SCALABLE ENVIRONMENTAL CONTROL SYSTEMS WITH REMOTE MONITORING AND SOLAR POWERED PNEUMATIC RECOVERY OF FREE PHASE HYDROCARBONS

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Agenda

- Introductions
- Principles of Green Energy
- Availability of Green Energy (Solar)
- Benefits of Green Energy Remediation
- Technical Details
- Example Deployments

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- partners with federal, state, local and international government agencies
- over 20,000 private sector clients worldwide
- distribution in 72 countries
- provides products and product training to colleges, universities and technical schools around the globe


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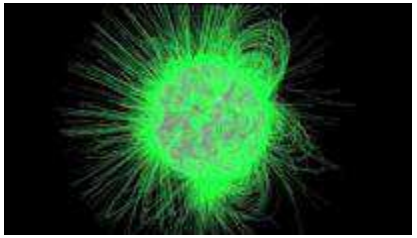
Sun Cultures

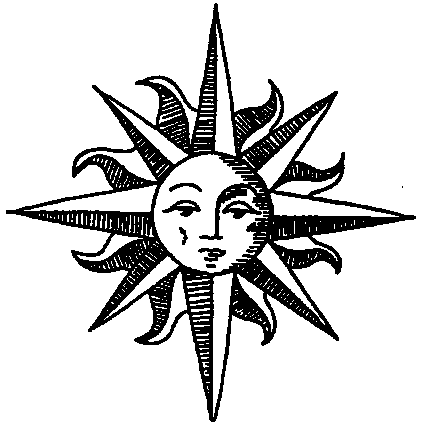
Most life on earth depends on the sun. Outside of the tropics you must either hibernate; living off internally stored energy,

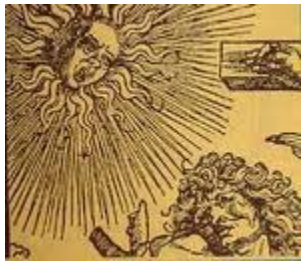
or

Learn how to preserve and store energy from the sun. Food for eating, wood for burning, etc...

Storage is the biggest problem to solve.



