AK-CHIN ENERGY SERVICES
BIOMASS FEASIBILITY EXPERIENCE

Presentation To

The Arizona Waste-To-Energy Workshop

Renewable Energy From Biomass In Arizona

Sponsored By The

Environmental Protection Agency

October 24, 2007

Ak-Chin Energy Services

Topics

- **Project Background, Objectives & Constraints**
- **Ak-Chin Indian Community Reservation**
- **Diagram of Electric System Components**
- **General Biomass Project Check List**
- **Biomass Project Activities**
- **Current Status Of Project**
- **Contact Information**

Project Background, Objectives & Constraints

- **Background**
  - Ak-Chin Energy Services (ACES), an enterprise of the Ak-Chin Indian Community, has a need for additional electrical power.
  - The Ak-Chin Farms, an enterprise of the Ak-Chin Indian Community, uses chicken litter from the Hickman's Egg Ranch as fertilizer for its agricultural crops.
  - The Ak-Chin Indian Community supports the use and/or development of cost-effective renewable energy.
- **Objectives**
  - Use the chicken litter and other biomass materials to either produce bio-gas or burn and generate electricity.
  - Eliminate possible odor and fly problems.
  - Meet all environmental requirements.
- **Constraints**
  - **Return nutrients to Ak-Chin Farms**
  - **Ensure that the Ak-Chin Farms experiences no adverse economic or nutrient dispersement impact**.

