Turning Liabilities into Assets: Using Decommissioned Oil and Gas Infrastructure for Solar Energy Development

Municipal Climate Change Action Centre

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Outline

- Motivations
- Challenges
- Proposed solution
- Obstacles and Advances
- M.D. of Taber RenuWell solar development project
  (funded by Municipal Climate Change Action Centre)
- Potential Benefits
- Summary

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Motivation:
Declines in oil and gas sector

CLIMATE

Peak Oil Returns: Why Demand Will Likely Peak By 2030

BY JOE ROMM FEB 22, 2016 8:00 AM

http://thinkprogress.org/climate/2016/02/22/3720343/peak-oil-demand

- Since 2008, OECD economies have grown without increasing oil consumption
- Major factors are:
  - Growing acceptance of CO2 induced climate change
  - Improved levels of energy efficiency
  - Declining Energy Return on Energy Investment for unconventional fields
  - Higher costs for new oil and gas developments

Motivation:
Technical and economic breakthroughs in solar

Environment

Solar and wind power cheaper than fossil fuels for the first time

Despite the low price, not enough money is being put into renewable ways of generating electricity

Andrew Griffin | @_andrew_griffin | Wednesday 4 January 2017 | 151 comments

11K shares

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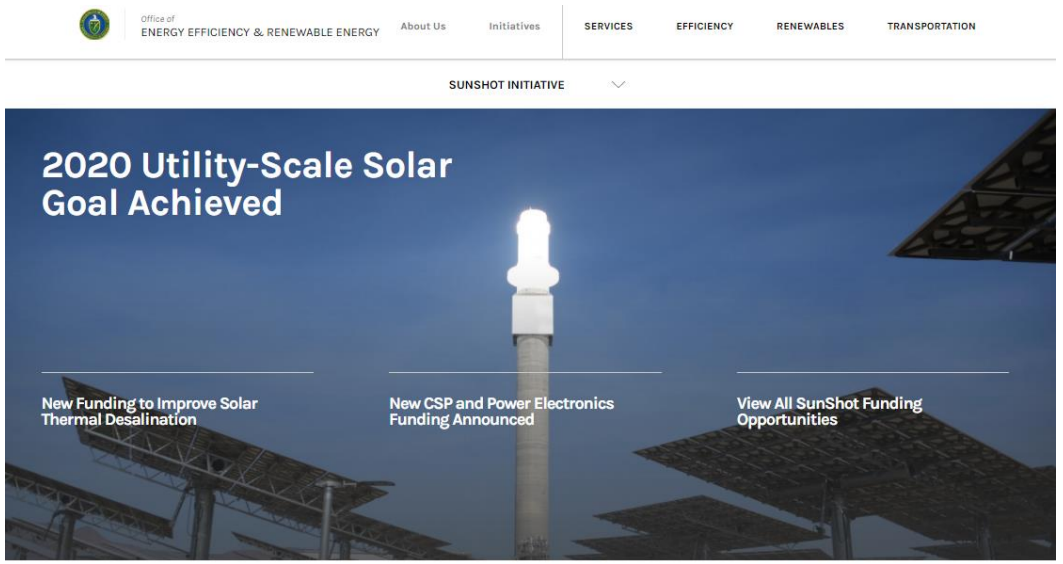

SunShot U.S. Department of Energy

The SunShot Initiative is a national effort to drive down the cost of solar electricity and support solar adoption. SunShot aims to make solar energy a low-cost electricity source for all Americans

SunShot Subprograms

- Concentrating Solar Power
- Photovoltaics
- Systems Integration
- Soft Costs
- Technology to Market

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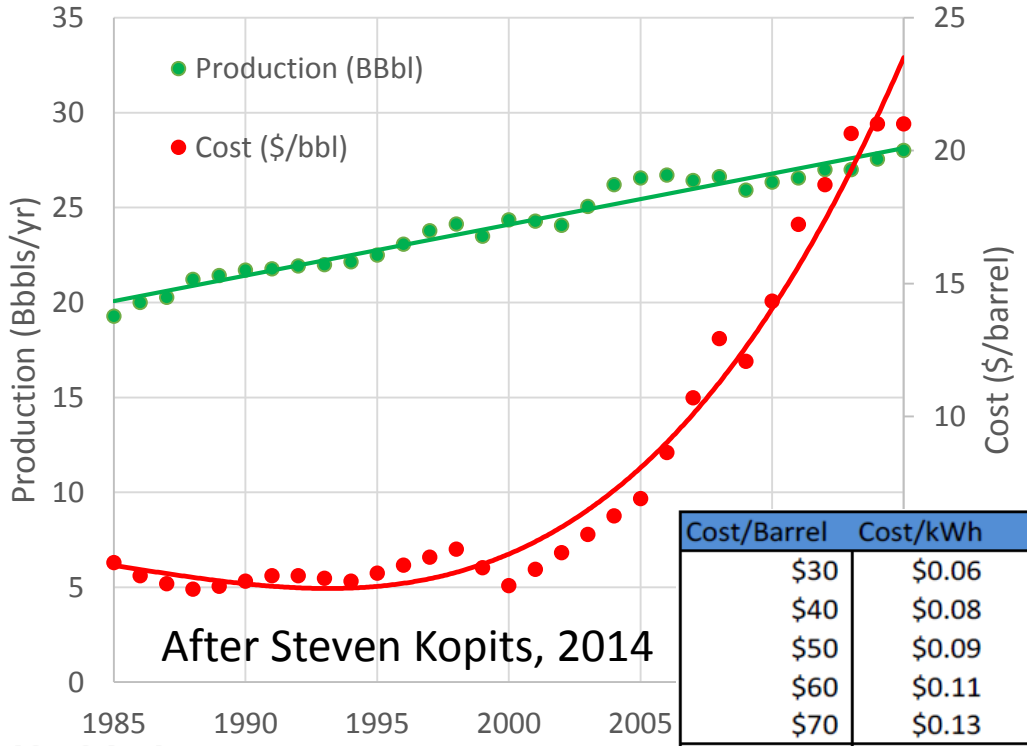
Motivation:
Energy production vs. Unit cost

http://energypolicy.columbia.edu/events-calendar/global-oil-market-forecasting-main-approaches-key-drivers

