SAND2014-18900C

Exceptional service in the national interest

Sandia National Laboratories

Evolving Infrastructures: Kewa Gas Station

Aaron Caté

MS Student Intern, New Mexico State University

Sandra Begay-Campbell (Supervisor / Mentor)

Sandia National Laboratories

August 2014

U.S. DEPARTMENT OF ENERGY

National Nuclear Security Administration

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Abstract

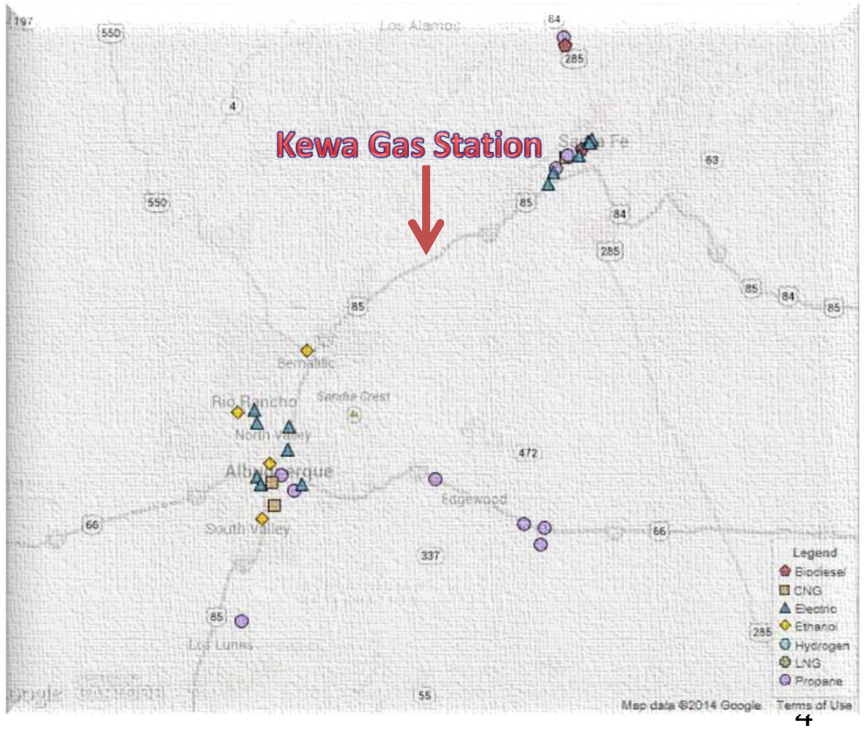
- The primary factor of increasing greenhouse gas emissions and global climate change are due to the burning of fossil fuels, mainly in transportation.
- Tribal lands contain prospective renewable energy resources for sustainable technologies that are clean alternative resources of energy creating accessible opportunities for Native American tribes to these advanced technologies based on the location of their reservation and communities.
- Energy sustainability will play an important future role in clean and energy development.

Introduction

- Tribal Energy Program
  - Provides financial and technical assistance for promoting renewable energy on tribal lands
- Santo Domingo Pueblo
  - Located 25 miles north of Albuquerque and is among the 19 Pueblo Indian tribes of New Mexico
- Research Objective
  - Explore the scope of renewable energy and energy efficiencies as a means of tribally owned gas stations.
  - Transition to renewable resources as alternatives for economic development.
  - Reduce the reliance of fossil fuels.

