2009 PORS

"A Case Study; Using Walnut Shells For Power Generation - The Promises, Problems and Solutions"

Presented by:

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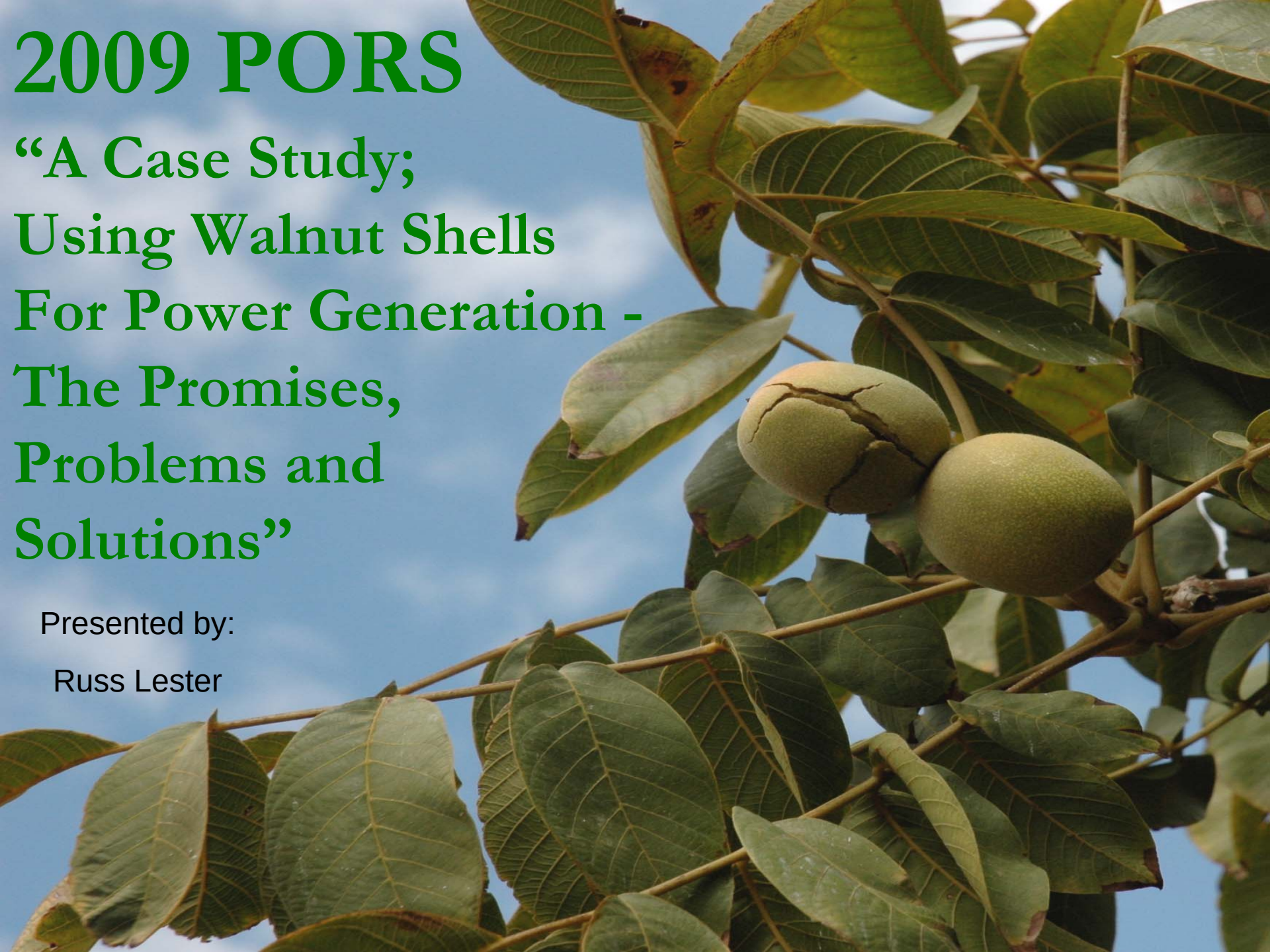

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Dixon Ridge Farms

- **Grower and Processor of Organic Walnuts;**
  - The largest handler of organic walnuts in the United States;
  - We grow organic walnuts on over 500 acres, and buy about 2,500 more acres of organic walnut production from 67 growers
- **Family farming in California since 1867 and organic since 1990;**
- **We follow a sustainable, whole systems approach to organic farming and business.**

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Our Energy Goal

Total farm and processing net energy self sufficiency by 2012 for all types of energy

We aim to achieve this goal while taking into account:

1. Carbon neutral or negative
2. Nitrous-oxide neutral or negative
3. Use non-food sources for energy
4. Energy costs should be reasonable
5. Transferable

