A photograph of a house with a red SUV parked in front, overlaid with a semi-transparent grey box containing text. The house is partially obscured by dense green foliage. The SUV is a red Toyota 4Runner. The text is centered in the grey box.

# Residential Electrical Efficiency & Photovoltaic Panels

By  
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# Agenda

- Introduction
- Project Objectives
- Project Startup
- Project Results
- Renewable Energy
- Project Outcomes
- Knowledge Gained
- Summary
- Q&A



# Introduction

- 45 Year North Shore Resident
- Greening for 25 years
- First Real Job – Working Alberta Oil Rigs
- Worked in Information Technology for over 20 years
- Career path change in 2006 – BCIT Building Technology Two Year Programme
- Green Building Coordinator – Light House Sustainable Building Centre

# Introduction

- Starting own company 'Efficient Resource Solutions'
- Bicycle is main mode of transportation
- Try to incorporate green, sustainability, environmentally friendly practices into all aspects of life
- Reduction & efficiency are always first on my task list

# Project Objectives

- Primary Objective – Reduce residential resource consumption
  - Electricity, natural gas, water
- Secondary Objective – Use renewable sources to offset remaining usage
  - Photovoltaic Panels, Solar Hot Water, Rain Water Collection
- Other Objectives
  - Maximize usable space, minimize waste, environmentally friendly, recycle





# Project Startup

- Determine present energy consumption
  - Electricity – 15 kWh/d
  - Natural Gas – 161 MJ/d
  - Avg Daily Energy Consumption – 60 kWh/d
  - Yearly Consumption Per SM – 182 kWh/m<sup>2</sup>a
- Set goal from energy reduction
  - Electrical – 10 kWh/d
  - Natural Gas - ?????
  - Average Daily Energy Consumption - ???
- Initial EnerGuide House Evaluation - 67