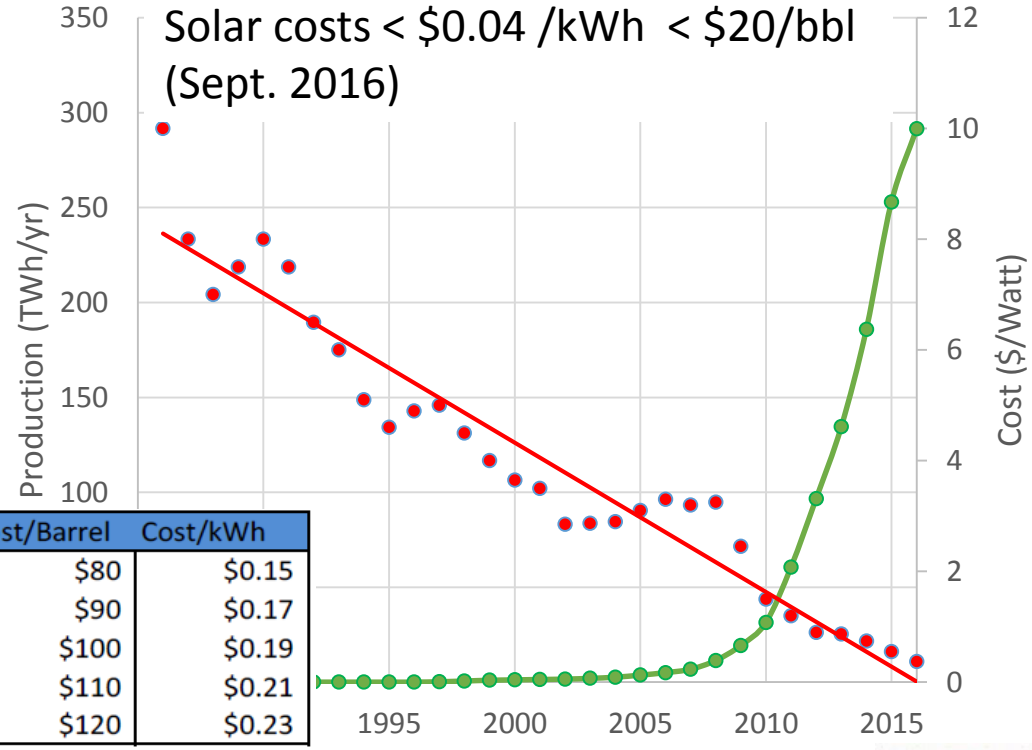
http://cleantechnica.com/2014/09/04/solar-panel-cost-trends-10-charts/
https://en.wikipedia.org/wiki/Solar_power

Annual Oil Production and $/barrel



Cost/Barrel	Cost/kWh	Cost/Barrel	Cost/kWh
$30	$0.06	$80	$0.15
$40	$0.08	$90	$0.17
$50	$0.09	$100	$0.19
$60	$0.11	$110	$0.21
$70	$0.13	$120	$0.23

Annual Solar production and $/Watt



2019 World Energy Council world-wide survey
Oil and gas decomissioning liabilities > $300 Billion

KEY FINDINGS

1. A successful energy transition depends on infrastructure that is adaptable, reliable and affordable. We need to find better ways to utilise existing energy assets as we transition to a decarbonised system
2. Use of existing infrastructure is a resource for more affordable transition to decarbonisation. Realising this opportunity must be a priority that requires consideration of infrastructure repurposing opportunities where these make sense.
3. The magnitude of stranded assets is unknown to the market. There is a potential risk that decarbonisation could become cost-prohibitive if large portions of existing infrastructure are stranded.
4. Businesses should reframe market strategies to explore the opportunities of reusing existing infrastructure to support transition to a low-carbon future.

RECOMMENDATIONS

1. EXISTING ENERGY INFRASTRUCTURE AND ITS POTENTIAL REPURPOSING OPPORTUNITIES SHOULD BE PART OF TODAY'S LONG-TERM PLANNING AND STRATEGIC DIALOGUE

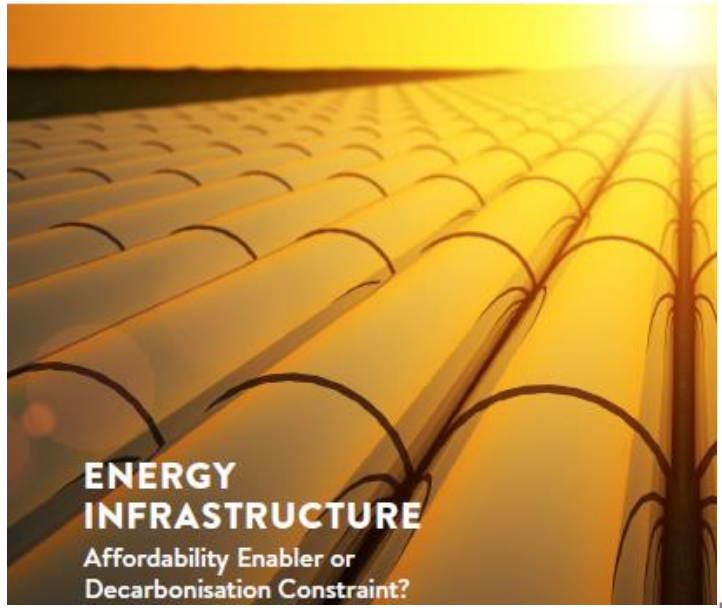
Existing energy infrastructure has been built around conventional resources over many decades with trillions of dollars in investment. It will be a missed opportunity to not plan for the role of existing infrastructure in future energy systems.

2. NATIONAL GOVERNMENTS AND WIDER ENERGY STAKEHOLDERS SHOULD CO-DEVELOP AN ENERGY INFRASTRUCTURE ACTION PLAN

Energy leaders from around the world including national and regional policymakers have a critical role to play in driving forward the development of a coordinated Action Plan to better realise opportunities for aligning decarbonisation of energy supply with existing infrastructure that may need to be appropriately dealt with. In Europe, besides national governments, European policymakers will have a key role for energy infrastructure plan to ensure coherence for all the countries.

WORLD ENERGY COUNCIL

Innovation Insights Brief | 2019



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https://www.worldenergy.org/assets/downloads/Innovation-Insights-Brief-Energy-Infrastructure-Affordability-Enabler-or-Decarbonisation-Constraint.pdf

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Motivation:
Challenges to Alberta's oil and gas industry

The firm that brought foreign money to the oilsands sees sun setting on Canadian crude

SANDRA MERGULHAO, BLOOMBERG NEWS | January 6, 2017 7:43 AM ET
More from Bloomberg News