Ak-Chin Indian Community Reservation

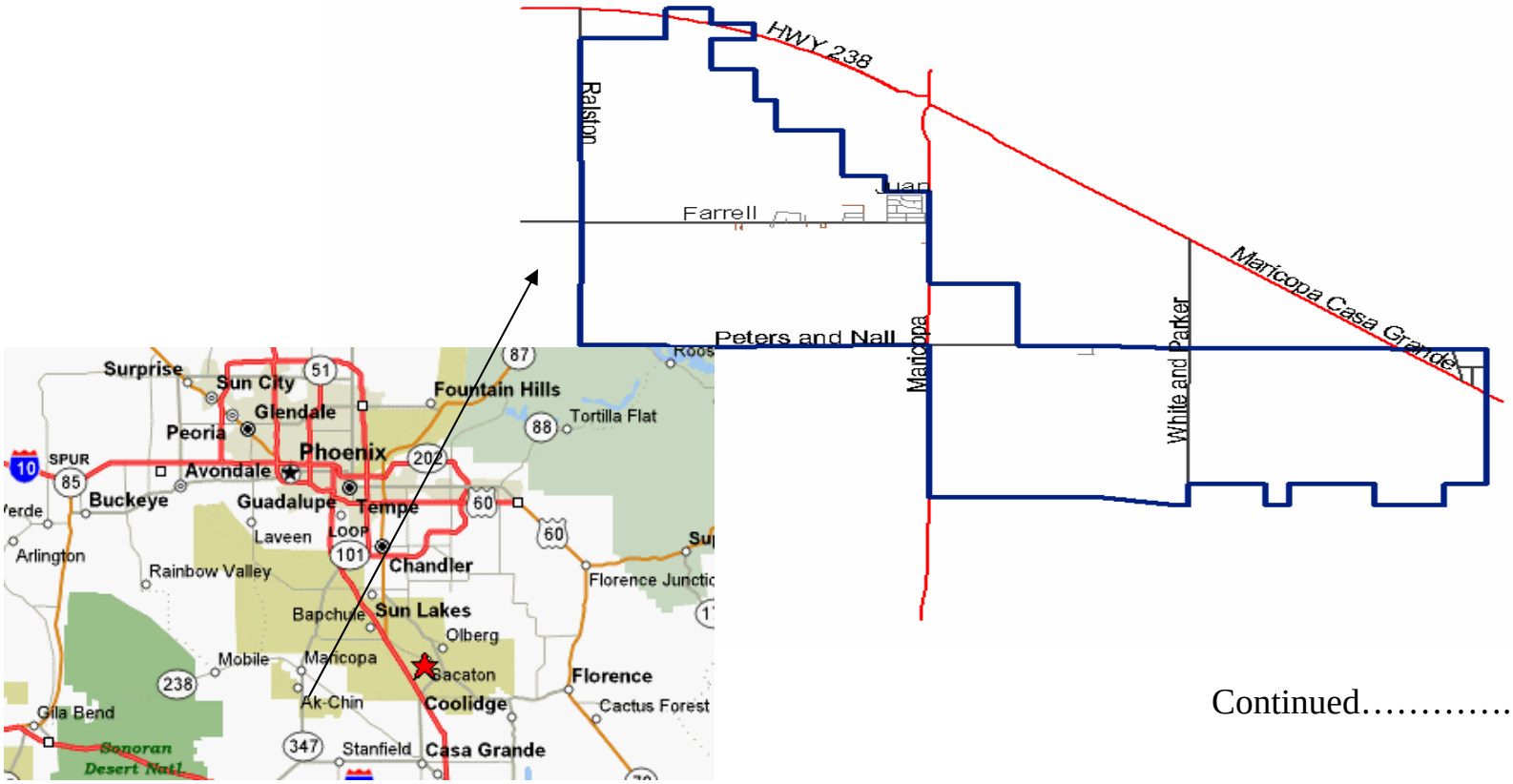

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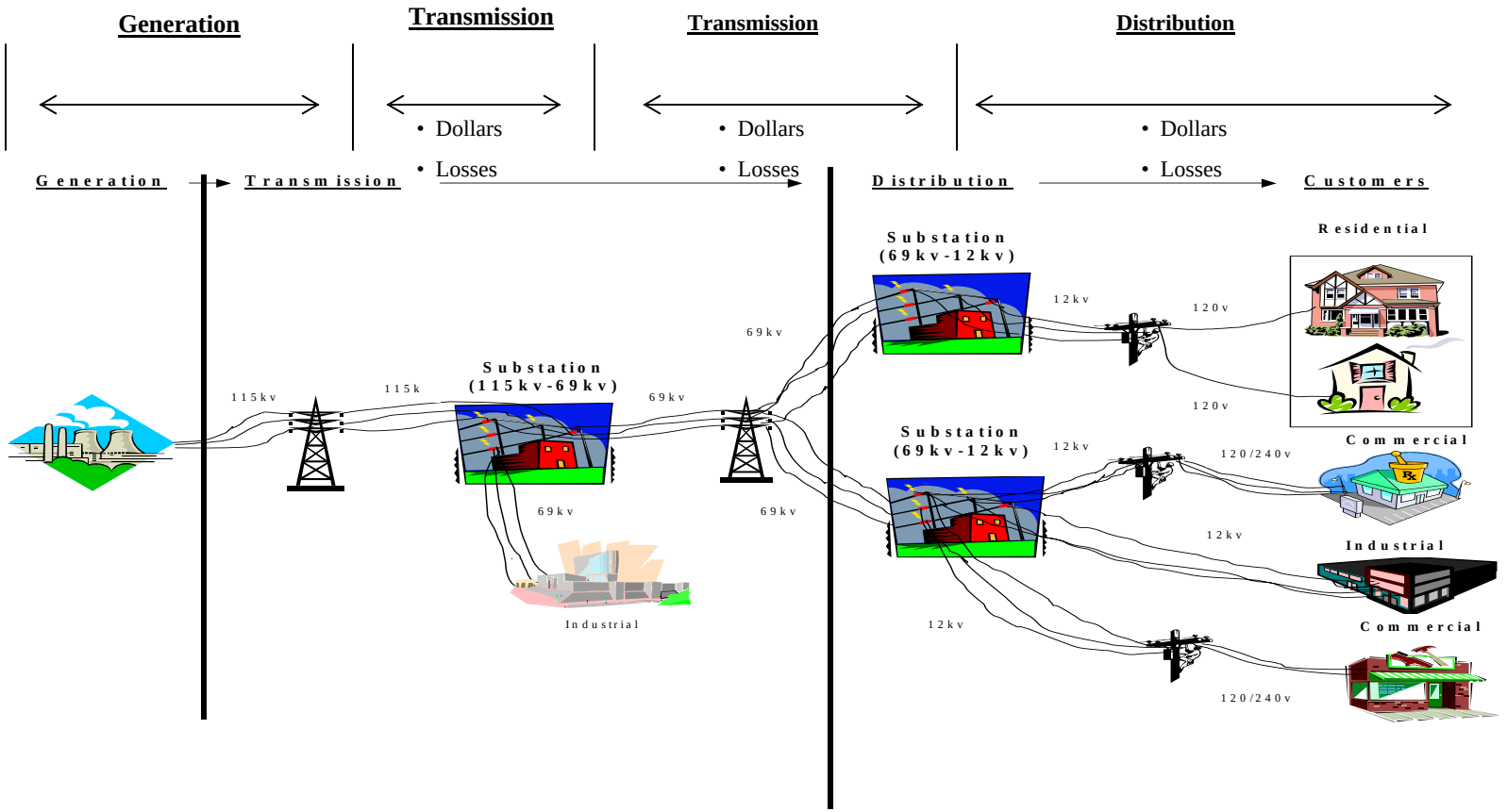
Diagram of Electric System Components



