Gap Analysis
Solar Thermal Installation Training - Infocap Chile
West Valley College ATTE
Executive Summary

This report outlines research done to determine the solar thermal training needs and gaps at Infocap in Chile. It also outlines the solar thermal workforce needs in Chile. Corfo funded this Training Needs Assessment, in partnership with Infocap and West Valley College Advanced Transportation Technology and Energy (ATTE).

Goal of the Report

This report focuses on three primary goals; establishing Infocap's capacity for solar thermal training, understanding Chile's need for trained solar thermal installers, and determining curriculum requirements for developing Infocap's train-the-trainer, and solar installation training.

Infocap

Infocap is a Workforce Development University dedicated to helping the most vulnerable adults in its community. Infocap offers certifications in the following workforce programs:

- Metal Work
- Sanitary Installations (Plumbing)
- Masonry and Siding
- Electrical Installation
- Furniture Design
- Garment Production
- Construction Layout
- Structural Work Carpentry
- Cooking Basics
- Cosmetology

Education at Infocap

Infocap receives 1500 student application, but only 300 students are accepted into Infocap’s free workforce development training program. Each program allows for 25 students per trimester.
Infocap hosts two different sessions per trimester. The evening session is for students who are currently employed. The afternoon session is geared towards the most at risk students, with no current employment. The program is made up of three trimesters or 540 hours of instruction. The Solar Thermal Installer program will be set up as specialization training for students who have already completed three trimesters successfully. This specialization training will be approximately 160 hours of training.

Infocap’s goal is for students to move on to junior level positions and grow with in a company, or build an independent contractor business. Infocap educational programs have a success rate of 70% to 80% of students working within the field they are trained.

**West Valley College ATTE**

West Valley College, Advanced Transportation Technology & Energy (ATTE) is part of the California Community College Chancellors Office Workforce and Economic Development Initiative. Over the last 13 years, the ATTE program has a proven and successful track record in developing workforce and economic development training programs in the energy and transportation sectors. The program offers course work in the areas of renewable energy, energy efficiency, green building, alternative fuels, transportation demand management, robotics, and geographic information system. Our focus has been workforce development and career pathways.

**Data Collection**

This report consists of data collected through a series of meetings and site visits by ATTE and Infocap in Santiago Chile the between April 17th and April 21st 2011. The organizations are listed below:

- Infocap Employees
- Infocap Student
- Ministry of Foreign Affairs
- Foundation Chile
- Acesol
- AMCHAM
- Renewable Energy Center

ATTE and Infocap visited three solar thermal installations during ATTE’s visit to Chile:

- Hotel Galarias Santiago
- Jehovah Witness South America Headquarters
- New Low Income Condominiums in Santiago
**Infocap Employees, Students & Site Visit**

- Met with a group of infocap employees to gain an understanding of the acceptance process for infocap.
- Tour of Infocap facilities and classroom instruction, including the potential locations for solar installation instruction.
- Potential solar thermal installation students provided insight on their solar install experience and expectations for a training program.

**Ministry of Foreign affairs**

- Chile is currently engaged in a partnership with California (Chile-California “Partnership for the 21st Century”). This Partnership is collaboration on improving the issues of Human Capital Development, Education, Environmental Protection, Energy, Agriculture, Information and Communication Technologies, and Trade. Officials from the Ministry of Foreign Affairs have been meeting with Jerry Brown and other California officials.
- Costs structure for Solar Thermal is of great concern. The system costs are going down, but the cost of installation will increase, as the installers are required to get certification.
- Tax breaks are difficult to use and may not be extended.

**CDT**

- Estimates there is a need for 10 to 12 installers for future large installations.
- Estimates 40,000 new Solar Thermal installations over the next two-years, however, they believe the limited tax incentives may impact this number.
- CDT currently working on certification for Solar Installers.

**Site Visits**

**Hotel Galerias Santiago**

This Solar Thermal System was built on the edge of the rooftop, with no consideration for maintenance. The installation staff constructed a large platform to allow for the installation of the panels, but there is no room for maintenance of panels at the edge of the rooftop moving forward. Safety and maintenance was not considered for this installation.

**Jehovah Witness South American Headquarters**

This was a small rooftop Solar Thermal Installation, very high end. This rooftop installation was designed with room for maintenance.