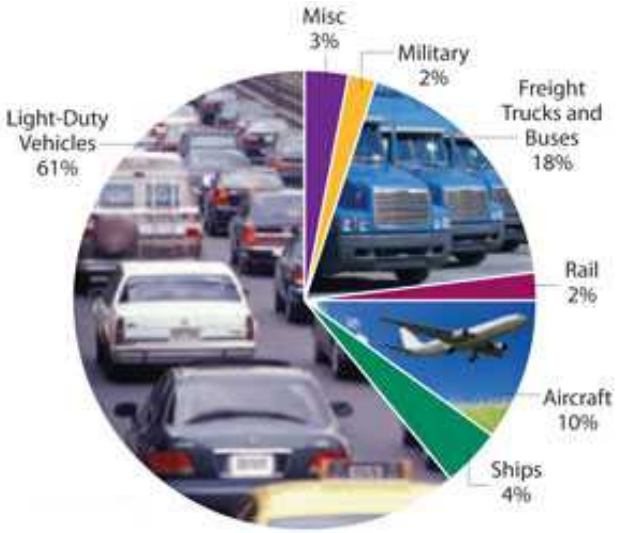
Background

- Kewa Gas Station
  - Located on U.S. I-25 Exit 259 – the area's key north-south artery
  - Facility serves as the Santo Domingo Pueblo tribe's primary wholesale and retail operation
    - 20 retail gas pumps
    - Local food franchise and market
    - Sells approx. 1700 gallons of fuel/day to approx. 500 vehicles

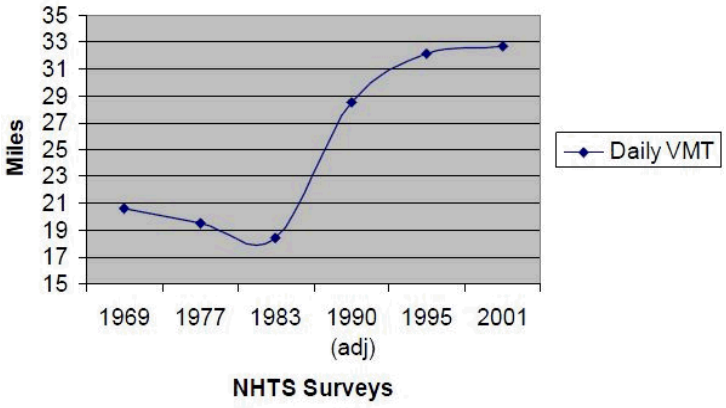


Background

- Climate change impacts
  - Greenhouse gases
    - Carbon dioxide (CO_2), Halons, methane($CH_{4),}$, ozone, and nitrous oxide (N_2O).
  - Transportation produces as close as to 30% of all the polluting emissions in the United States
  - Passenger cars and light trucks generates 61% of U.S. transportation emissions.
- 1 gallon of gasoline emits 24 lbs. of CO_2 emissions
- Kewa Gas station contributes to 162 tons of CO_2 coming from the average 500 motorists traveling on I-25



Daily Vehicle Miles Traveled - All Vehicle Types



Background

- Renewable resource
  - Photovoltaic (PV) solar arrays
  - Wind turbines
  - Biomass-derived energy

Biofuels/Alternative Green Fuels

- Biodiesel
  - Made from raw materials and animal fat
  - Contains no petroleum
  - Contains good lubricating properties
- Ethanol
  - Clear colorless-alcohol prepared from sugar and starch found in agricultural crops
  - Cleaner and diminishes greenhouse gas emissions

- B20 fuel
  - 20% biodiesel mixed with 80%% petrol
- Water eutrophication
  - Phosphorus and fertilizer in water

- E10
  - A blend of 10% ethanol volume and 90% gasoline
- E85
  - 85% ethanol blend with 15 containing gasoline remaining
- Water use
  - 20 gal. of water → 1 gal. of ethanol

EVSE Charging Stations

- Electric Powered Vehicles
  - Hybrid Electric Vehicles (HEV)
  - Plug-in-hybrid electric vehicle (PHEV)
- Charging Station
  - Requires power to charge either from a grid or renewable sources.
    - Level 1
      - Single phase coupler – 120 VAC at 16 amps
    - Level 2
      - Supplies 240 VAC at 80 amps
    - Level 3
      - Very high voltage. Charges within a range of 400-600 VDC 2ith 400 amps maximum