General Biomass Project Check List

Material •Availability & Quantity •Quality •Cost •Testing For BTU's, Moisture, Nutrient and Digestibility	**Interconnection** •Voltage & Facilities Required •Utility Requirements •Distance To Electric Facilities •Cost
Transportation •Location •Distance •Cost	**Technology** •Digestion •Combustion •Cost
Financial •Equity Requirements •Capital Investment •Tax Incentives	**Regulatory** •Renewal Energy Portfolio Requirements •Green Tags (Market & Value) •Environmental Requirements
Site •Land •Water •Road Access •Cost	**Other** •Job Creation •Constraints

Biomass Project Activities

- Study use of chicken litter to produce energy either through digestion or combustion.
- Determine chemical content of chicken litter.
- Identify raw chicken litter nutrient content as used by Ak-Chins Farms.
- Identify nutrients remaining after digestion or combustion.
- Identify power production capabilities from digestion or burning that fit with ACES operational needs.
- Identify resultant fertilizer distribution system.
- Determine economic and non-economic Benefit / Cost of digestion or combustion.

(Continued…….)

Biomass Project Activities (continued)

Resource Assessment – Chicken Litter

- 1.5 Million Birds
- 100 tons per day of chicken litter
- Need between 30,000 - 90,000 gallons dilution water per day
- Digester output 300,000 gpd liquid effluent
- Enough bio-gas for the production of approximately 1MW of electrical power

(Continued…….)

Biomass Project Activities (continued)

Chicken Litter Test

- Digestion
  - Dry BTU Content
  - Wet Digestibility
  - Nutrient Value

- Gasification
  - Energy Values
  - Moisture Content
  - Chemical Composition of Residual Ash

(Continued…….)

Biomass Project Activities (continued)

Technology Review

- **Digester**
  - Heated anaerobic digestion so as not to be subject to seasonal weather impacts
  - Produces bio-gas (Biological process producing Methane and CO_2)
  - Reduces environmental impact of chicken litter
  - Minimal effect on the nutrient content of the digested chicken litter, with half or more of the organic nitrogen (Org-N) being mineralized to ammonia (NH_3-N) thereby enhancing the ability of growing plants to utilize the nitrogen.
  - Homogeneous nutrient balanced liquid fertilizer output
- **Gasifier**
  - Gasification of carbon-based feedstock without introduction of air or oxygen
  - Benign ash
  - Produces syn-gas (Coking process producing Methane, Hydrogen, CO, and CO_2)
  - Negligible emissions
  - No nitrogen left in ash
  - Not enough feedstock available

(Continued…….)

Biomass Project Activities (continued)

Nutrient Distribution Strategy

Current	Proposed
Truck hauls raw chicken litter to fields	Tanker truck or pipeline used to deliver liquid fertilizer to fields
Truck spreads raw chicken litter on fields	Tanker truck or pipeline transfers liquid fertilizer from tanker to feeder tractor and liquid fertilizer inject below soil
Tractor disks raw chicken litter into soil	Tractor disks soil
Nutrient content of raw chicken litter varies from barn to barn	Nutrient content of liquid fertilizer is homogenous
	Reduction of nitrogen loss

(Continued…….)

Biomass Project Activities (continued)

Financial Analysis For Digester

- Debt – Equity Ratio – 80 – 20
- Project Life – 20 years
- Interest Rate – 6%
- Digester Capital Cost - $4.6 million
- Chicken Litter Cost - $0
- Project O&M – 0.015 $/kWh
- Delivery System Capital Cost - $342,000
- Electrical Interconnection Cost - $100,000
- Energy Output Value At Busbar– 0.065 $/kWh
- Generator Size – 1,000 kW
- Energy Output – 7,884,000 kWhs (at 90% capacity factor)
- Green credits - 0.010 $/kWh
- Payback – approximately 10 – 12 years
- Internal Rate of Return – greater than 12%, without grant and 100% ownership by Ak-Chin Indian Community

Biomass Project Activities (continued)
Study Recommendation

- Digestion, because:
  - Will Reduce of Odors, Pathogens & Flies
  - Nutrient content will be maintained and will provide a homogenous liquid fertilizer with consistent levels of nutrients
  - Trucking solution to distribute and apply liquid fertilizer, is similar to current practice of spreading chicken litter
  - Will produce approximately 1 MW of electrical power, helping to meet ACES' power supply needs
  - Proximity of Biomass Sources
  - Compatible with cultural resources & environment
  - Ak-Chin Farms does not have to alter cropping patterns
  - Existing utilities are close to site, making interconnection more cost effective
  - Good road access

Current Status of Project

Project has not been authorized for development because an agreement with the Ak-Chin Farms on a nutrient delivery strategy has not been reached.

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