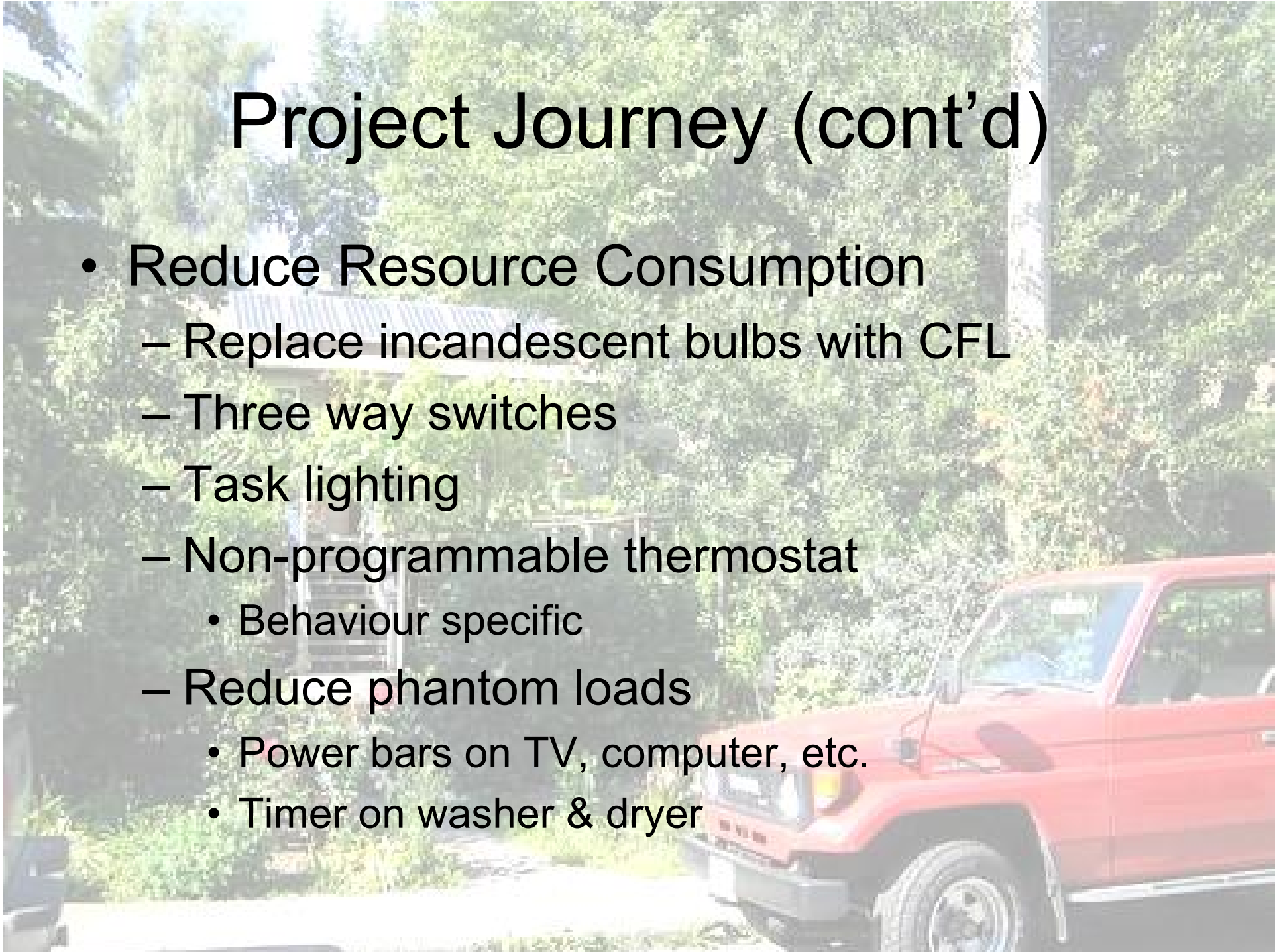
# Project Journey

- Identify & Replace Inefficient Appliances
  - Natural Gas vs Electricity
  - Furnace (94% Efficiency, Direct Vent)
  - Washer (Front Load, Energy Star)
  - Dryer (Natural Gas)
  - Stove (Natural Gas)
  - Fridge (Energy Star)



# Project Journey (cont'd)

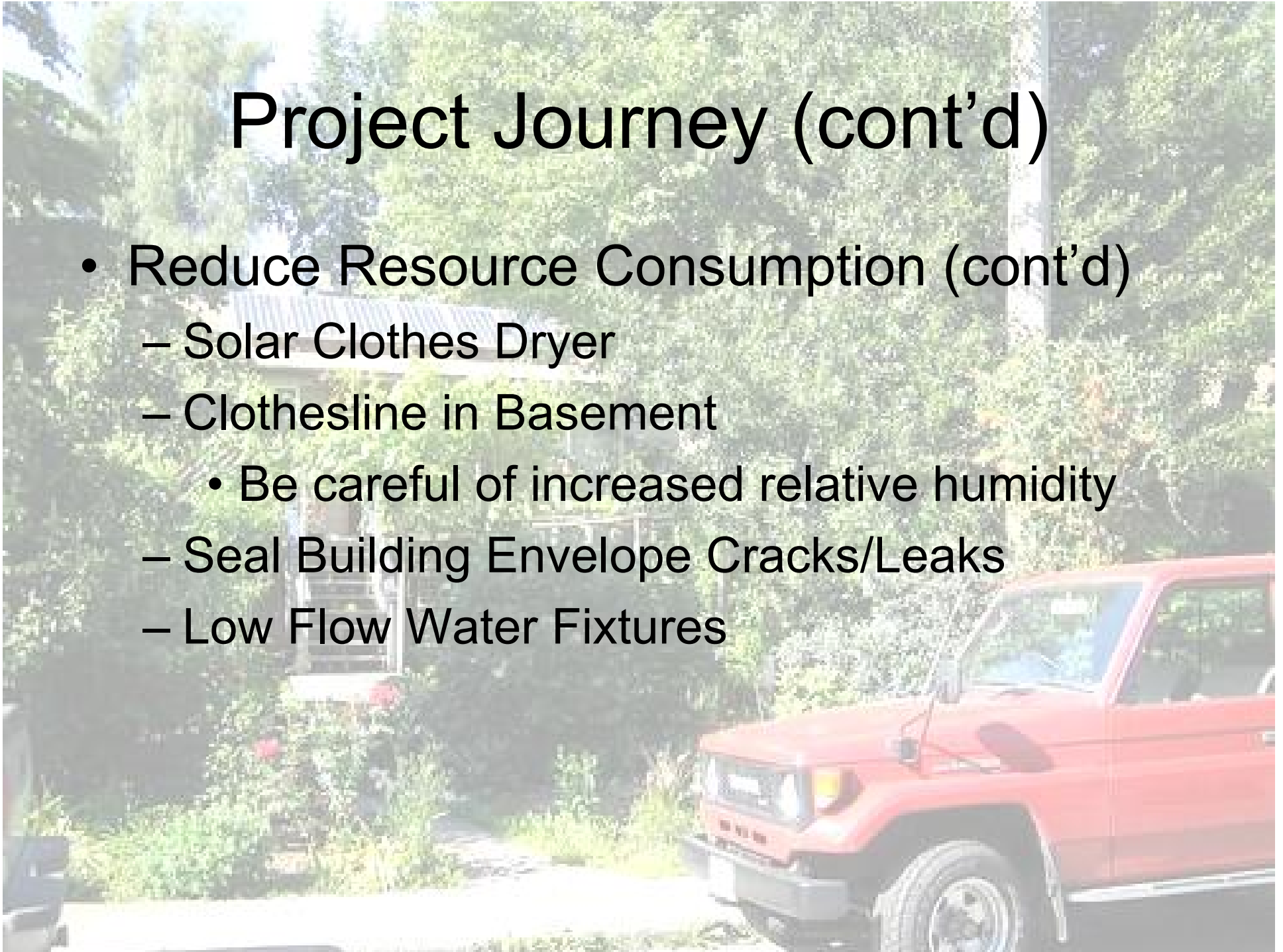
- Reduce Resource Consumption
  - Replace incandescent bulbs with CFL
  - Three way switches
  - Task lighting
  - Non-programmable thermostat
    - Behaviour specific
  - Reduce phantom loads
    - Power bars on TV, computer, etc.
    - Timer on washer & dryer





