provide Broadband Connectivity and Smart Grid and Green Grid Applications which would ultimately benefit and sustain economic development to an area that would not otherwise have such opportunities. The partnerships will bring the ability to strengthen Educational Institutions, Medical Centers and Local Businesses which will improve and protect the way of life for new residents and historical tribes that have much value to our state. The projects presented have many far reaching affects and will present an example of how this infrastructure can encourage communities to thrive and evolve into an era of generations that value and continue with the principles that are based on sound renewable energy.

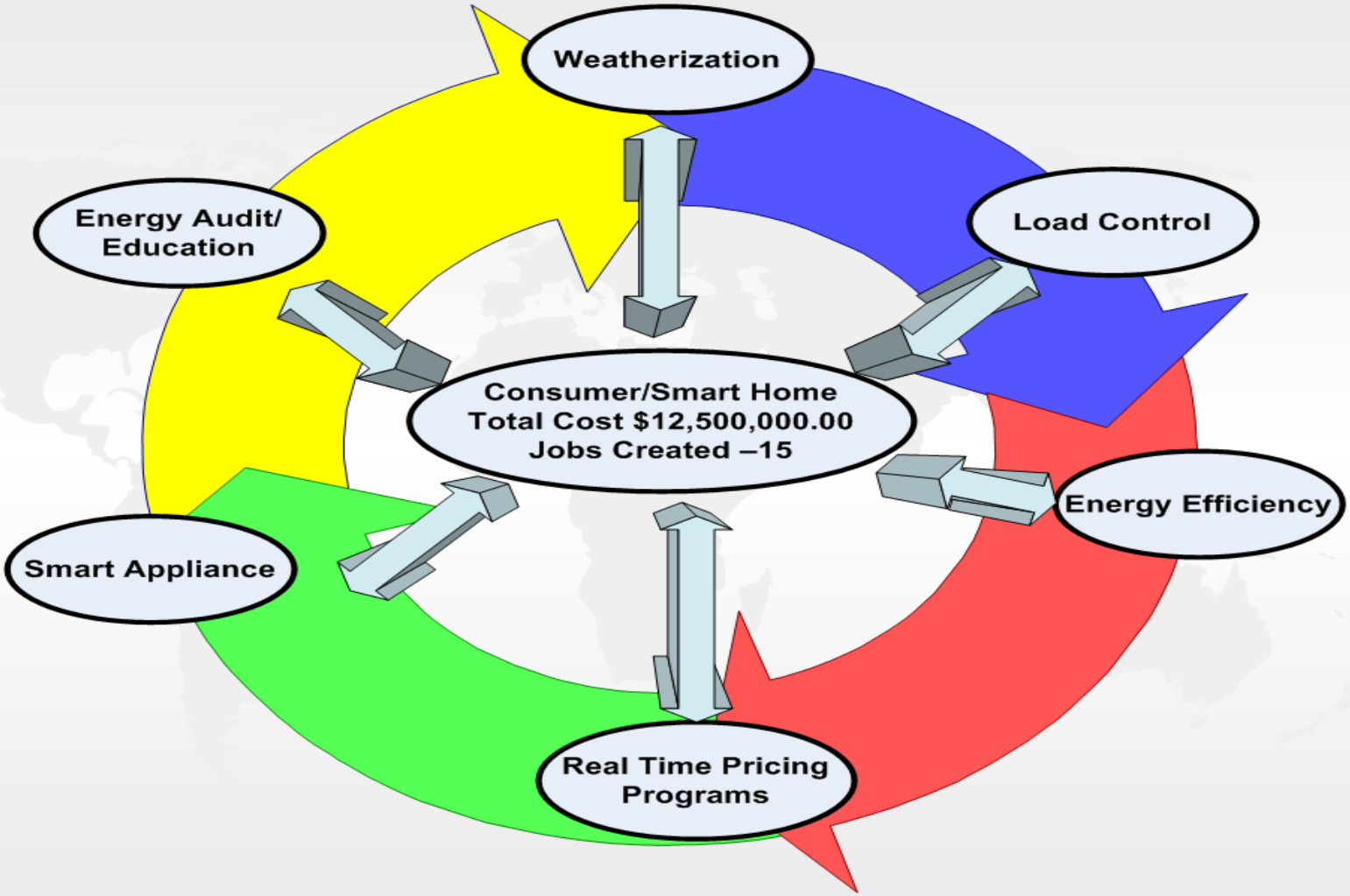
Representation of these principles will promote sound renewable energy which is ready to deploy and maintain for all needed resources on behalf of this project and in alliance with listed partnerships.