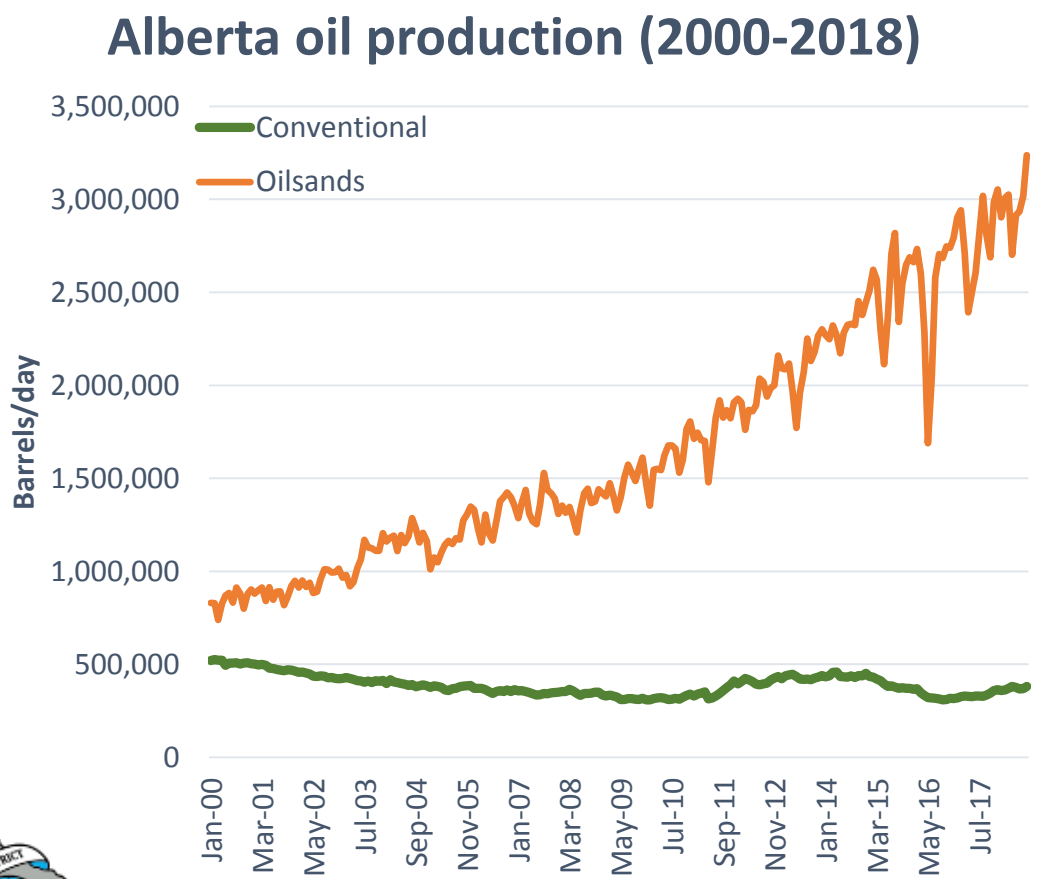
Graton expects the oil and gas industry's recovery to be muted compared with previous cycles and is looking at financing more environmentally friendly and renewable power projects across Canada. Eric Healey/Postmedia Network

- Increasing dependence on unconventional gas and oilsands
  - ➢High production costs
- Lack of bitumen refining capacity
- Key producers (Saudi) motivated to sell low cost/high quality oil before demand decreases further
- Declining oil industry results in high unemployment and lower royalties

http://business.financialpost.com/news/energy/the-firm-that-brought-foreign-money-to-the-oilsands-sees-sun-setting-on-canadian-crude

Motivations:
Declining production from conventional fields

- Southern Alberta fields are mature
- Peak oil production in mid 1970s
- Rising costs for decreasing return
- Investment shifted to unconventional:
  - Northern Alberta oilsands and shale plays
  - Even higher production costs
- Major impact on employment and rural economies



Challenges:
Rapid increase in O&G liabilities

- Only 79,826 wells have been reclaimed to date (16%)
- 75,132 abandoned wells awaiting reclamation
- 81,672 suspended wells require abandonment
- 156,804 leases (313,608 acres) require surface reclamation
- Liabilities are estimated to be between $30 and $100 billion

THE WESTERN PRODUCER

Orphan wells: Alberta's $47 billion problem

By Barb Glen
FOLLOW

Published: March 22, 2018
Farm Living, News
6 comments
33

It's estimated that more than 155,000 Alberta energy wells have no economic potential and will eventually require reclamation. | Barb Glen photo

Challenges:
Rapid increase in O&G liabilities

- Significant delays in lease reclamation
- Many mature assets sold to smaller companies without adequate financial resources
- From 2012 to 2017, OWA inventory increased from 74 to 1,778 due to bankruptcies
- Nearly 30 more O&G companies currently in receivership
- Landowners seeking compensation from ARSB for unpaid lease rentals
- Rural municipalities owed more than $81M in unpaid property taxes

RMA RURAL MUNICIPALITIES OF ALBERTA

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MEDIA | 08 Mar 2019 12:10

Rural municipalities out more than $81 million in unpaid taxes from oil and gas companies

Nisku, AB, March 8, 2019 – The Rural Municipalities of Alberta (RMA) have recently conducted a survey that identifies that an unprecedented **$81 million in property taxes** from oil and gas companies have gone unpaid. This is a unique challenge that has not been experienced by municipalities in Alberta before. The survey, conducted in January and February 2019, had responses from 54 of the RMA's 69 members municipalities that cover the landscape of rural Alberta.

http://www.orphanwell.ca/wp-content/uploads/2018/10/OWA-2017-18-Ann-Rpt-Final.pdf

https://rmalberta.com/news/rural-municipalities-out-more-than-81-million-in-unpaid-taxes-from-oil-and-gas-companies/

Challenges:
Rapid expansion of renewable energy

- Renewable energy now less expensive than fossil fuels
  - Wind ($0.037/kWh)
  - Solar ($0.048/kWh)
- Lowest cost projects are usually the largest
  - Require major land allocations
  - Often need costly transmission and distribution upgrades
  - Frequently rely on experienced, out-of-province crews and expertise

Canadian Solar wins PPAs for 94 MWp in Alberta

February 18 (Renewables Now) - Canadian Solar Inc (NASDAQ:CSIQ) said last week it has won 94-MWp of subsidy-free solar photovoltaic (PV) projects in the latest Alberta province auction.

Solar panels. Author: 100% Campaign.

In all, the company was awarded three solar power purchase agreements (PPAs) with Alberta's Ministry of Infrastructure at an average price of CAD 48.05 (USD 36.28/EUR 32.11) per MWh.

Expected to start commercial operation in early 2021, these solar plants -- Jenner, Tilley, and Hays -- are to be able to generate together enough power for more than 20,000 local homes. The output will cover 55% of the electricity needs of the Alberta provincial government.

Challenges:
Rapid expansion of renewable energy

- Government goal of 5,000 MW requires more than 35,000 acres
- Major pressure on agricultural lands
  - Currently approved projects require more than 9,000 acres
  - Regulatory processes not fully developed
  - No clear guidelines on final reclamation, etc.

Alberta explores ways to soothe landowner angst as wind and solar takes off

Landowners don't want to get stuck with clean-up bill when renewable energy facilities expire