# Project Journey (cont'd)

- Reduce Resource Consumption (cont'd)
  - Solar Clothes Dryer
  - Clothesline in Basement
    - Be careful of increased relative humidity
  - Seal Building Envelope Cracks/Leaks
  - Low Flow Water Fixtures

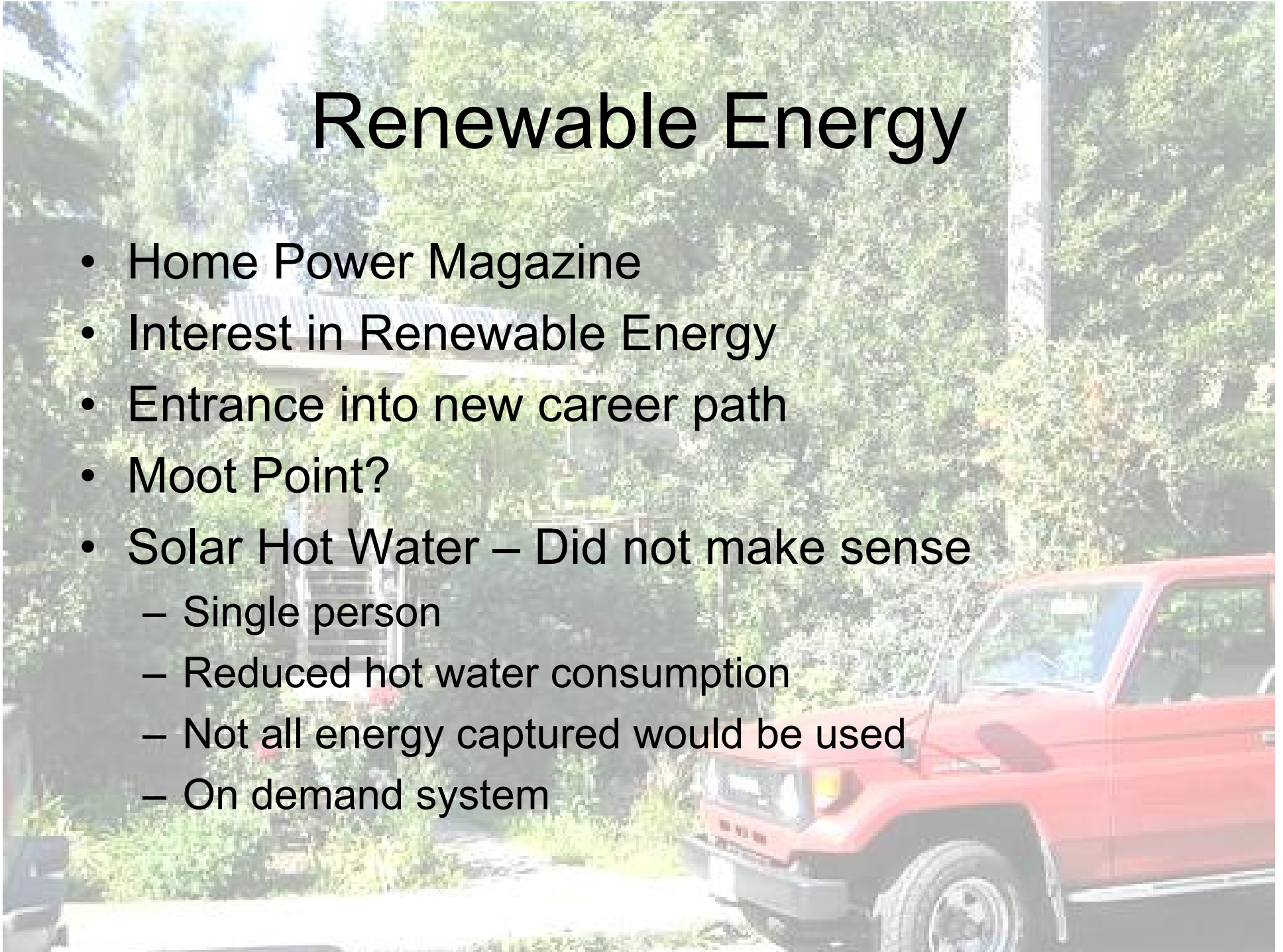


# Project Results

- Efficiency Evaluation
  - Determine New Energy Consumption
    - Electricity – 3 kWh/d (25)
    - Natural Gas – 121 MJ/d (270)
    - Avg Daily Energy Consumption – 112 kWh/m<sup>2</sup>a
    - 93% Energy use of Passivhaus design criteria
    - Avg Canadian House – 200 kWh/m<sup>2</sup>a
- Final EnerGuide House Evaluation - 74