**New Construction of a Condominium High Rise**
Largest Solar Thermal Installation in Chile, over 100 panels. The builder installed this system and most safety and maintenance issues were addressed. The builder took advantage of the tax incentives and 100% of the costs are to be refunded to the builder.

Foundacion Casa De La Paz

- Concerns about the lack of tax incentives reducing the demand for Solar Thermal and reducing the number of jobs for students in the Solar Installation Field.
- Foundacion Casa De La Paz is currently installing 20 German collectors in a small town and the intent is to grow to 200 collectors.
- Rooftops in Chile are typically not strong enough to handle the load of a Solar Thermal system.

Foundation Chile/Acesol

- Piloting a program for Solar Thermal Installation Training to determine the certification program. This program will be 40 hours; all students will have Solar Thermal Installation experience.
- Currently reviewing ISO 9000 standards.
- The need for Solar Thermal Installers is growing despite the lack of tax incentives.
- Over 1000 trained installers will be needed by 2020, geographically dispersed throughout Chile.

AMCHAM

- Infocap to work with AMCHAM on Marketing Solar Installation Programs.

Renewable Energy Center

- Also looking at establishing Solar Thermal Installation Certification.
General Findings of the Gap Analysis

- Infocap has no curriculum for Solar Thermal Installation
- Infocap has no trained instructors for Solar Thermal Installation
- Infocap has no college infrastructure to host a Solar Thermal Installation Program
- Chile has no trained Solar Thermal Installation workforce

Recommendations

Train-The-Trainer

Infocap sends multiple trainers from welding and plumbing courses to be trained in Solar Installation Training at West Valley College.

Infrastructure

Infocap builds a ground floor rooftop simulation for students to design and install Solar Thermal in a classroom setting. Infocap purchases all the necessary tools required to implement a Solar Installation class.

Curriculum

West Valley College ATTE develops Solar Installation curriculum to hand off to Infocap.

Solar Thermal Installer vs. Solar Site Planner

The Solar industry is in its infancy in Chile. The workforce is untrained and currently the workforce is doing not only installation but the design of the system as well. Ninety percent of the system failures are due to the installation of the system. As systems fail so does the growth of the industry because of a perception that Solar Thermal is not a good alternative. A trained workforce can eliminate these issues. Training for a Solar Installers is specific to the installation. If Solar Thermal Installers are required to design the system, there will be a need for a Solar Site Planner Program.
Solar Thermal Installer Certification

Currently there is no certification for Solar Installers. There are several agencies working on the certification, but this certification is at least a year away.

Certification will have positive impacts for Solar Installers, as certification can increase the installers pay rate, as well as, the demand for the certified installer, if builders are required to hire only certified installers. Negative impact will be on training developed prior to the certification, as all training will need to be aligned with certification requirements.

Independent Contractors

Infocap encourages students to work as independent contractors due to the low paying jobs found with large construction companies. Due to the high cost of tools necessary to install and maintain Solar Thermal systems, Infocap students will have issues with the costs. However, due to the failure rate of current solar thermal systems, independent contractors may be in high demand for maintenance repairs.

Workforce Requirements

It is estimated that the need for Solar Installers will grow to 1000 installers by 2020 throughout Chile.

The current tax incentive plan is due to expire shortly, however, because of the limitations on the current incentives very few builders have used the incentives and the demand for Solar Thermal Installers is still growing. Future incentives will only increase the demand, but the lack of the incentives does not appear to be impacting the demand.

Students and Training Needs

ATTE Strongly recommends students and trainers selected to attend training are from the Welding and Plumbing Programs. Students chosen for this program should have some construction work experience.

Classroom preparation should include a ground level rooftop simulation for installing and uninstalling systems throughout the trimester.
APPENDIX A