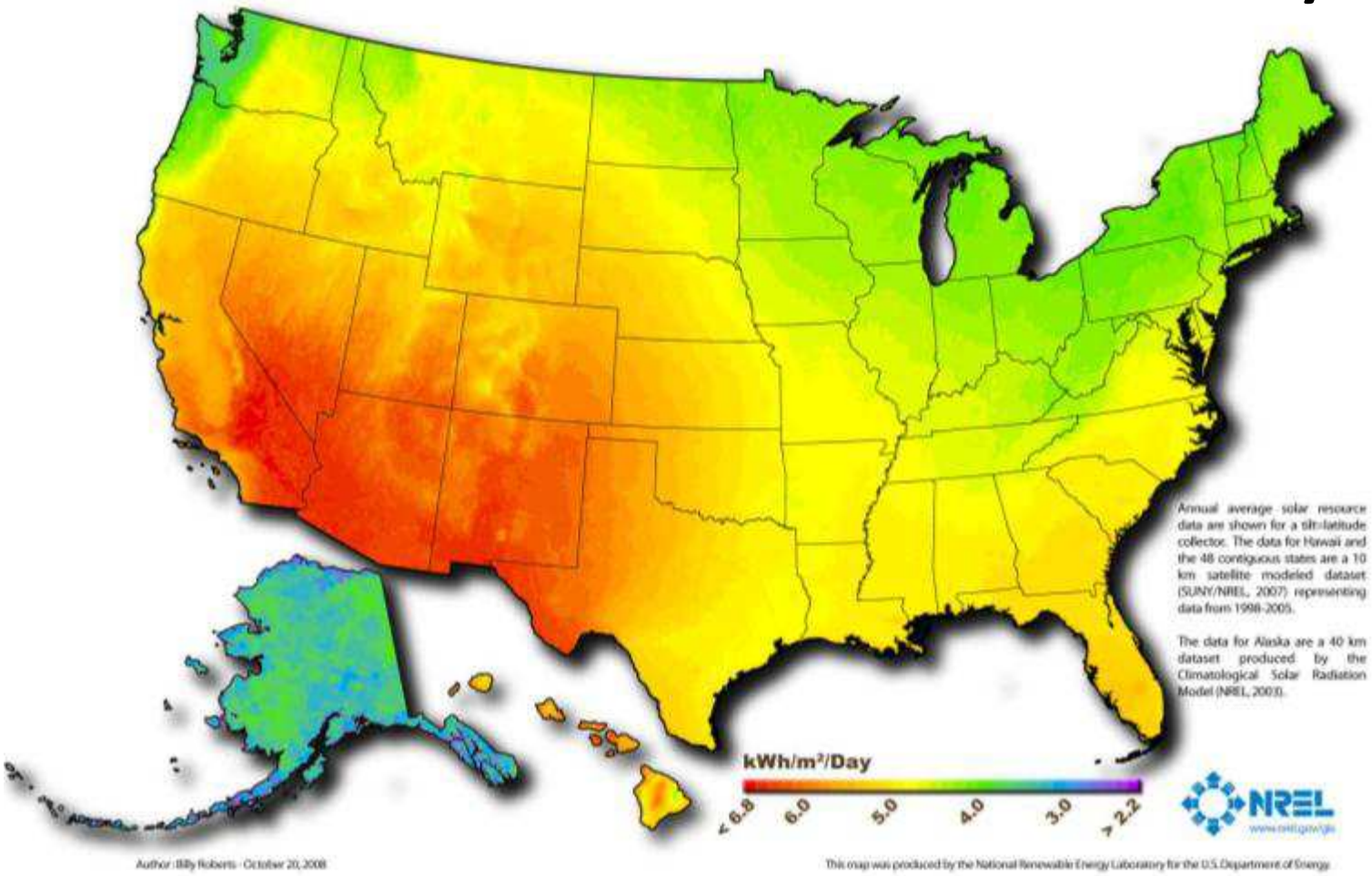




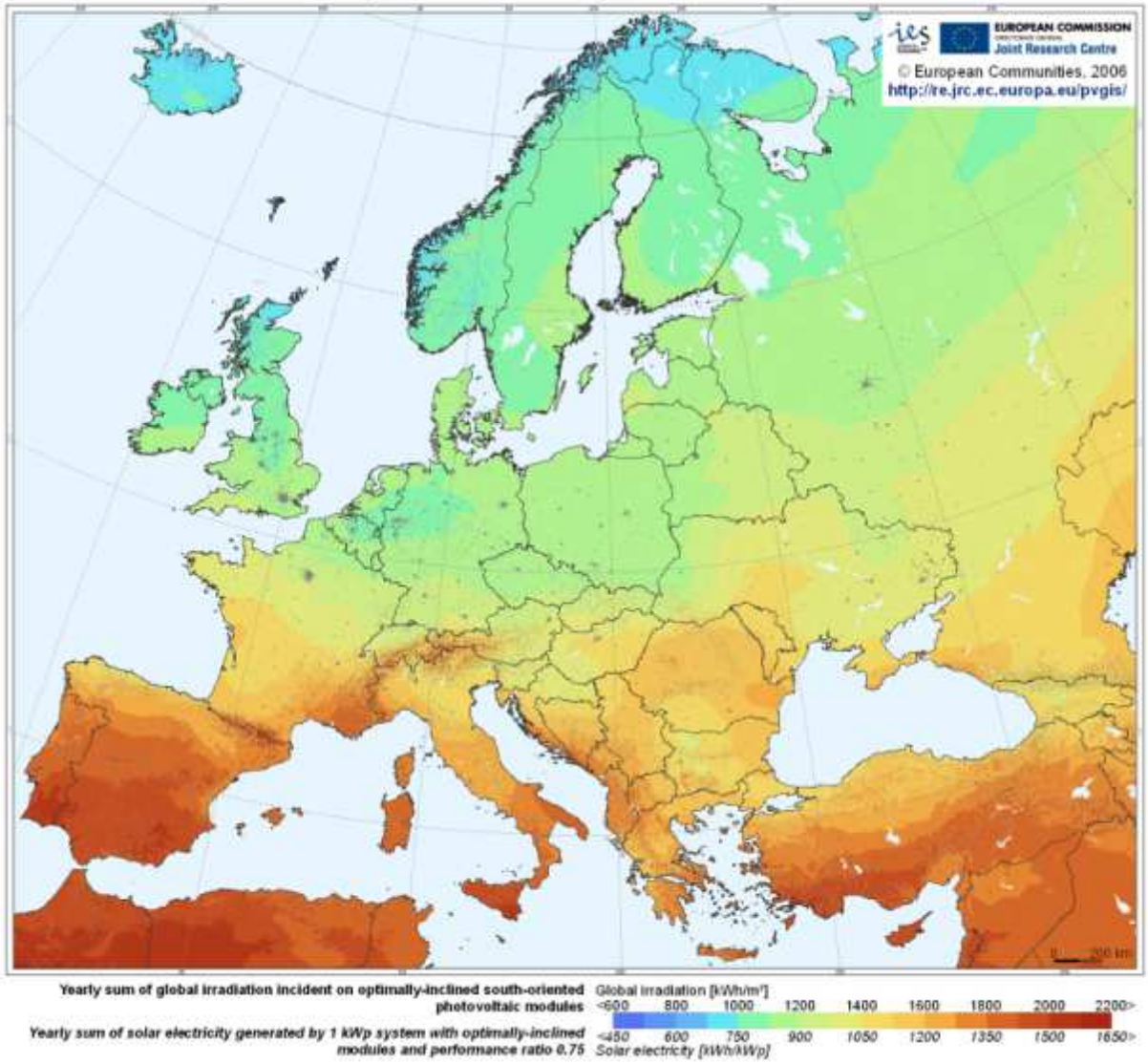
Interesting Fact

- In 20 days the earth receives the equivalent amount of energy from the sun as contained in all of the fossil fuels available on the earth combined

What Is Your Solar Availability?

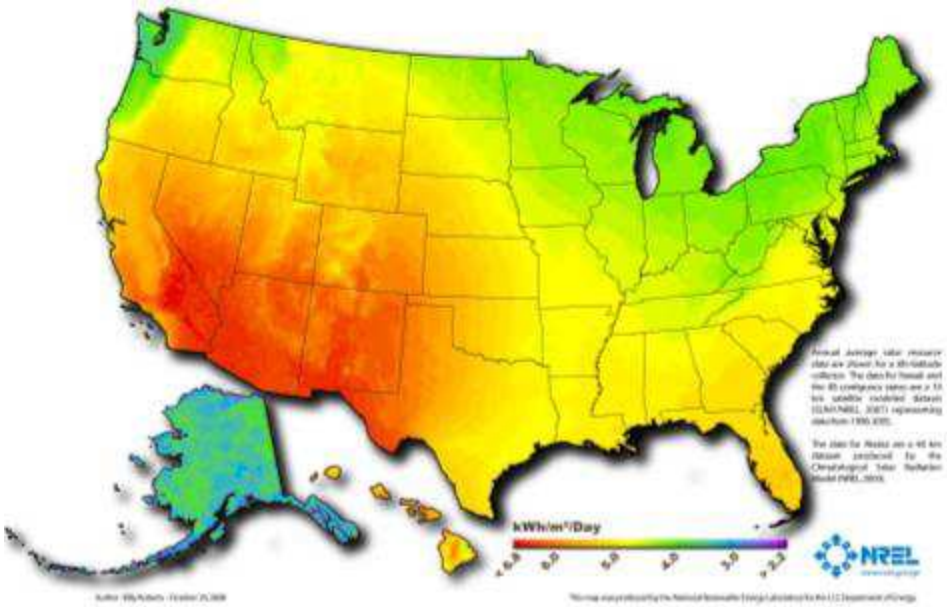


Photovoltaic Solar Electricity Potential in European Countries



Solar Power Rules of Thumb

- Rule of thumb a 1/8th HP (<100W) motor requires one square yard of solar panel.
- 35 AH battery gives < 5 hours of runtime for a 1/8 HP load.
- To run a 1/8th HP motor continuously, it requires 5 square yards of solar panel and 4, 35 AH batteries.



Required Available Energy to Operate a System

- Hydrocarbon Recovery rate (GPD) forecasting must be based on the yearly average sunlight. This information is available for most of the Earth
- Once go/no go decision is determined, an additional detailed analysis must be performed based site specific data.

Reasons to consider Solar Powered Remediation Equipment

- No need to wait for public utility to run power.
- No need to schedule licensed electrician.
- Systems can be configured for multiple well applications
- Systems can be easily moved when site conditions warrant adjustments to plume migration

Safety

- Low voltage systems can be installed safely by anyone comfortable installing a car battery.
- Very little training required.
- Reverse polarity protection prevents overheating the battery and electronics.
- No heavy equipment to install.