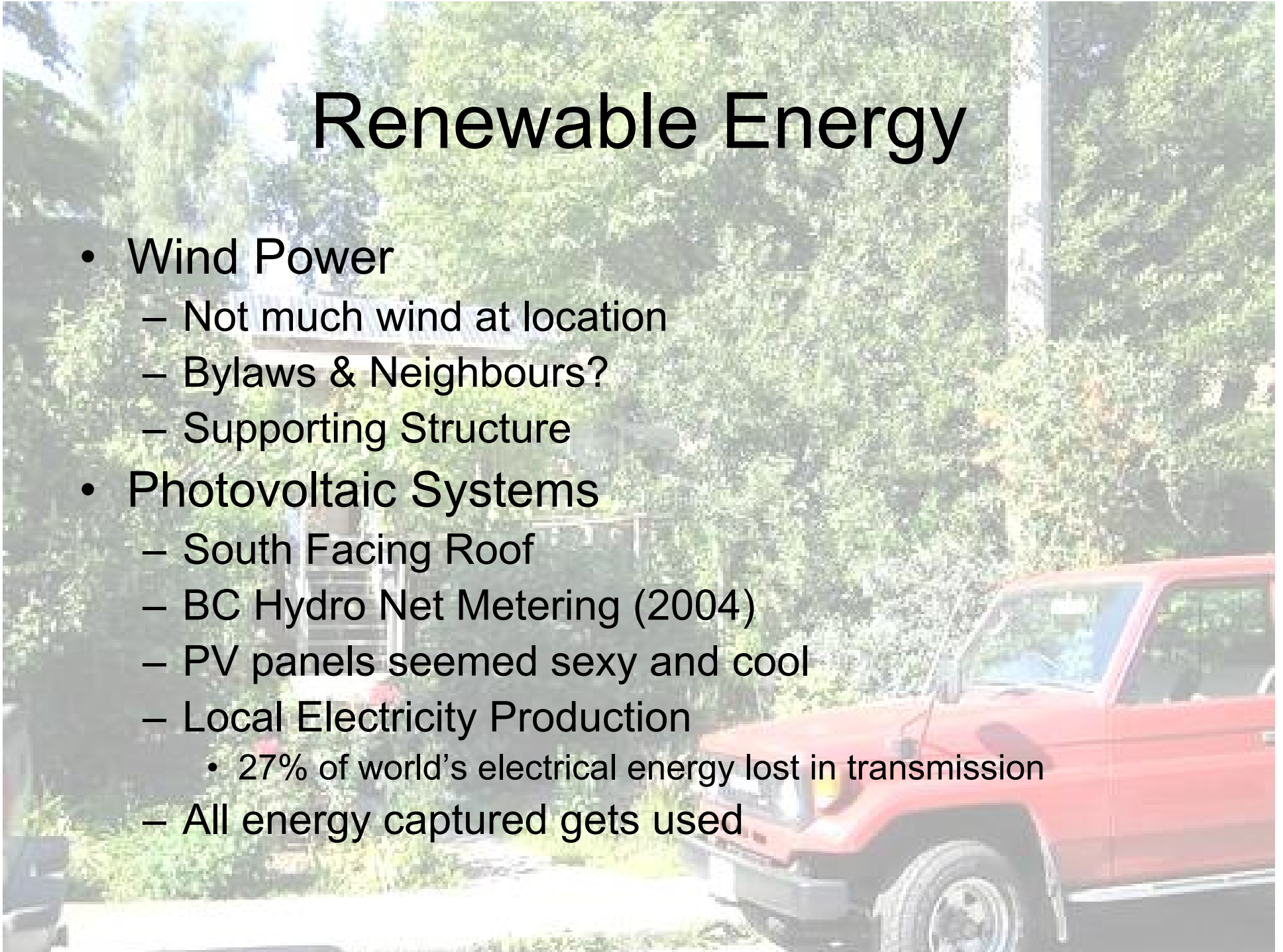
# Renewable Energy

- Home Power Magazine
- Interest in Renewable Energy
- Entrance into new career path
- Moot Point?
- Solar Hot Water – Did not make sense
  - Single person
  - Reduced hot water consumption
  - Not all energy captured would be used
  - On demand system