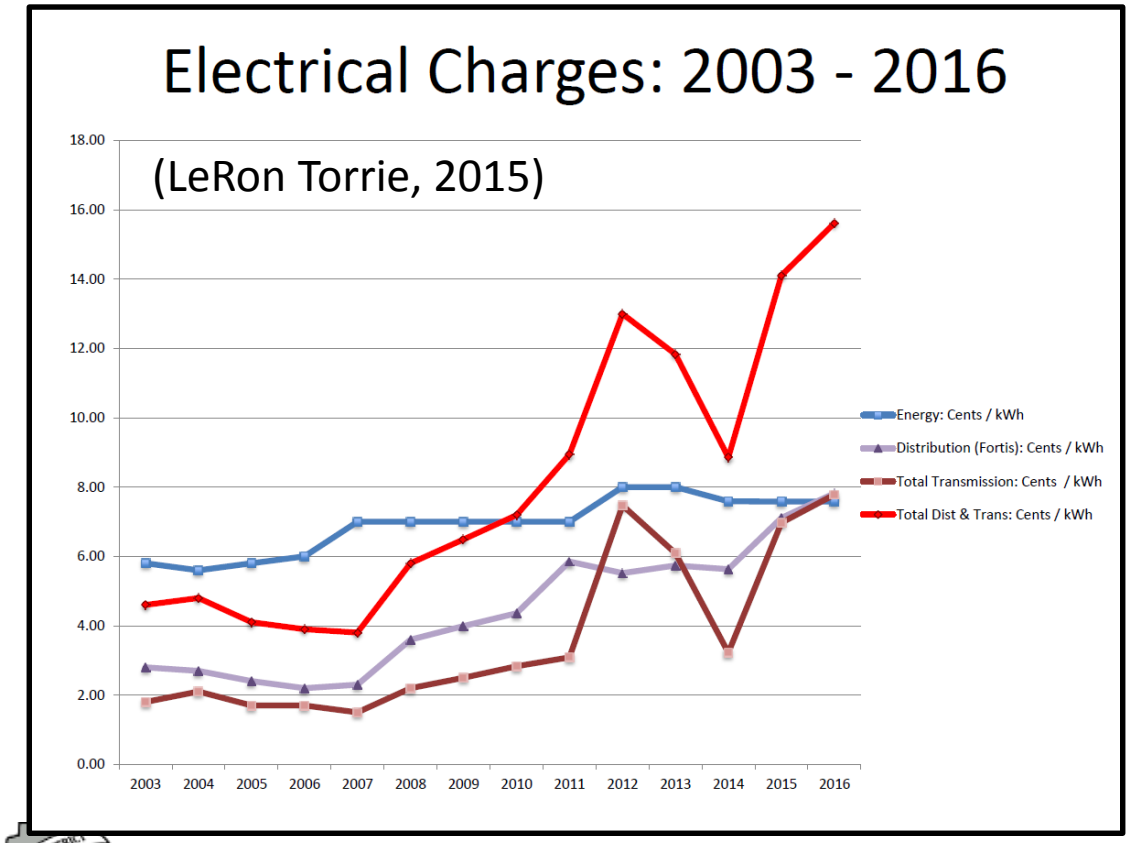
Tony Seskus · CBC News · Posted: Apr 13, 2018 4:00 AM ET | Last Updated: April 13, 2018

Alberta is experiencing a boom in renewable energy development, including wind energy. Landowners want to make sure their land is properly reclaimed when such facilities reach the end of their lifespan. (Kathryn Marlow/CBC)

https://www.cbc.ca/news/business/renewable-energy-alberta-1.4614527

Challenges:
Rising electricity prices caused by delivery charges

- Large scale generation projects (non-renewable and renewable) often require upgrades to the transmission and distribution networks.
- System upgrades are passed along to consumers at cost plus 8% profit
- Since 1999, energy costs have fallen due to competition
- Delivery charges (which are a virtual monopoly) have tripled



Proposed Solution:
Converting oil and gas leases to renewables

155,610 inactive wells

311,220 acres requiring reclamation

5,000 MW planned :

35,000 acres required for solar

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Proposed Solution:
Converting oil and gas leases to renewables

Convert abandoned leases to small scale solar generation

- Stable, secure power costs
  - $50/MHh
  - Generate GHG offsets: $18/MWh

Total market (assuming 10% leases)

- Over 30,000 acres available for solar
- Abandonment : > $1.5 billion
- Solar construction: > $12.3 billion

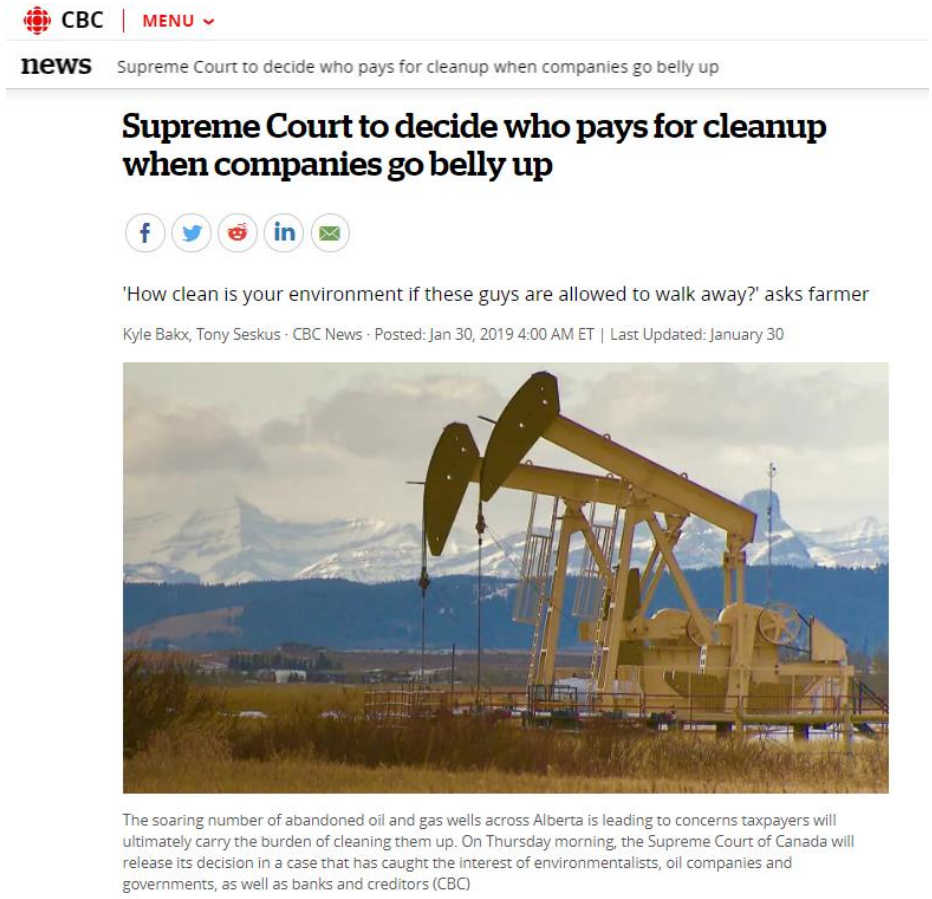
Decrease abandonment/reclamation costs up to 40%

Save 25% on solar installations

Defer reclamation>$10K/lease: $205M

Past obstacles

- Regulatory uncertainty (compounded by Redwater case)
- Oil companies unwilling to discuss Asset Retirement Obligations
- No formal AER process for transferring lease responsibilities without removing roads and powerlines
- OWA mandate restricted to lease closure activities
- Local governments had no framework for approving these developments



CBC | MENU

news Supreme Court to decide who pays for cleanup when companies go belly up

Supreme Court to decide who pays for cleanup when companies go belly up

'How clean is your environment if these guys are allowed to walk away?' asks farmer

Kyle Bakx, Tony Seskus · CBC News · Posted: Jan 30, 2019 4:00 AM ET | Last Updated: January 30