Cost Advantages

- Saves Time = fines
- New grid power runs cost thousands and take months
- No expensive electricians
- Remote area deployment without need for liquid fuel generator- requiring regular refills time savings O&M
- A remote monitoring addition can identify and alert a problem without making a trip to the site

Free Phase NAPL Recovery Using Geotech Solar Sipper

- Ground water table fluctuation: Seasonal, tidal.
- Product layer recharge rate. Very important to know recharge rate of fluids in the well
- Annual average solar resource data
- LNAPL - floating intake recovery
- DNAPL -fixed intake with water sensor

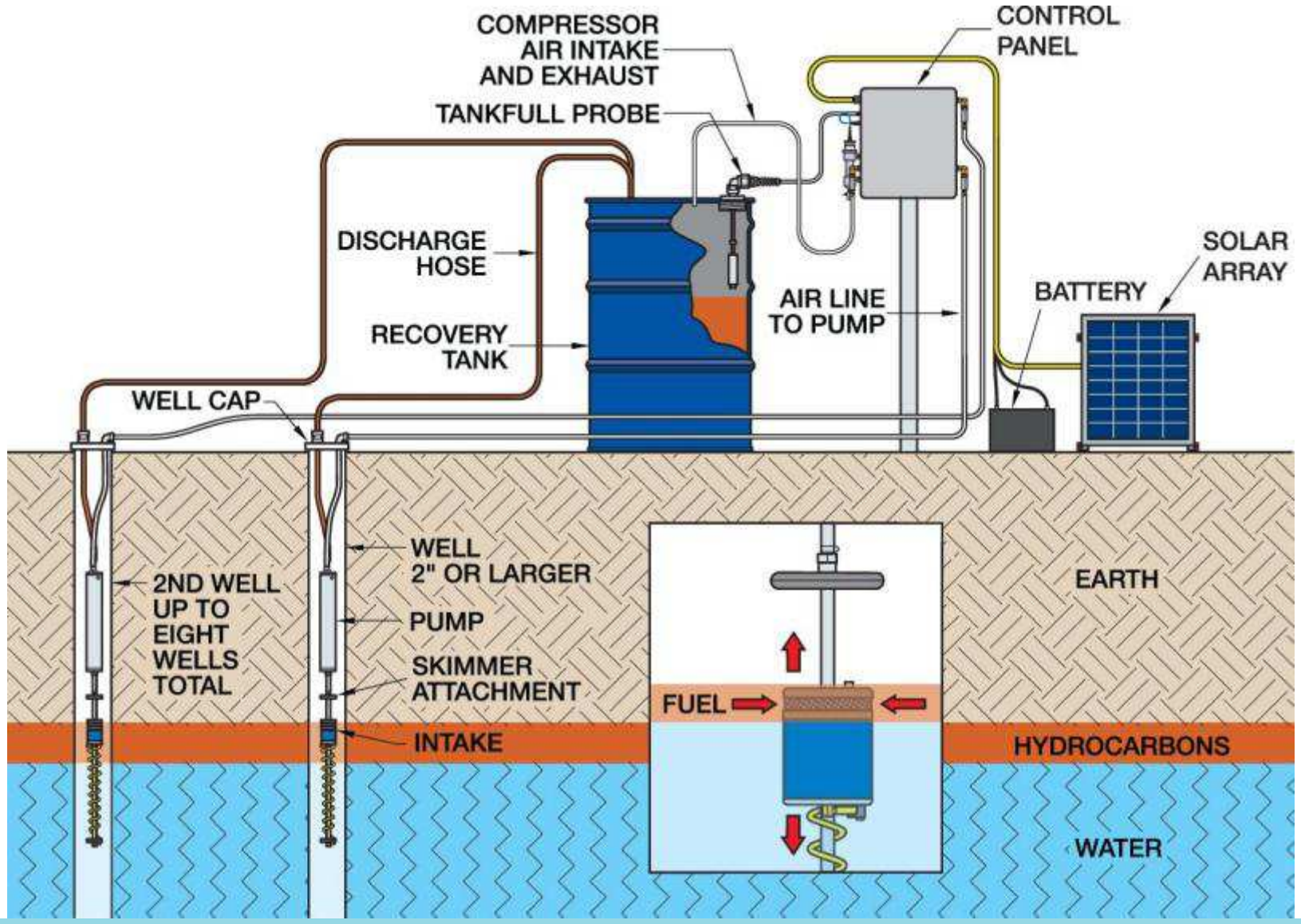
Pneumatic Pump Intake Type

- LNAPL product fluid density and viscosity must be known for Hydrophobic/Oleophilic screened intake mesh size and application
- The 100 mesh (blue screen) is good for gasoline, kerosene, diesel, JP-4 and #2 Fuel Oil
- The 60 mesh (green screen), is usually good for hydrocarbons that fall between #2 and #4 fuel oil viscosities

Pneumatic Pump Intake Type

- The specific gravity of the LNAPL to be recovered must be less than 1.0 and its viscosity is less than 100 SSU for use with the "light" oil filter (100 mesh), and 400 SSU for use with the "heavy" oil filter cartridge (60 mesh)
- The presence of surfactants or detergents in the product can also affect the screen's ability to differentiate between water and hydrocarbons. (Bio fuels are beginning to effect application design)
- Heavy oil intake has adjustable intake without a screened membrane for viscosity over 400 SSU.
- Fixed Intake for DNAPL applications