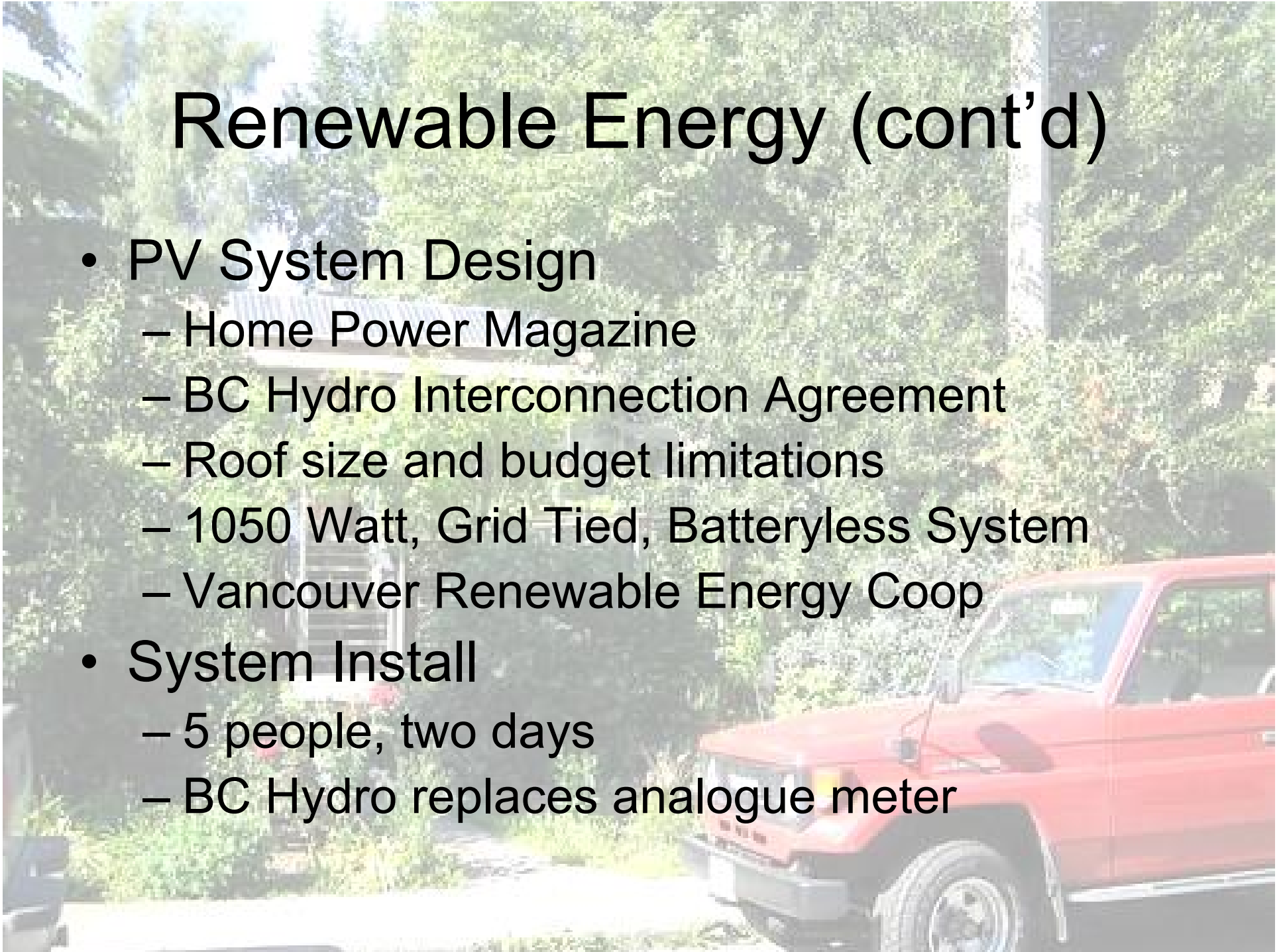
# Renewable Energy

- Wind Power
  - Not much wind at location
  - Bylaws & Neighbours?
  - Supporting Structure
- Photovoltaic Systems
  - South Facing Roof
  - BC Hydro Net Metering (2004)
  - PV panels seemed sexy and cool
  - Local Electricity Production
    - 27% of world's electrical energy lost in transmission
  - All energy captured gets used



# Renewable Energy (cont'd)

- PV System Design
  - Home Power Magazine
  - BC Hydro Interconnection Agreement
  - Roof size and budget limitations
  - 1050 Watt, Grid Tied, Batteryless System
  - Vancouver Renewable Energy Coop
- System Install
  - 5 people, two days
  - BC Hydro replaces analogue meter







