****The farmer Victor Soto owns 15 hectares of land in the Andean highlands of Chile. He mainly lives from his herd of Alpacas, 200 heads in total. Wool and some animals are sold on the local markets. Beside his animals, Victor grows tomatoes on an area of 0.5 hectares. Half of the harvest is used for the own consumption of his family, the other half is sold at local markets and the neighboring farmers. In order to increase the productivity of his farm, Victor decided to take a loan and to purchase some equipment, including a small ware-house, a tiller and a livestock shed. Labor is provided by family members for free during peak periods i.e. planting and harvesting. One person of the neighborhood works full time at the farm to ensure smooth operations, earning a monthly 180,000 Chilean Pesos (CLP). The mayor part of his income is generated by selling the wool of the Alpaca. Each animal produces around 5 kg per year.

Country Case Card II – Chile

Water Requirement Tool, Pump Sizing Tool,
Simplified Financial Viability Tool, Farm Analysis Tool

* To date, the farm has bought a total of 60 kg in local seeds at average price of CLP 675 per kg. 70 kg of fertilizer (priced at CLP 335 per kg) and 150 liters of herbicides (priced at CLP 1000 per liter) have gone into the farm.
* Fuel for machinery (planting, harvest, processing) is at CLP 33.550 per liter. For one planting season approximately 50 liters are needed. Per planting season, repair and maintenance costs of CLP 135.000 occur.
* Market value for an Alpaca is at CLP 135.000 and Victor aims to sell one quarter of his herd. The clean wool is sold for CLP 23.000 /kg.

Farm Analysis

* What is the farm’s gross income? 22.365.000 CLP
* What is the farm’s total expense? 5.905.859 CLP
* What is the farm’s total variable cost? 4.186.450 CLP
* What is the farm’s gross profit? 16.459.141 CLP
* What is the highest variable cost? The salary of the permanent employees

During his time as a farmer, Victor has seen the weather change for the worse, making it hard to succeed with his farm. “When the rains were good we had good harvests”, he remembers from his childhood years. But nowadays the rains are unpredictable and unevenly distributed. He is considering utilizing intensive irrigation from now forward, using an earth canal supplied flood irrigation system. This would give him the opportunity to start a second growing period in September.

First planting period is in the beginning of March.

Water Requirement

* Only one growing season, starting in March (incl. water requirements for the herd):
	+ In which month is the highest water need and how much is it? April, 18,8 m³.
* With a second growing period with planting in September (incl. herd):
	+ In which month is the highest water need and how much is it now? December, 41 m³
* What is the highest daily water requirement, if he would use micro sprinkler irrigation for the two growing periods? 32,6 m³
* What is the pump utilization rate when having one and two growing periods under micro sprinkler? 44 and 48 %.

****

After doing a first calculation, Victor decides for a micro sprinkler system and will prospectively implement a second growing season. He can use a well with 10 m depth, with an average yield of 50 m³/hour. To ensure a sustainable use, he will only extract half of the yield and pump it to a water tank 2 m above ground, 200 m away from the well. He would use pipes of 1 ½ inches diameter and 3 90° elbow connectors. Measurements show that the groundwater level is at 20 m. The drawdown when extracting water is 2 m and the fields and troughs for the livestock are located about 10 m below the tank outlet. For the irrigation system he will use PVP pipes of 1 ½ inches diameter and again 3 90° elbow connectors. He also installs a water meter and fertigation system, where the head loss in each one of these is 2 m. The manufacturer’s datasheet for sprinkler irrigation shows pressure requirements of 0.5 bar. The distance from the tank to the field is around 20 m and he needs a 30 m long pipe to feed the lateral tubes which go into the tomato rows.

Pump Sizing

* What is the Total Dynamic Head of the pumping system? 50 m
* Which is the lowest power (kWp) required (solar deration losses of 25 %)? 2,1
* How big is the surface of solar panels to be installed? 14 m²
* From a neighbor who changed the water system, Victor could get PVP-tubes of 1” for free. Should he accept this friendly offer? No.

Victor is considering various options for undertaking the daily water pumping in order to satisfy the water need for his tomatoes. Using irrigation, she will improve the current yield by 50%, while also adding an additional harvest. Three employees now work the whole year on the farm. You used the Farm Analysis Tool to project his new profit, which will be at 16.459.141 CLP/year and fully invested in a new irrigation system.