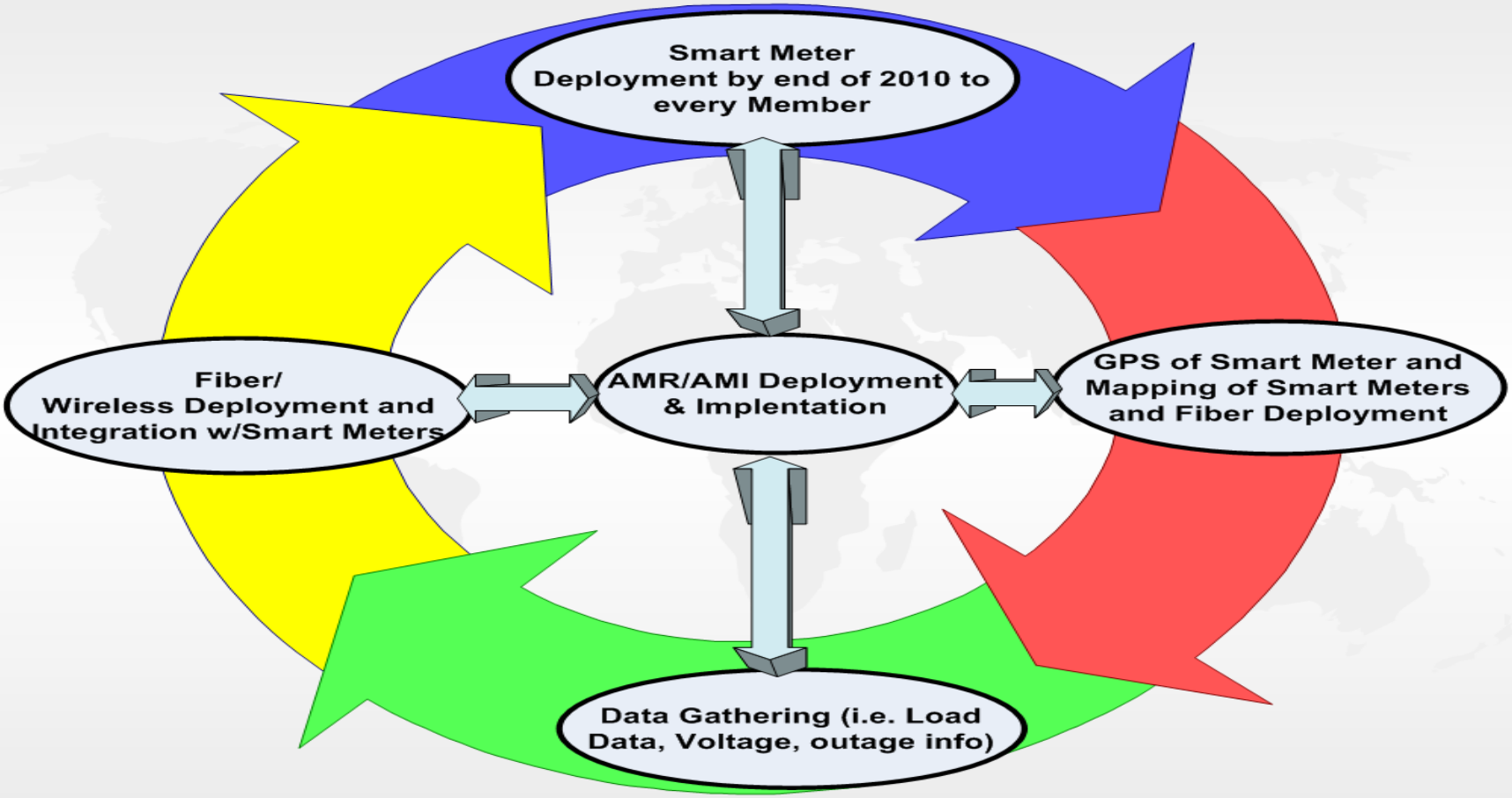

Environmental Stewardship, Carbon Footprint reduction
Jobs 15
$12,500,000.00
Consumer/Smart Home
Energy Efficiency
Economic Development Green Jobs, Location Nuetral Jobs, Medical Transciption, Light Manufacturing
Home & Business Applications, Voice, Data, Video
Jobs 206
$60,000,000.00
Solar PV Program Green Grid
Energy Efficiency
Health Care Tele Health, Clinic-Hospital Links, Home Health Care
Jobs 30
$6,000,000.00
Taos Regional Command &Homeland Security Center
Energy Efficiency
100 PROFESSIONAL CERTIFICATIONS
Education Workforce Development, Lambda Rail Access, Green Ciruculum & Training Programs,Career Tech/ Distance Learning, Sustainability
Jobs 75
$23,300,000.00
Smart Grid
Energy Efficiency
JOBS 5015
$33,000,000.00
Broadband Access Fiber/Wireless


Distribution Automation & Outage Restoration
Electric Infrastructure
Energy Efficiency
AMI/AMR Smart Meter
Demand Side Management
SCADA
Smart Grid
Total Cost
$23,300,000.00
Jobs – 75


Central Command Center/
Emergencies
Smart Grid Control Center
Utility Dispatch
Public Safety & Welfare
Taos Regional Command-Dispatch and
Homeland Security Center
Total Cost - $6,000,000.00
Jobs – 30
E911
Green Grid Control Center
Utility Dispatch
Homeland Securtiy
Initiative


Municipalities/ County/State Government
Distributed Generation Model
Commercial
Goal of 2015 by 2015
Solar PV Program Green Grid
Total Cost- $60,000,000.00
Jobs - 206
Renewable Energy Mainstream
Educational
Energy Efficiency
Residential


Weatherization
Load Control
Energy Efficiency
Real Time Pricing Programs
Smart Appliance
Energy Audit/ Education
Consumer/Smart Home
Total Cost $12,500,000.00
Jobs Created –15


Smart Meter Deployment by end of 2010 to every Member
Fiber/ Wireless Deployment and Integration w/Smart Meters
AMR/AMI Deployment & Implentation