The soaring number of abandoned oil and gas wells across Alberta is leading to concerns taxpayers will ultimately carry the burden of cleaning them up. On Thursday morning, the Supreme Court of Canada will release its decision in a case that has caught the interest of environmentalists, oil companies and governments, as well as banks and creditors (CBC)

https://www.cbc.ca/news/business/orphan-well-supreme-court-oilpatch-1.4997355

Recent Advances

- July, 2018: New AER regulation (SED: 002) allows for partial reclamation and overlapping surface leases
- Nov. 2018, received support from surface rights association
- Dec. 2018: received landowner support to explore options for problem orphan well lease
- Jan. 2019, SCC decision in favour of the AER in the Redwater case
- Jan. 2019, OWA exploring alternate lease transfer options

Supreme Court rules energy companies must clean up old wells – even in bankruptcy

Canada's top court overturns Redwater Energy lower court decision

Tracy Johnson · CBC News · Posted: Jan 31, 2019 9:50 AM ET | Last Updated: January 31

An orphan well site near Carstairs, Alta., awaiting proper abandonment and reclamation. (Government of Alberta)

https://www.cbc.ca/news/business/supreme-court-redwater-decision-orphan-wells-1.4998995

MD of Taber/RenuWell Solar Development Project: Funded by Municipal Climate Change Action Centre

MD of Taber chosen to create

"Best Practice Guidelines" for Alberta Municipalities

- Working with MD of Taber to:
  - Engage stakeholders to determine needs and priorities
  - Develop templates for:
    - Land use Bylaws
    - Development approvals
    - Taxation
    - Emergency response
    - Assessing infrastructure impacts
    - Reclamation of solar projects
  - Determine which leases are best candidates for solar conversion
  - Create value for the community

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Community Generation Capacity Building Program

Successful Municipal Applicants

Recipient Organization	Project Name	Project Description
Lethbridge County	Stewart Siding Solar Farm	This will include land use agreements, feasibility assessments, financial analysis, stakeholder engagement, environmental assessments, and wildlife studies for a solar PV project.
Municipal District of Taber	RenuWell Solar Development Project	Re-purposing abandoned oil and gas infrastructure for small scale generation. This project proposes the creation an inventory of abandoned and orphan leases throughout the MD, rank them according to their value for community solar development and explore the potential of creating co-ops to generate power for irrigation.
Mountain View County	Mountain View County Solar PV Study	Update the existing feasibility study, complete an interconnectivity study and a financial assessment study for a Distributed Generation solar PV system.

CGCB Documents

CGCB Program Guide
CGCB Program Application Form
CGCB Program Evaluation Matrix
CGCB FAQ
CGCB Brochure
CGCB Successful Municipal Applicants Infographic

Community Generation Overview
Community Generation FAQ
Small Scale Generation Regulation

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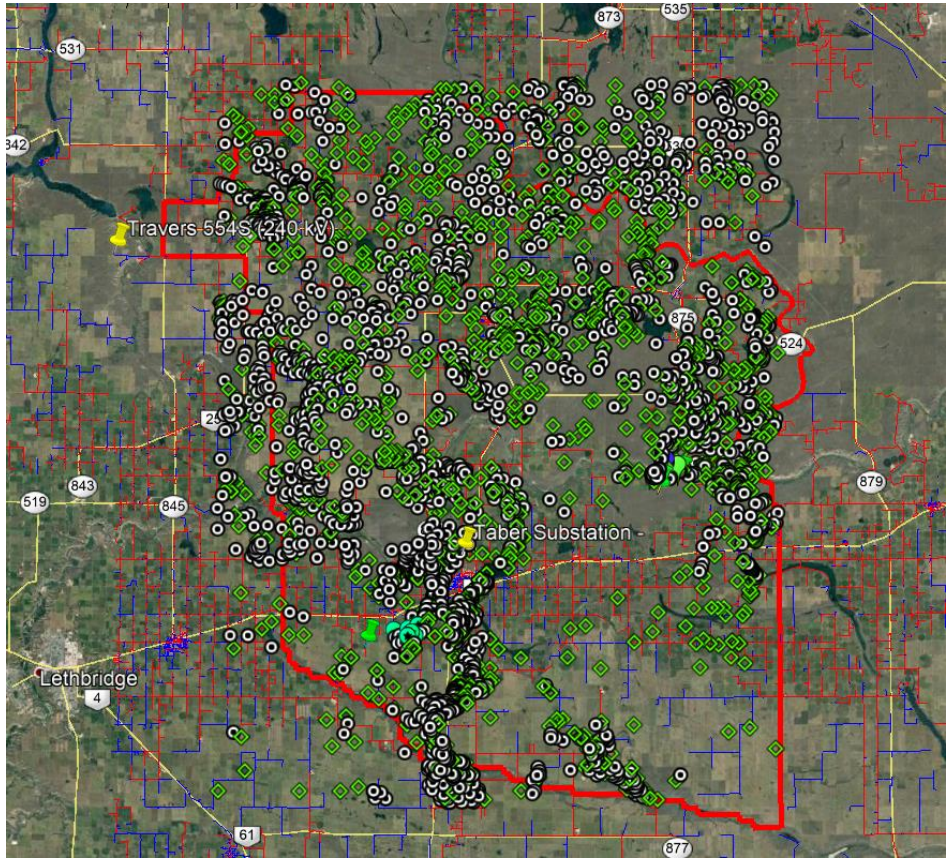
Why the MD of Taber?

- More than 3000 inactive wells
- World-class wind and solar resources
  - Two major wind projects
  - Six utility scale solar projects in various stages of development
- Exceptional land management policies
- Comprehensive renewable energy policy framework with priority on agriculture and the environment

Benefits for the MD of Taber

- Provides options for some of the 3000+ inactive wells
- Reduces pressure to use agricultural land for solar projects
- Small-scale solar generation can provide lower energy costs
- Employment and economic development opportunities
- Tax revenue to replace oil and gas shortfalls
- Establish MD of Taber as a leader in Energy Diversification