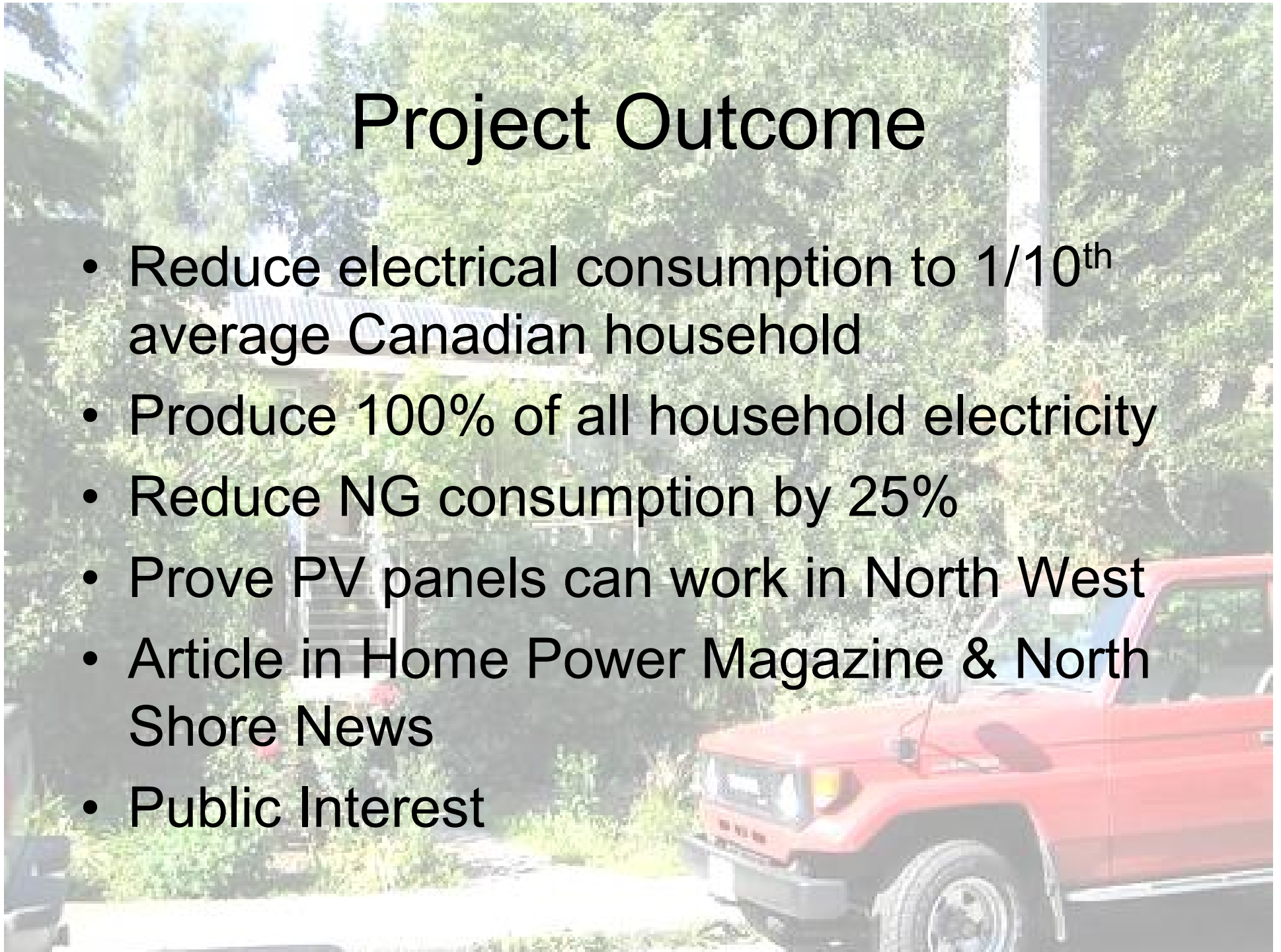


DC DISCONNECT  
AC DISCONNECT  
(EXTERIOR)

INVERTER

# Project Outcome

- Reduce electrical consumption to 1/10<sup>th</sup> average Canadian household
- Produce 100% of all household electricity
- Reduce NG consumption by 25%
- Prove PV panels can work in North West
- Article in Home Power Magazine & North Shore News
- Public Interest