GPS of Smart Meter and Mapping of Smart Meters and Fiber Deployment
Data Gathering (i.e. Load Data, Voltage, outage info)

Kit Carson Electric Cooperative, Inc.

Summary

Kit Carson Fiber to the Home Project – Step One

Implement Fiber Connectivity to the Service area

- Provide fiber optic based broadband connectivity to its members for Two-Way Communication influencing Smart Green Grid Application, Education, Distance Learning, Telemedicine and job creation and other Economic Development that creates clean sustainable jobs;

Kit Carson Fiber to the Home Broadband Project Summary

Kit Carson Electric Cooperative applied for and was awarded 63.8 million dollars in order to build a Broadband infrastructure to deliver affordable broadband service to 29 communities comprised of approximately 20,500 households, 3,600 businesses and 183 critical community institutions, two Native American Pueblos within a 2,951 square mile, rural underserved area in Taos, Colfax and Rio Arriba counties. The project “Kit Carson Fiber–To-The-Home project (FTTH)” award was announced on August 16, 2010, by Johnathan Addelstein, Rural Utilities Service Administrator. Pursuant to the guidelines of the American Recovery and Reinvestment Act of 2009 (ARRA) certain rules and regulations require us to build an open access network. In order to receive the grant and loan funds of 63.8 million dollars the following proposed steps to Kit Carson Telecom (KCT) will be taken to ensure compliance:

- There are two main participants in an open Access Business model, the WSP and the RSP. KCT will be split in half and will operate as Kit Carson Telecom (WSP) and Kit Carson Telecom (RSP).
- KCT-WSP will be the owner operator who will manage the open Access Network.
- KCT-RSP will be part of the Retail Service Providers who will deliver services over the fiber optic network to their customers.