Depth to Fluid (feet)	Airline Length (feet)	Product Weight	Product Recharge Rate (GPH)	Vacuum Time (mm:ss)	Pressure Time (mm:ss)	Delay Time(hh:mm:ss)	Expected Daily 8 hours Recovery (US Gallons)	KWH	8 Hours 65W Panel 75 AH Combo % Capacity	8 Hours 130W Panel(s) 75 AH Combo % Capacity
10	25	Light	1	0:00:15	0:00:30	0:11:00	8	0.006	10%	5%
10	25	Light	2	0:00:15	0:00:30	0:05:00	16	0.013	20%	10%
10	25	Light	4	0:00:15	0:00:30	0:02:30	30	0.023	35%	18%
10	25	Light	8	0:00:15	0:00:30	0:01:15	48	0.038	58%	29%
10	25	Light	16	0:00:15	0:00:30	0:00:37	70	0.055	84%	42%
10	25	Light	32	0:00:15	0:00:30	0:00:20	88	0.069	106%	53%
10	25	Medium	1	0:00:30	0:01:00	0:11:00	8	0.012	18%	9%
10	25	Medium	2	0:00:30	0:01:00	0:05:00	15	0.023	35%	18%
10	25	Medium	4	0:00:30	0:01:00	0:02:30	24	0.038	58%	29%
10	25	Medium	8	0:00:30	0:01:00	0:01:15	34	0.055	84%	42%
10	25	Medium	16	0:00:30	0:01:00	0:00:37	45	0.071	109%	54%
10	25	Heavy	1	0:01:30	0:03:00	0:11:00	6	0.029	45%	22%
10	25	Heavy	2	0:01:30	0:03:00	0:05:00	10	0.047	72%	36%
10	25	Heavy	4	0:01:30	0:03:00	0:02:30	14	0.064	99%	49%


COMPRESSOR AIR INTAKE AND EXHAUST
CONTROL PANEL
TANKFULL PROBE
DISCHARGE HOSE
SOLAR ARRAY
BATTERY
AIR LINE TO PUMP
RECOVERY TANK
WELL CAP
WELL 2" OR LARGER
2ND WELL UP TO EIGHT WELLS TOTAL
PUMP
SKIMMER ATTACHMENT
EARTH
FUEL
INTAKE
HYDROCARBONS
WATER

Checklist

- Recharge rate of product layer in the well and expected recovery rate (gallons per day)
- Seasonal ground water level fluctuation
- Type of product to determine chemical compatibility
- Number of wells (within 500 foot radius)
- Latitude & Longitude of site

The Original

New Mexico Site

Western Colorado Site

- Recovered 11,000 gallons over 4 years.
- Converted to air sparge now monitoring DO.
- Compressor station.