Inactive wells and selected orphan wells/facilities



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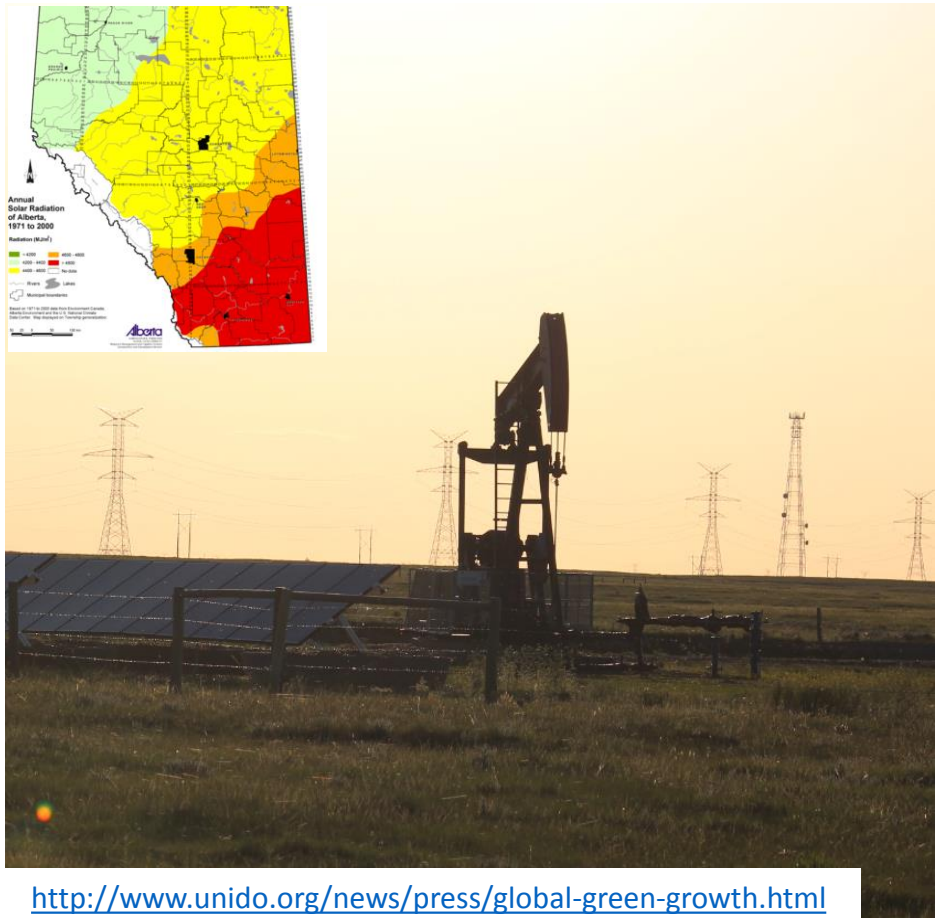
Benefits for Alberta

- Accelerate renewable energy development
- Job creation and workforce training
- Progress towards climate change goals
- Improved profitability for oil and gas sector
- Extended life-cycle for oil and gas leases
  - Less farmland required for renewable energy
- Distributed power generation – greater grid stability
- Develop skills and technology for export
- Improved image for Alberta's oil and gas industry



http://www.unido.org/news/press/global-green-growth.html

Benefits for Alberta:
Assuming solar installed on 10% of inactive leases

Alberta

Leased land converted to solar	**31,000 acres**
Installed solar generation	6,200 MW
Annual production capacity	8,092,000 MWh
Annual CO2 savings	4,531,360 mt
Annual revenue generated	650 M$
Total investment (solar and abandonment)	11.1 B$
Deferred reclamation expenses	155 M$
Person-Years employment	55,900

No additional land removed from agricultural land base

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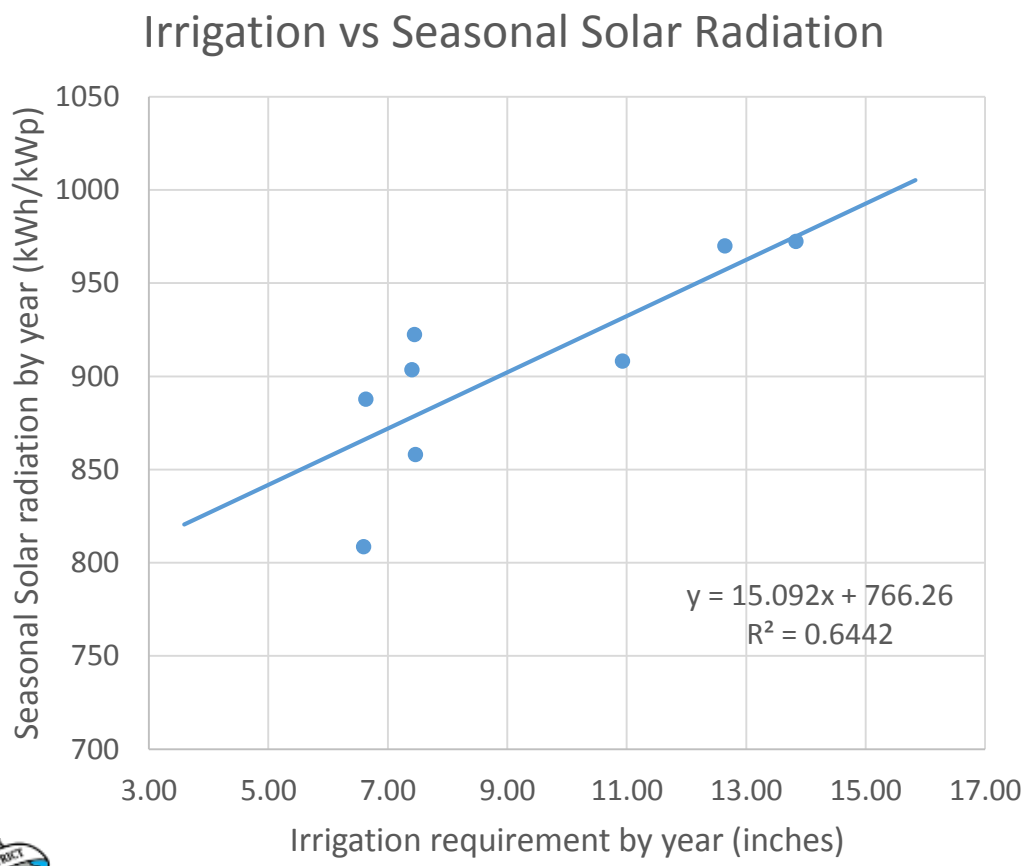
Benefits for Landowners

- Annual application for lease maintenance and rental payments no longer required.
- Land returned to productive use
- If required, allows time for effective bio-remediation
- Sustainable energy development is consistent with most landowner's values
- Lower energy costs from small-scale solar can decrease irrigation expenses.
- Community-owned solar gives landowners the opportunity to use abandoned leases to generate their own electricity.