Project Plan by Phases Broadband Deployment

Engineer & Design Backbone Infrastructure (Transport) Fiber Optic Construction

Headquarters to Los Cordovas 1 & 2

Los Cordovas to Arroyo Hondo

Headquarters to Talpa

Talpa to Penasco

Carson to Ojo Caliente

Arroyo Hondo to Sunshine

Ojo Caliente to Hernandez

Sunshine to Amalia

Los Cordovas to Carson

Headquarters to Angel Fire

Angel Fire to Eagle Nest

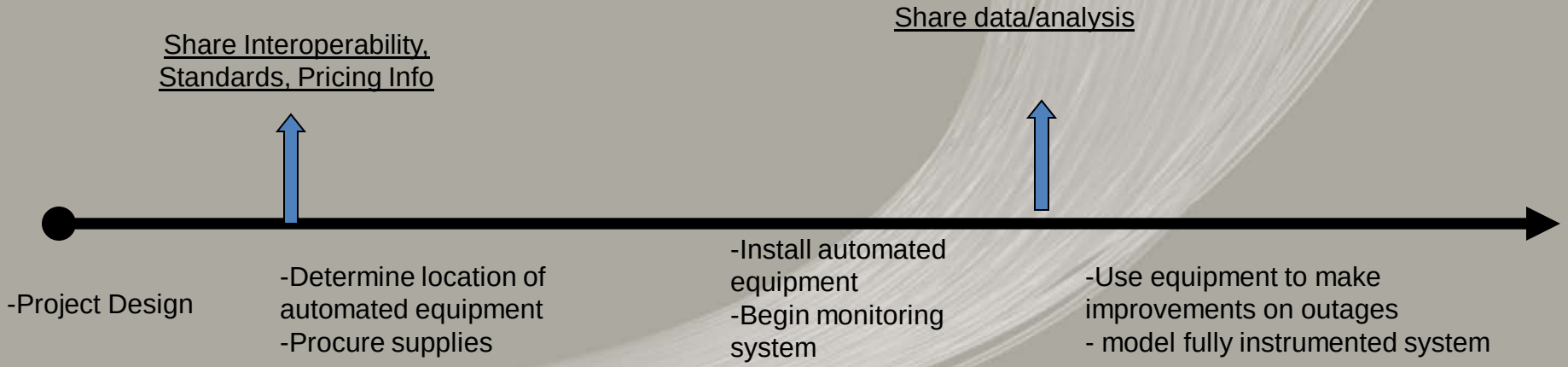
Eagle Nest to Red River

AMR-AMI SMART GRID IMPLEMENTATION

- **Fully implement electric connections to all end-users with 2-way smart meters and a grid that ensures reliable delivery with improved efficiency, and provides cost savings through load management and price incentives;**