Solar Sipper

- 7 Single Well Solar-Sipper Systems
  - Recover DNAPL and LNAPL
  - Low maintenance
  - Low cost
  - Maximizes early mass removal
  - Limited net environmental impact
    - Reduce greenhouse gas emissions
    - Small Footprint

Arkansas Refinery Site -Nine Systems each consisting of

- 1-Multi-well Solar Sipper Control Panel
- 1-Solar Panel Assembly
- 7-Down well canisters and floating intake skimmer assemblies
- 7-4” Slip Cap assemblies with compression fittings

Remote Status of Remediation Systems

Leppert Associates Remote Telemetry Database
Clean Harbors El Dorado

LRS Name Click For More Details	Operational Status	Tank Level (Empty 1/4 1/2 3/4 Full)	Oil Extractions In The Last Seven Days Of Operation	Communication Status	Charging Status
SS-02	Operational		77	Communicating	Nominal
SS-03	Operational		76	Communicating	Nominal
SS-04	Operational		94	Communicating	Under Charging
SS-05	Operational		123	Not Communicating	Under Charging
SS-06	Operational		277	Communicating	Under Charging
SS-10	Operational		2350.00	Communicating	Under Charging
SS-11	Operational		79	Communicating	Nominal
SS-12	Operational		66	Communicating	Nominal
SS-13	Operational		106	Communicating	Nominal

Detailed Query of All Parameters

System Summary

Summary of Unit SS-05

Property Name	Last Update Date and Time (Central Standard)	Value
In Low Battery Shutdown	2012-01-11 05:53:11	No
In Low Temperature Shutdown	2012-01-11 05:53:11	No
In Oil In Line Shutdown	2012-01-11 05:53:11	No
In Tank Full Shutdown	2012-01-11 05:53:11	No
Last Packet Received Time	2012-01-11 05:53:11	N.A.
Last Packet Requested Time	2012-02-01 23:37:39	N.A.
Extraction Cycles Total	2012-01-11 05:52:11	2103
Battery Maximum Daily Value	2012-01-10 22:35:33	13.5
Battery Minimum Daily Value	2012-01-10 22:35:33	11.4
Battery Current Voltage	2012-01-11 05:53:01	12.5
Tank 1 Quarter Full Sensor Tripped	2012-01-11 05:52:31	No
Tank Half Full Sensor Tripped	2012-01-11 05:52:31	No
Tank 3 Quarter Full Sensor Tripped	2012-01-11 05:52:31	No
Temperature (F)	2012-01-11 05:53:01	46.6
Atmosphereic Pressure	2012-01-11 05:53:01	-14.6
Max Pressure 1	2012-01-11 05:47:11	-14.6
Min Pressure 1	2012-01-11 05:47:11	-14.6
Max Pressure 2	2012-01-11 05:47:51	-14.6

Summary of Unit SS-06

Property Name	Last Update Date and Time (Central Standard)	Value
In Low Battery Shutdown	2012-02-01 23:44:17	No
In Low Temperature Shutdown	2012-02-01 23:44:17	No
In Oil In Line Shutdown	2012-02-01 23:44:17	No
In Tank Full Shutdown	2012-02-01 23:44:17	No
Last Packet Received Time	2012-02-01 23:44:17	N.A.
Last Packet Requested Time	2012-02-01 23:44:16	N.A.
Extraction Cycles Total	2012-02-01 23:43:16	6675
Battery Maximum Daily Value	2012-02-01 14:13:29	14.6
Battery Minimum Daily Value	2012-02-01 14:13:29	11.5
Battery Current Voltage	2012-02-01 23:44:06	12
Tank 1 Quarter Full Sensor Tripped	2012-02-01 23:43:36	Yes
Tank Half Full Sensor Tripped	2012-02-01 23:43:36	Yes
Tank 3 Quarter Full Sensor Tripped	2012-02-01 23:43:36	Yes
Temperature (F)	2012-02-01 23:44:06	55.3
Atmosphereic Pressure	2012-02-01 23:44:06	14.1
Max Pressure 1	2012-02-01 23:38:15	21.4
Min Pressure 1	2012-02-01 23:38:15	1.6

Benefits of Remote Monitoring

- Strategic vs. routine site visits
- Prepared for site visits when you arrive
  - Tools
  - Parts
  - The Right Personnel
- Cost efficiency

Benefits of Green Energy Remediation Summary

- Speed
- Safety
- Plentiful Energy
- Inexpensive to implement and modify
- Green; no fuels, no emissions
- Simple implementation
- Cost effective option for your customer

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