Alternating factors

Assess, Replace, and Upgrade

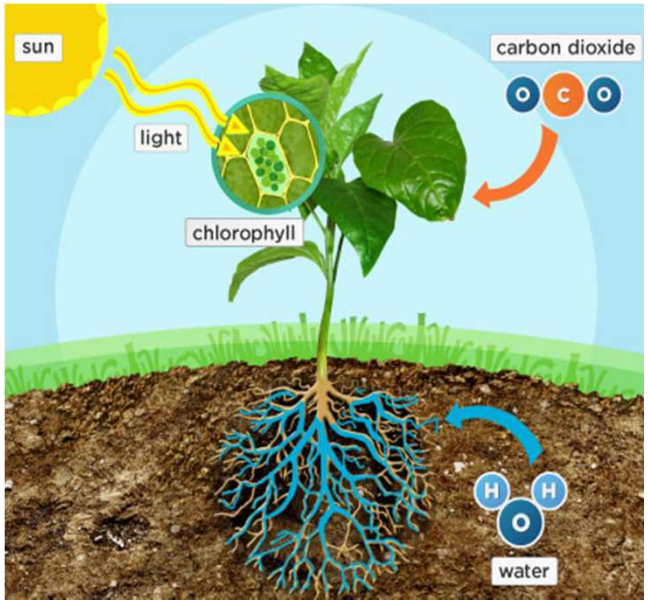
- Heating and cooling systems
- Water heating systems
- Refrigeration and freezer appliances
  - ENERGY STAR Certified
- Lighting
  - Replace the incandescent lamp (light bulb)
    - Only 10% light conversion
  - Upgrade to Compact florescent lamps (CFLs)

Alternative Factors

Sandia National Laboratories

The Photosynthesis Method

- Instillation of trees, landscaping and vegetation
  - Trees feed on carbons into their roots (biomass).
- Green roofs
  - Absorbs heat and acts as an insulator
  - Reduces energy cost for heating
  - Beneficial for winter seasons



Overcoming the hurdles

- Federal Programs
  - Providing grants, project funding, loans, and green tags
    - U.S. Department of Energy/Tribal Energy Program
    - U.S. Department of Interior
    - U.S. Department of Agriculture
    - U.S. Environmental Protection Agency
- Strategic Energy planning
  - Creating opportunity for tribes to engage long-term commodities and support tribal energy projects
- Development and Culture.
  - Empowering the tribal people to stay traditional in preserving their culture and upgrading to renewable resources, which will enhance tribal energy efficiencies.

Conclusions

- Greenhouse Gases
- Climate Change
- Transportation
- Green Gas Station
- Renewable resources
  - Biofuels
  - EVSE Charging Stations
    - Vehicle to Grid or Solar powered chargers
- Federal Grants and Strategic Energy planning
  - Creates opportunity for tribes to engage long-term commodities and support tribal energy projects
- Further tribal economic development investments

References

- Anderson, S. T. (2012). The demand for ethanol as a gasoline substitute. *Journal of Environmental Economics and Management*, *63*(2), 151-168.
- CFC. (2012). Solar power for electric vehicles. In *Clean Fuel Connection*. Retrieved July 18, 2014, from <http://cleanfuelconnectionnews.com/electric-vehicles/solar-power-for-electric-vehicles/>
- EIA. (2014). How much electricity is used for lighting in the United States?. In *Independent Statistics & Analysis: U.S. Energy Information Administration.* Retrieved July 28, 2014, from http://www.eia.gov/tools/faqs/faq.cfm?id=99&t=3
- Garnenez, P. (2009). Green Gas Stations: A Guide for Tribally Owned Gas Stations. *Sandia National Laboratories*.
- Union of Concerned Scientists. (2014). Clean Vehicles. In *UCSUSA*. Retrieved August 7, 2014, from http://www.ucsusa.org/clean_vehicles/why-clean-cars/global-warming/
- U.S. Department of Transportation (2014). Summary of Fuel Economy Performance (Public Version). (2014). *NHTSA, NVS-220.* Washington, DC.
- Velarde-Tiller, V. E. (Ed.). (2005). *Tiller's Guide to Indian Country: Economic Profiles of American Indian Reservations* (pp. 761-762). Albuquerque, NM: BowArrow Publishing Company.

Thank You!!!

Sandia National Laboratories