Project Description: Automate distribution system

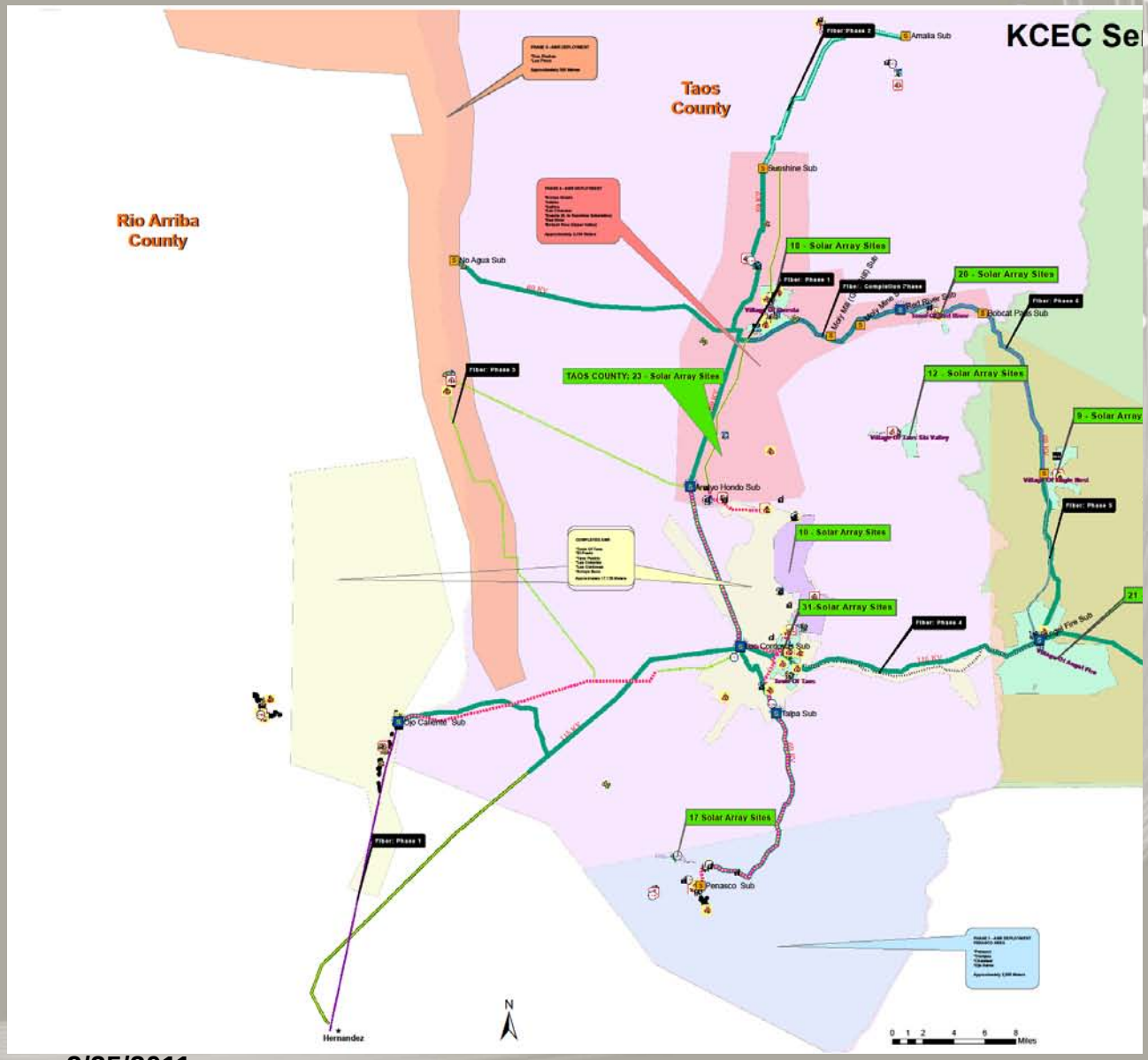
- **Fiber for communication to tie all automated equipment**
- **Technology: Automatic Switches with 2-way capability**
- **Automate Voltage Regulators with 2-way capability**
- **Automate Step-down Transformers and OCR's**
- **Goal/Outcomes: Demonstrate automated switching procedures from control to minimize outage time.**
- **Monitor system to sectionalize fault locations using automated system.**
- **Ability to determine long range growth plans incorporating system control, load management and PV integration**



SOLAR PV INTEGRATION – GREEN GRID

- **Continue Integrate Solar PV into the system and increase this to 15 MW by 2015. Study and manage the grid behavior with increasing deployment of renewable power;**

Demonstration Area



KCEC IS AWARDED Clean Renewable Energy Bond (CREB)