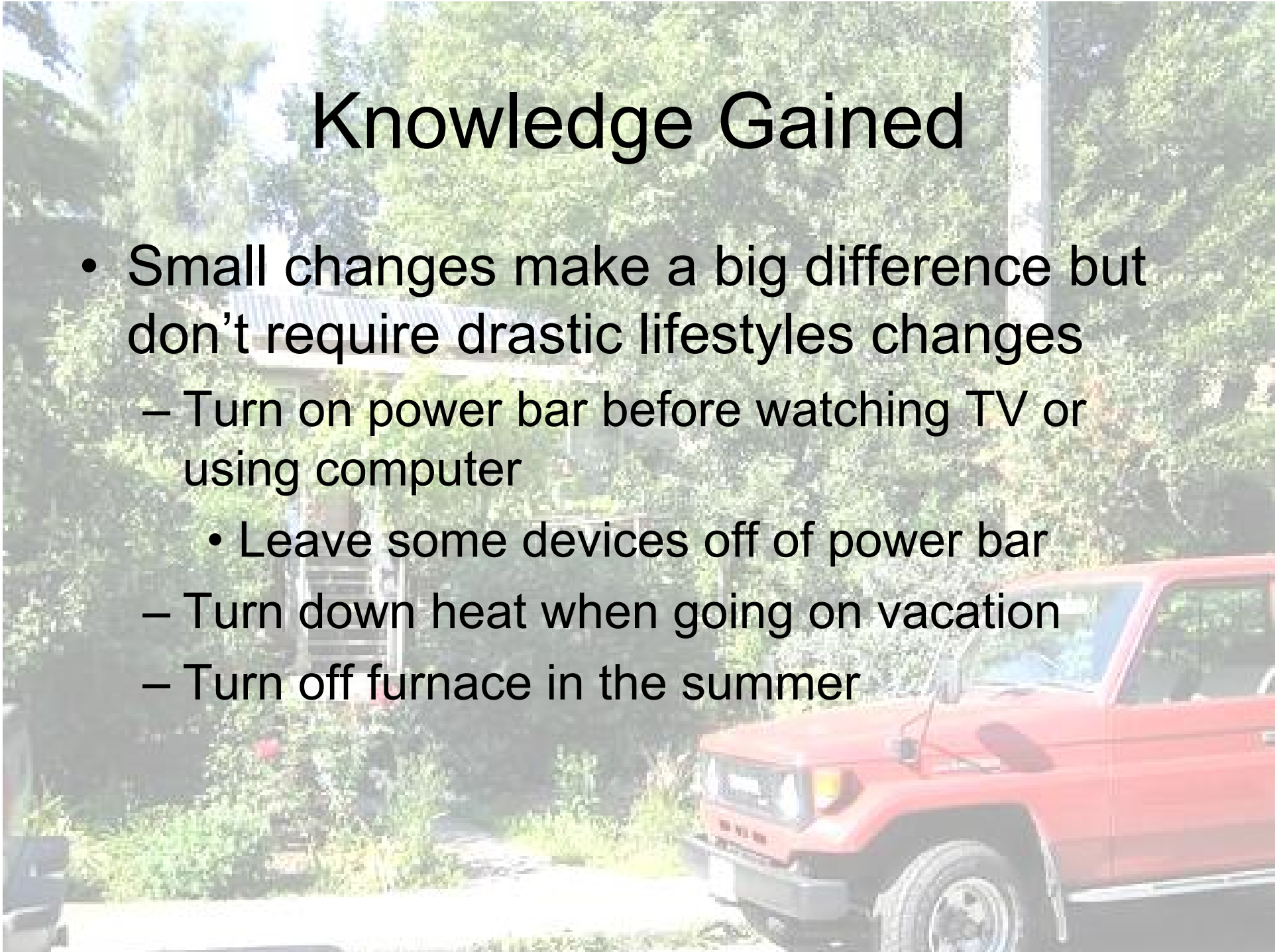
# Knowledge Gained

- Resource reduction before alternate resource usage
- Electrical resource reduction was 5 times more effective than PV install
- Behavioral changes have a large impact in energy efficiency
  - House annual energy consumption 112 kWh/m<sup>2</sup>a
  - ‘Passivhaus’ annual energy consumption 120 kWh/m<sup>2</sup>a



# Knowledge Gained

- Small changes make a big difference but don't require drastic lifestyles changes
  - Turn on power bar before watching TV or using computer
    - Leave some devices off of power bar
  - Turn down heat when going on vacation
  - Turn off furnace in the summer