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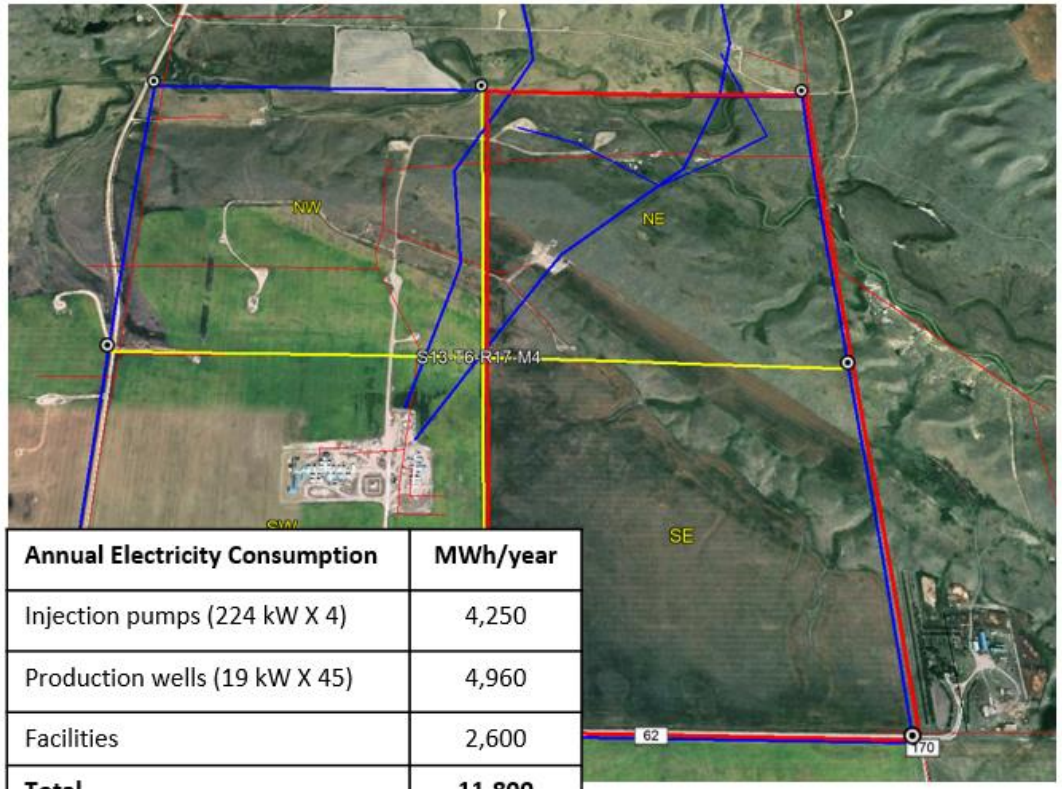
Benefits for Oil and Gas sector

- Solar arrays on abandoned leases can generate lower-cost power for on-going production operations
- Improves GHG emission intensity
- Reduces reclamation expenses by recognizing value in the existing infrastructure
  - Roads
  - Powerlines
  - Prepared leases
- Improve landowner relations



Annual Electricity Consumption	MWh/year
Injection pumps (224 kW X 4)	4,250
Production wells (19 kW X 45)	4,960
Facilities	2,600
Total	**11,800**

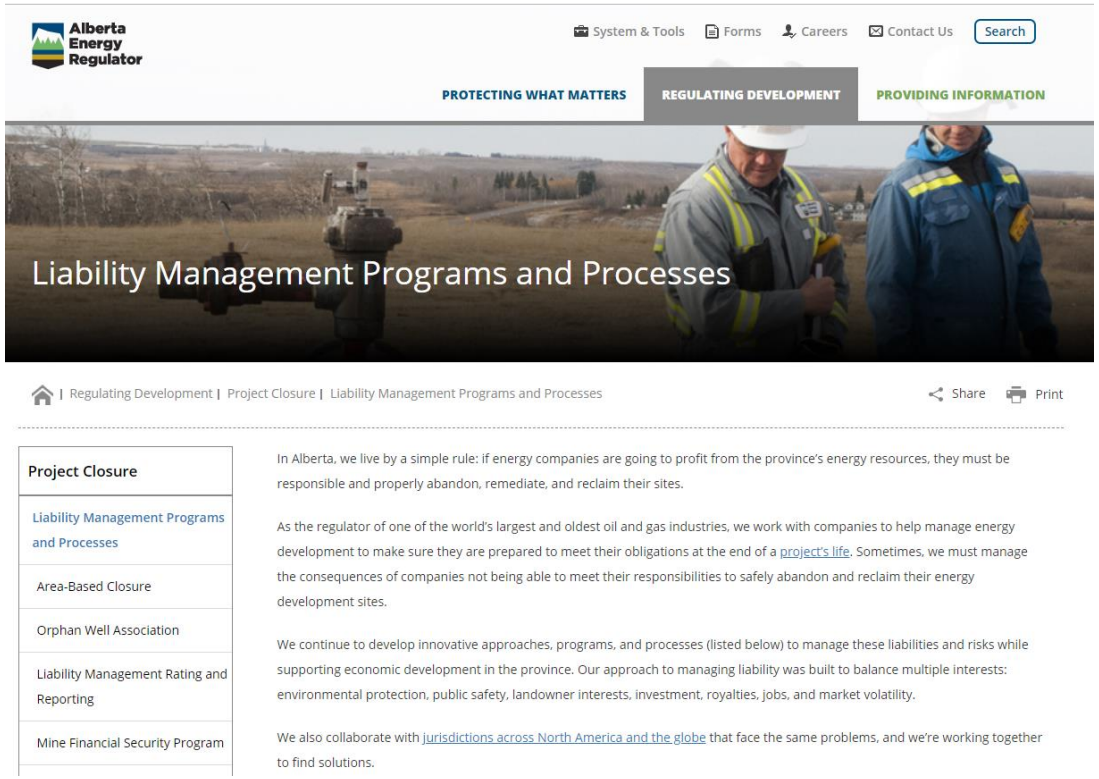
Benefits for renewable energy developers

- Smaller-scale projects on disturbed land are beneficial for environmental approval
- Using existing roads, prepared leases and grid connections reduces the cost of renewable development
- Many similar small-scale projects in the same area can compete with large scale solar developments
- Developing projects on previously disturbed lands provides access to sites in high-quality resource areas while reducing conflicts with agriculture.

Solar energy is also expected to be an important part of Alberta's energy future. This solar field is situated directly adjacent to the Trans-Canada Highway near Brooks, AB. The property also has an oil pumpjack. (Kyle Bakx/CBC)

Benefits for the Alberta Energy Regulator

- Provides motivation for more rapid lease closure
- Recognizing value in the existing infrastructure may accelerate the asset retirement process.
- Renewable energy development on abandoned oil and gas leases enables the AER to provide oversight and mediate between landowner and energy industry objectives.