KCEC was notified on November 23, 2006 by the Internal Revenue Service that they have been allocated $5,000,000.00 under the Clean Renewable Energy Bond Limitation of the Internal Revenue Code Section 54. Through the process of the application KCEC met the criteria regarding the requirements a project must meet in order to be eligible to obtain an allocation of the limitation. energy bonds. The application for the clean renewable energy bond limitation was filed on April 26, 2006. Through these allocated bonds KCEC has been able to promote solar renewable energy in Northern New Mexico along with promoting economic development. Solar energy projects throughout the KCEC service area are planned as well as with assisting residential consumers in the area with one megawatt solar installation projects.

CREB'S PROJECTS COMPLETED

UNM-TAOSKLAUERCAMPUS500KW ARRAY-ENERGIZED8/29/09

KCECSOLARPARKINGCANOPY 100KW–ENERGIZED1/12/10

KTAO RADIO SOLAR ARRAY 43 kW-ENERGIZED 2/12/10

KCEC PROPOSED SOLAR PROJECTS

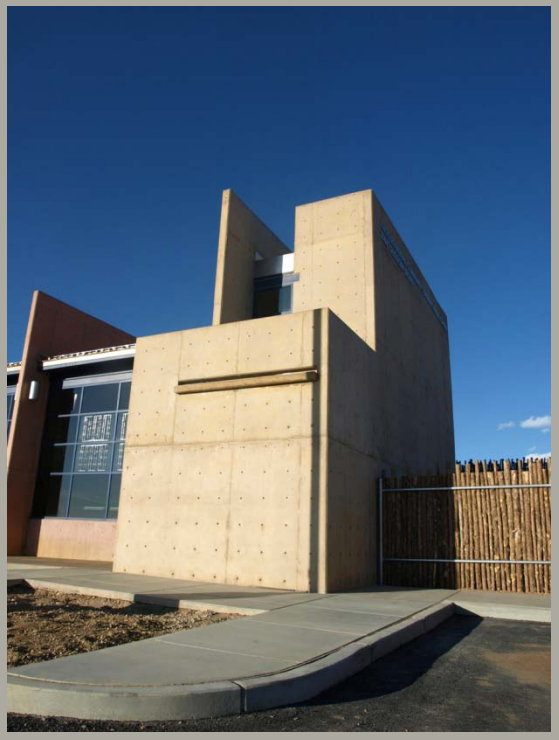
Taos ECO Park – 250 kW

Chevron Venture Technologies 1.2 MW

Standard Solar LLC - Rio Costilla Livestock Association (RCCLA) 1.5 MW

TAOS REGIONAL COMMAND DISPATCH AND HOMELAND SECURITY CENTER

- **KCEC has constructed a State-of-the-Art Taos Regional Command-Dispatch and Homeland Security Center that will house all emergency services (enhanced 911) based on the communication backbone provided by the broadband system.**



SCADA AND CYBER SECURITY

- **Develop and implement a secure cyber system and integrate SCADA as well as monitor and analyze the smart and green grid for secure, reliable and affordable power.**

Project Description: System wide Communication and Control

Broadband, Internet, TLC, wireless 2 way communication to end-users;

Technology: SCADA units with feeder control and auto-reclosers;

Bring all 13 substations under SCADA including automation of feeder control and auto-reclosers;

Data Storage Cyber Security and Computer network Increased power reliability and outage prevention;

PV and onsite energy storage for model control center Implement and test Cyber security;

Acquire grid and user data and analyze at centralized headquarters Demonstrate viability of control center as a microgrid with PV generation and storage;

KCEC Goals and Outcomes for the Future of the Service Area

- **Fully document the process and implementation of the Fiber to Home Project and assist this project for scaling up and replicating in other parts of the state and country;**
- **Improve educational opportunities in the local schools and institutions of higher learning through fiber connections and solar array placement;**
- **Partnerships with municipalities and educational facilities to promote economic development and educational opportunities;**
- **Study cost-effective options for integrating storage and provide detailed analysis and implementation plans.**