# Knowledge Gained

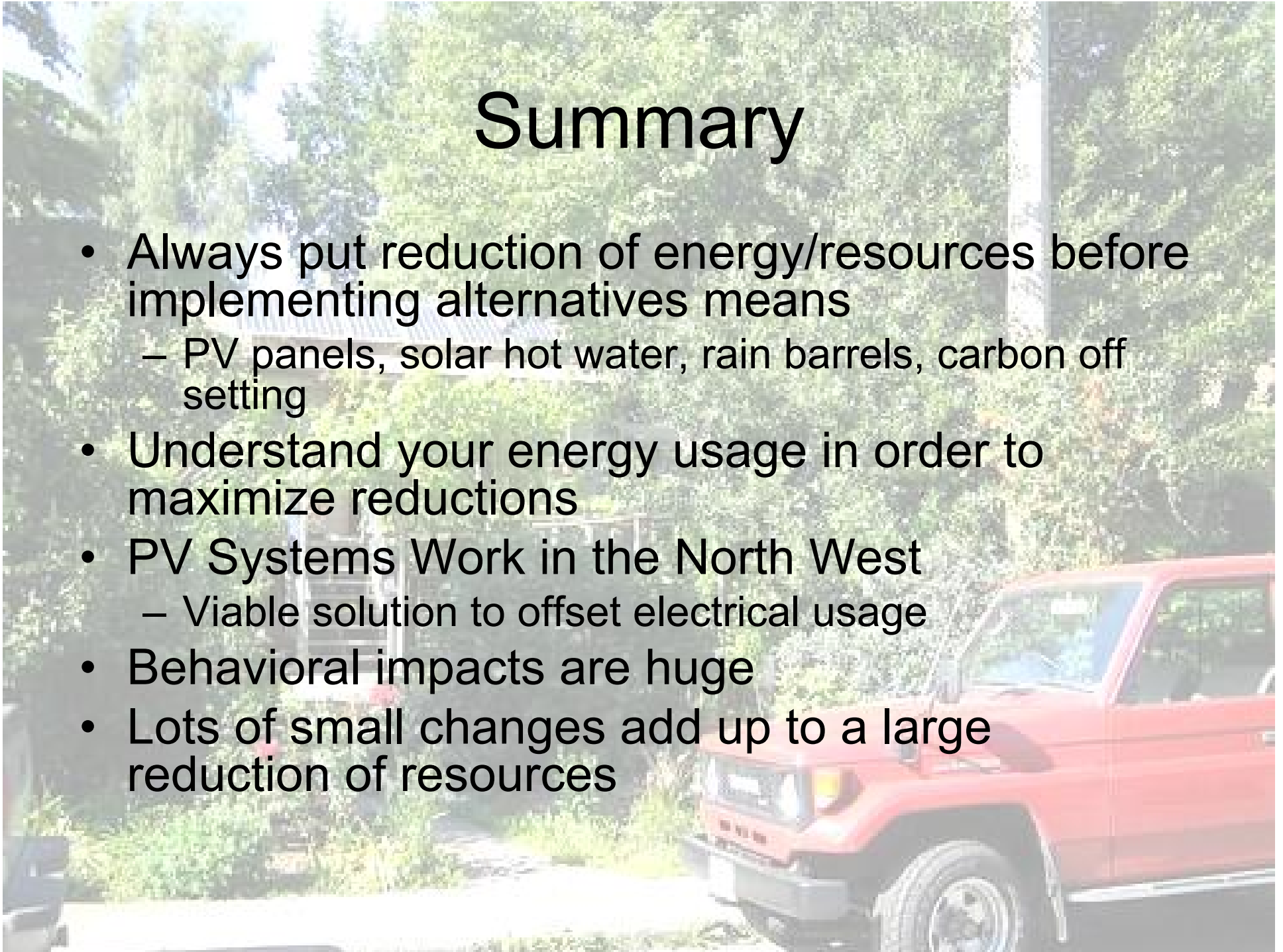
- Over 200 year payback for PV System
  - Average 3.7 sun hours per day (YVR)
  - 1050 Watt System (6 x 175 Watt Panels)
  - 3.7 hours/day x 1.05 kW = 3.885 kWh/d
  - Round to 3 kWh/d (shading, inefficiencies)
  - 3 kWh/d \* \$0.0635/kWh = \$0.1905/d
  - \$15,000/\$0.1905/d = 78740 d = 215.7 y
- Ontario Green Energy Act
  - Feed In Tariff Up to \$0.82/kWh

# Knowledge Gained

- Every dollar invested in efficiency  $\geq$  ten dollars in PV system cost reduction
  - PV system cost \$15,000
  - PV System produces  $\approx$  3kWh/day
  - Old Fridge used  $\approx$  4 kWh/day
  - New Fridge uses  $\approx$  1 kWh/day
  - PV System Doubled with Old Fridge
  - New Fridge = \$800
  - $\$15000/\$800 = \$18.75$  Saved/\$ in Efficiency

# Summary

- Always put reduction of energy/resources before implementing alternatives means
  - PV panels, solar hot water, rain barrels, carbon off setting
- Understand your energy usage in order to maximize reductions
- PV Systems Work in the North West
  - Viable solution to offset electrical usage
- Behavioral impacts are huge
- Lots of small changes add up to a large reduction of resources



A photograph of a house with solar panels on the roof, surrounded by lush greenery, with a red SUV parked in the foreground. The text "Questions & Answers" is overlaid in the center.

# Questions & Answers