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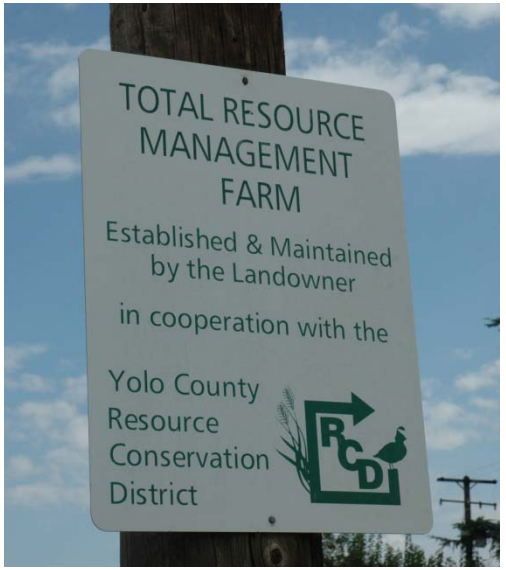
Current Conservation Practices



1. **Recycle**
   - Hulls/shells – spread back into orchard
   - Water – recirculation systems since 1982
   - Prunings – chipped and back into soil since 1976
   - Aluminum/paper/plastic/steel/etc - as much as can
2. **No till / Mow production methods since 1980**
3. **Integrated Pest Management**
4. **Fertilize with Compost, rather than synthetic fertilizers**
5. **Irrigation – New type**
   - Overhead hoses - through tree branches
   - Drop rotary sprinklers – greenhouse style
   - Compatible with cover crops/organic production
   - VFD Electric Pump Motors
   - Operate at 10-25 PSI at pump vs. 35-50 PSI for drip and micro-sprinklers
6. **Freezer insulation - all at or above R 80 even though “normal” is R 25**
7. **Dryer Improvements**
   - Recirculation cover - tent/building
   - Save 35-40% of drying fuel
   - Same number of dryers, trailers and drying capacity
8. **Land conservation / preservation**

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Current "Green" Energy Production

1. **Solar**
   - **3,500 square feet of PV panels**
   - **Generates $3,500/year of electricity**
   - **Very low maintenance**
   - **Specifications on all new buildings include loading for solar panels of 6#/sq. ft**
   - **Future desire to increase to over 90,000 sq. ft**
   - **Side benefit of cooling by shading roof with panels**
   - **Solar addition is a perfect fit with freezer energy use**

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Current "Green" Energy Production (cont.)

2. **Bio Max 50** – Manufactured by Community Power Corp (CPC), Grant from California Energy Commission (CEC)

    - **Production**
        - **Propane:** Offsets $12-14,000/year during 5-week drying season
        - **Electricity:** Produces $30,000-$45,000/year
        - **Hot Water:** Hydronic
        - **Heating:** Use hydronic or hot air to heat our buildings & dryers
        - **Local Use:** Will use 100% of produced energy on site
        - **Fuel:** Uses about 820,000 pounds of walnut shell per year
    - **Environmental Impact**
        - **Walnut shells:** Are a renewable, non-food source of energy
        - **Carbon Cycle:** Atmospheric CO_2 absorbed by trees to produce walnuts, which provide food and shells for energy production that will be used to dry and process walnuts, emissions back to air
        - **"Waste":** Hope is to use "char-ash" in compost and apply back into orchard (long-term carbon sequestration)
        - **Net negative release of carbon**: 1,000 year half-life in soil

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Status Report

- **Energy Generation and Reduction**
  - Generate about 20% of our electricity use
  - Offset about 40% of our propane use
  - Reduce dryer heat needs by about 70% via CHP and recirculation
  - ➔ Total is about 25% of all energy used
- **Costs**
  - ➔ Cost to produce electricity and propane onsite is about the same as retail price
  - ➔ May be revenue generating depending on GHG reduction market and excess energy generation sales

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Future Projects (Grants Please!)

- **More solar panels on the roofs – possibly up to 90,000 sq ft**
- **Walnut Oil, 2009**
  - Press inedible walnuts into oil for biodiesel or walnut oil fuel
  - Estimated 12-14,000 gallons could be produced per year under current production
  - Would supply 75% of current diesel needed for tractors, irrigation, trucks and generators
  - Estimated cost of $1.25/gallon
- **Change gas generator to a “diesel” generator, 2009**
  - 85% producer gas, 15% liquid fuel (diesel, synthetic-diesel, bio-diesel or vegetable oil)
  - 100 kW of electrical production
- **CPC Bio Max 100, late 2010 - use rest of shells available to produce 100 kW or 200 kW**
- **Use CHP in Absorption chillers on HVAC and freezers**
  - Should save about $18,000/year
- **CPC Liquid Fuel Module, 2009 trials, 2010 production**
  - Will generate approximately 25 gallons/day, 15,000 gallons/year of synthetic diesel
- **CPC Hydrogen Module, ?**
  - Possibly use for fuel cell energy for forklifts, vehicles, electricity generation
- **Research Studies**
  - Carbon and Nitrogen – UCD, NRCS, DRF
  - Char ash use – CPC, UCD, DRF
  - Energy efficiency improvements – UCD Energy Efficiency Center, PG&E, DRF
  - Energy production – UCD, CA Biomass Collaborative ?, DRF

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Current Impediments

1. Emissions
2. Char/ash Soil Application
3. Interconnection

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Impediment 1: Emissions

- Letter of non-compliance
- Time to issue Authorization to Construct (ATC) estimated to be 3 years
- Length of time to issue Authorization to Operate (ATO) - 9 months
- Costs – about $28,600, so far
- Annual costs - ???