Simplified Financial Viability

* What is the initial investment cost for each option:
	+ Solar? 5.945.000 CLP
	+ Grid? 2.340.000 CLP
	+ Diesel? 3.410.000 CLP
* What is the internal rate of return (IRR) for each option:
	+ Solar? 296 %
	+ Grid? 686 %
	+ Diesel? 460 %
* What is the break-even point for each option:
	+ Solar? 1 year
	+ Grid? 1 year
	+ Diesel? 1 year
* When does solar break-even with diesel and grid?
 Solar breaks even with diesel after two years and with grid after three years.

**Location Data**

Country Case Card II – Chile

Data Sheet

|  |  |
| --- | --- |
| Country | Chile |
| Location | Combarbalá, IV. Región |
| Longitude | 71º |
| Latitude | -31,3º |
| Exchange rate | 1 US $ = 671 CLP  |

**Climate Data**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| **Mean daily temperature in °C** | 21,6 | 21,7 | 19,1 | 16,9 | 14,6 | 14,3 | 12,7 | 14,2 | 15,1 | 17,2 | 19,2 | 20,4 |
| **Rainfall in mm/month** | 0,5 | 0 | 0 | 3,4 | 12 | 16 | 45 | 0,1 | 0,2 | 0,2 | 0,5 | 0,6 |
| **Solar irradiation in kWh/m² day** | 7,6 | 6,8 | 5,8 | 4,4 | 3,1 | 2,5 | 2,7 | 3,7 | 4,9 | 6,2 | 7,1 | 7,5 |

**Assets and equipment**

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Current Value (CLP) | Age | Normal life span |
| Tiller | 335.000 | 1 | 10 |
| Livestock Shed | 1.500.000 | 1 | 20 |
| Warehouse | 1.500.000 | 1 | 20 |

**Economics and financing**

|  |  |  |
| --- | --- | --- |
| Inflation | 2,7 % |  |
| Discount rate | 16 % |  |
| Annual profit margin increase | 1 % |  |
| Annual fuel price increase | 3.84 % |  |
| Reduction factor | 10 % |  |
| Alpha Bank Loan  | Amount | CLP 4.000.000 |
| Credit Period | 3 years |
| Annual interest rate | 16 % |

**Crop Acreage and yield**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Crop | Cultivated area (ha) | Estimated yield per season (kg per acre) | Estimated market price (CLP per kg) | Crop growing time | Spacing |
| Tomatoes | 0,5 | 20,000 | 170 | Average | Normal |

**Solar components**

|  |  |  |
| --- | --- | --- |
| **Solar Option** | **Costs in CLP** | **Life span in years** |
| **Solar panels** | 2.700.000 | 20 |
| **Control unit**  | 335.000 | 5 |
| **Motor pump** | 1.700.000 | 5 |
| **Wires / tubes** | 135.000 | 5 |
| **Water storage** | 370.000 | 20 |
| **Irrigation system** | 535.000 | 5 |
| **Installation cost** | 170.000 |  |
| **Maintenance cost** | 40.000 / year |  |

**Grid components**

|  |  |  |
| --- | --- | --- |
| **Grid Option** | **Costs in CLP** | **Life span in years** |
| **Motor pump** | 1.000.000 | 5 |
| **Wires / tubes** | 335.000 | 5 |
| **Water storage** | 370.000 | 20 |
| **Irrigation system** | 535.000 | 5 |
| **Installation cost** | 100.000 |  |
| **Maintenance cost** | 33.500 / year |  |
| **Electricity cost** | 160 / kWh |  |
| **Pump electricity demand** | 0.75 kW |  |
| **Pump water output** | 6 m3 / hour |  |

**Diesel pump components**

|  |  |  |
| --- | --- | --- |
| **Diesel Option** | **Costs in CLP** | **Life span in years** |
| **Diesel Generator** | 1.000.000 | 3 |
| **Motor pump** | 1.000.000 | 5 |
| **Wires / tubes** | 335.000 | 5 |
| **Water storage** | 370.000 | 20 |
| **Irrigation system** | 535.000 | 5 |
| **Installation cost** | 170.000 |  |
| **Maintenance cost** | 200.000 / year |  |
| **Diesel cost** | 600 / liter |  |
| **Pump diesel demand** | 1 liter / hour |  |
| **Pump water output** | 6 m3 / hour |  |
|  |  |  |
|  |  |  |