CURRICULUM OUTLINE

• Brief Overview to Renewable Energy
• Class Introduction and Orientation
  o Class Enrollment, Expectations, and Introduction
  o Learning Management Systems Introduction, Login and Use
  o Solar Hot Water Pretest
  o Break Into Teams (for hands-on activities and labs)
• Introduction to Solar Hot Water and Solar Resources
  o Earth Energy Resources
  o Solar Hot Water Compared Solar Electricity
  o Solar Radiation and Microclimates
  o Solar Resources
  o Quantifying Solar Energy
  o Solar Geometry Angles and Collector Orientation
  o Financial Rebates
  o SRCC, ASHRAE, IAPMO
• Solar Hot Water Technology
  o Types of Solar Hot Water Systems – Choosing Suitable Systems
  o Active and Passive
  o Open Loop and Closed Loop
  o Thermosyphon and ICS
  o Pressurized and Drain Back
• Solar Hot Water Components
  o Collector Types and Performance (unglazed, flat plate, vacuum tubes)
    - Selective Absorber Surfaces
  o Pumps and Controllers
  o Valves – Ball, Gate, Check, Relief and Air Venting
  o Storage and Heat Exchangers
  o Tempering and Anti-Scald Valves
  o Expansion Tanks
  o Heat Transfer Fluid
• Sizing Solar Domestic Hot Water Systems
  o Solar Fraction (SF) and Sizing Guidelines (residential and commercial)
  o Sizing Dependencies
  o Solar Hot Water Sizing
  o Radiant Heat
  o Solar Simulation Software and Sizing Examples
• Auxiliary Heating
  o Basic Considerations
- Preheating
- Dual Tank Systems
- Tankless Heaters
- Commercial Systems
  - Compare and Contrast Commercial vs. Residential
  - “Plug and Play” Installation vs. On-Site Assemble
  - Typical Controller Interfaces for Configuration and Monitoring
  - Integrated Variable Speed Pumps for System Energy Optimization
  - Circuit Filter, Flow Gate, Charging Valves, Back Flush, and Component Isolation Valves
  - Integrated Pressure Relief, Reclaim and Refill System
Appendix B

Lab One Equipment

- Standard Tool Kit- Adjustable wrench set, allen wrench set, socket wrench set, pipe wrench set, screw drivers, rechargeable battery drill (18 or 24 volts) with drill bits, 1 foot metal straight edge, hammer, miscellaneous assortment of screws, 2 dozen (sheet metal, stainless steel, wood screws)
- Magnetic compass
- Shade assessment tool (Solar Pathfinder, Solmetric Suneye, etc)
- Inclinometer (roof tilt gauge)
- Four foot carpenter’s level
- Volt-ohmmeter with 2 strap-on thermistors (10K ohms)
- Chalk line to mark position of rafters and collectors on roof
- Set of copper tubing and fittings, various sizes (1/2” coupler, 1/2” 90 degree elbow, 1/2” T, two 1 ft sections of copper type M tubing)
- Closed cell elastomer pipe insulation for 3/4” pipe 7/8” inner diameter (6 foot length with 1/2” walls)
- Wire cutters
- Infrared gun
- Solder torch with fuel
- No-lead solder
- Solder flux
- Flux brush
- Copper tube cutter
- Hacksaw
- Miter saw
- Saws-all
- Copper pipe support
- Silicone sealant
- C-clamps
- Tape measure
- Inspection mirror
- Nylon twine
- Emery cloth
- Rags
- Grease cleaner
- Latex gloves
- Soap bubbles (for leak detection)
- Quadrille tablet & clip board
- Roofing mastic
- Ladder with roof eave clamp
- Shoulder harness and rope
- First aid kit
• Knee pads
• Protective goggles
• Hard hats
Appendix C

Lab Two Equipment

- Select the most common type of system in the region – Potential vendors listed below
  - Heliodyne: HLAB (glycol and DFC system, may also be transported outdoors: info@heliodyne.com)
  - SunDogSolar: Rover (glycol and drainback systems: http://www.sundogsolar.net/products00.cfm)
  - Solar Energy Trainers: Solar Hot Water Trainers (Open loop, glycol and drainback systems: http://solarenergytrainers.com/hot_water_trainers.html)
- Collector Cutaway Demos (miniature versions) – 1 evacuated tube demo, 1 glazed flat plate glazed demo, 1 unglazed flat plate demo.
- 1 outdoor roof with shingles (4 feet off the ground with a 30 degree pitch, allowing for storage tank and other system components to be connected/installed under the roof.
- 1 glazed flat plate collector
- 1 evacuated tube collector
- 1 Closed loop drain back system
- Solar storage tank with internal or external heat exchanger (80 gallon)
- 10 gallon drain back tank
- 1-wall heat exchanger, internal or external
- piping
- pump
- programmable Cartoon Graphics Controller with sensors and BTU meter.