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Impediment 2: Char-ash Application

- We face potential oversight from the following agencies:
  - USDA, NRCS, US EPA, CA EPA, Yolo and Solano County Dept. of Ag and Dept. of Health, CIWMB, CA OSHA, US OSHA, WRCB, CCOF, USDA, DFG
  - Others?
- Costs- about $5,700, so far
- Char-ash testing shows that it is non-toxic
- Good news – partial grant to UCD to study soil application

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Impediment 3: Interconnection

- Catch 22
  - Solar net meter for four renewables only & prohibits biomass
    - Could have used Non-export, but equipment was about $50,000
    - Would never have been able to pay this off
  - FIT prohibits interconnection with solar net meter that took incentive money or CEC PIER grants
- Fees for FIT
  - Was told as high as $50,000, may be less, confusion
  - Don't know costs until we pay a non-refundable fee
  - Game stopper for small renewable generators
- FIT MPR (Market Price Referent) is not high enough to pay for these costs
- MPR - natural gas based, subsidized and variable. Falling NG prices=falling interest in RPG

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Global Issues

- Overcoming Centralized Power and Distribution thinking and marketing
- Security – centralized power plants and transmission is less secure
- Not all renewable power is green (or how it can be made "black")
  - TANC – Transmission Authority of Northern California
    - Description – 600 mile transmission line from NE CA to 15 MOUs
    - Will destroy 60,000 acres of forest, farm and range land, permanently
    - Total solar array of about 22,000 acres
    - Line constr. costs $1.5 - $6 Billion or $1000-$4000 for each house
    - Transmission line loss is huge
    - Could give to roof mounted solar instead
    - 650 square feet array could easily be put on each house served
  - Large solar in desert areas destroys a fragile environment, maintenance?
  - Algae ponds in the desert consume large quantities of water, destroy the environment and are not sustainable
- Transport of Bio Mass to centralized plants, not sustainable, cost-effective.

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Solutions

- Encourage small, distributed, renewable fueled generation.
- Encourage energy efficiency
- Encourage efficient and complete use of resources
- Transparent economics to show all costs of energy.
- Renewable fuels information clearinghouse, advocate, etc. needed
- One stop permitting - emissions, interconnection, by-products, etc.
- Permitting fees and costs scaled to size
- Simplified, fast and consistent method to rectify problems

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Solutions, cont.

Emissions

- Need to be based on fuel life cycle calculations
- Phased in for renewable power
- Fees should be reduced or eliminated
- Should not be regional standards/goals – expand zones & coordinate
  - If they are emitted in another district, they still are emissions
- Need to balance all GHG's – Looking just at NOX gives only a partial view

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Solutions, cont.

Interconnection

- Rule 21/net meter and AB 1969/FIT need to become one. Why?
  - **Simplify**. Would be better able to understand and promote.
  - **Eliminate conflicts** between the two programs.
  - **Simplify integration** of new renewable technologies.
  - **Administration** of AB 32, AB 1969/FIT, RPS and RPG goals would be simplified.
  - **Accommodate change**. RGFs (Renewable Generation Facility) would not have to understand and decide which is best for their needs now and in the future.
  - **Accommodate import/export change.** It is hard for RGFs to balance loads and generation. The hybrid would make this unimportant. Grid stability and capacity would be increased.
  - **Fully develop RPG.** Existing Net Meter limits generation to annual on-site use, not resource potential.
  - **Encourage Conservation**. RGFs would conserve energy because they would not make “use-it-or-lose-it” decisions.
  - **Simplify Tariffs**. The number and type of tariffs would be simplified.

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Conclusion

- Stimulate short and long-term economy and job gains. Move the USA and CA energy sector toward domestic self-sufficiency.
- Encourage maximum energy conservation and efficiency.
- Expedite adoption of Renewable Power Generation (RPG).
- Meet the goals of AB 32, RPS and AB 1969/FIT.
- Embrace Distributed Generation (DG) as a highly desirable method of meeting local energy loads without incurring the high environmental and economic costs of high voltage grid transmission and centralized generation.
- Diversification of fuel types for RPG is good, stabilizing the market, power generation and costs.
- Overshooting the goals of RPS, AB 32 and AB 1969/FIT is better than under achieving them.
- These solutions should be implemented immediately
- **THESE GOALS CAN BE MET & AGRICULTURE CAN PLAY A ROLE**