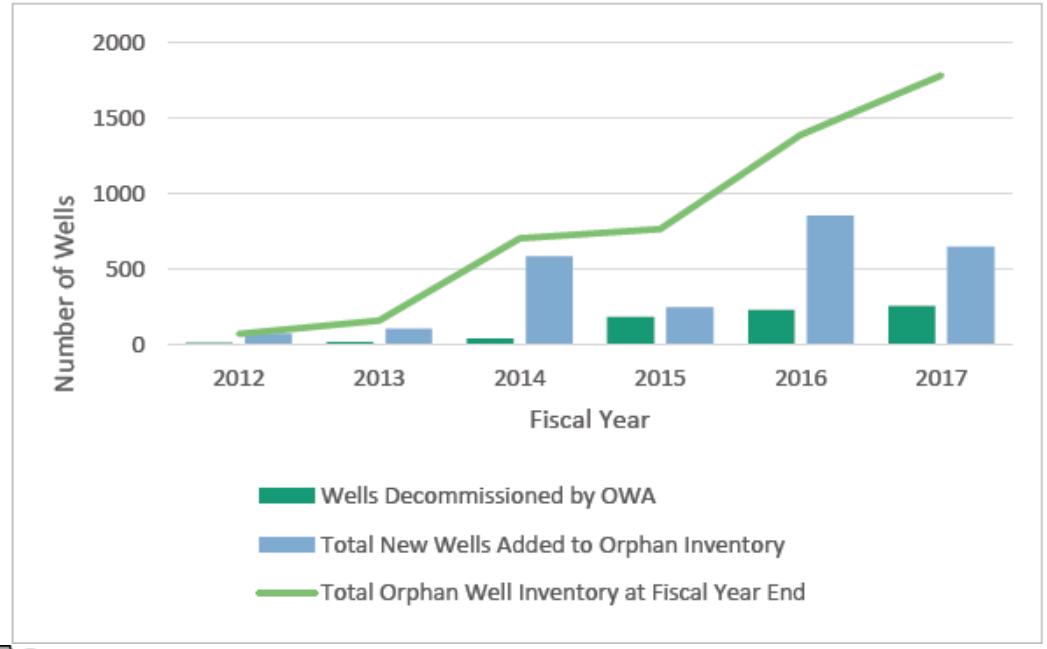


Benefits for the Orphan Well Association

- Renewable energy projects would assume responsibility for lease rental payments and maintenance (weed control, etc).
- The OWA/Surface Rights Board would be released from these obligations for the life of the projects
- Allowing sufficient time for effective bioremediation will maximize the probability that the site will meet certification requirements without further expense.
- Renewable energy development on orphaned leases can result in long-term savings because the final reclamation may not be required prior to lease transfer.

Highlights

Orphan Well Inventory and Wells Decommissioned



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Summary

Our vision is to bring together a range of stakeholders from government, oil and gas industry, renewable energy companies and academic institutions to :

- Prove the value of integrating solar power generation with mature oil and gas infrastructure
- Accelerate the cost-effective reclamation of oil and gas infrastructure liabilities
- Develop a model for a “sustainable energy/environmental bond” associated with the abandonment/reclamation liabilities for energy projects
- Achieve Alberta’s clean power generation/GHG reduction commitments without removing additional land from agricultural land base
- Develop software to enable oil and gas companies to rapidly identify, develop and implement renewable energy projects within their existing properties.
- Re-train oil and gas workers to build the green energy infrastructure
- Establish Alberta as a world-leader in the integration of conventional and renewable energy systems

Acknowledgements :
Municipal Climate Change Action Centre

The MCCAC provides funding, technical assistance, and education to support Alberta municipalities in addressing climate change by reducing their greenhouse gas emissions. Funding programs currently accepting applications include:

- Alberta Municipal Solar Program
- Solar for Schools Program
- Municipal Energy Manager Program
- Recreation Energy Conservation Program
- Electric Vehicles for Municipalities Program

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Acknowledgements

- Municipal District of Taber
  - Brian Peers, RenuWell Project Manager
  - Reeve Merrill Harris and Council
- David Hardie, AER Director Liability Strategy
- Action Surface Rights Association (ASRA)
- David Marks and The Orphan Well Association
- The RenuWell Project Team:
  - Larissa Stendie, Stakeholder engagement
  - Daryl Bennett, ASRA director, mylandman group, Landowner consultation
  - Doug Coreman, Coreman Consulting, Utility and regulatory consulting
  - Lliam Hildebrand, Iron and Earth, Oil & Gas stakeholder engagement & Worker retraining
  - SkyFire Energy Inc – Solar Engineering, Procurement and Construction
  - NuWave Industries – Well abandonment and Oilfield decommissioning

Questions?

$600 investment in solar panels

2009

2015

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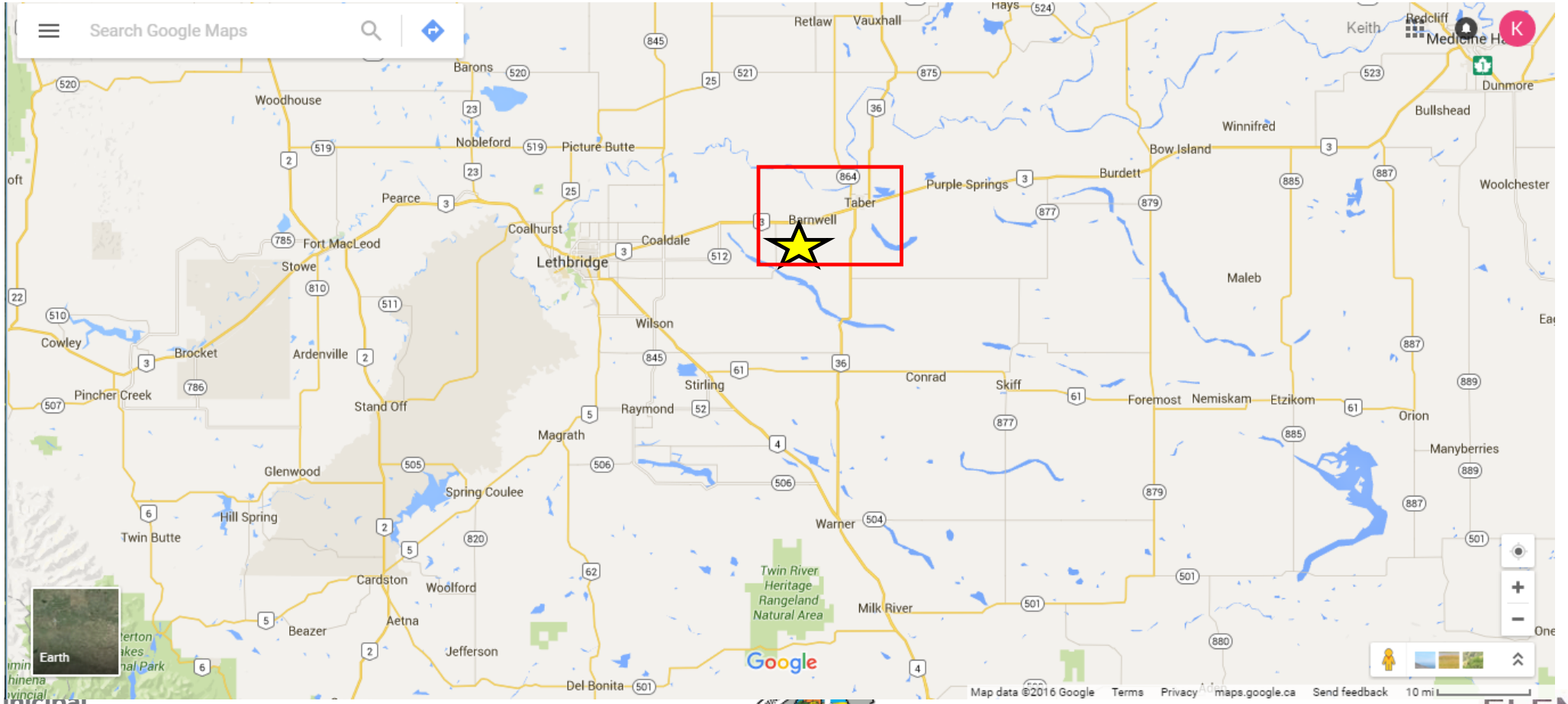
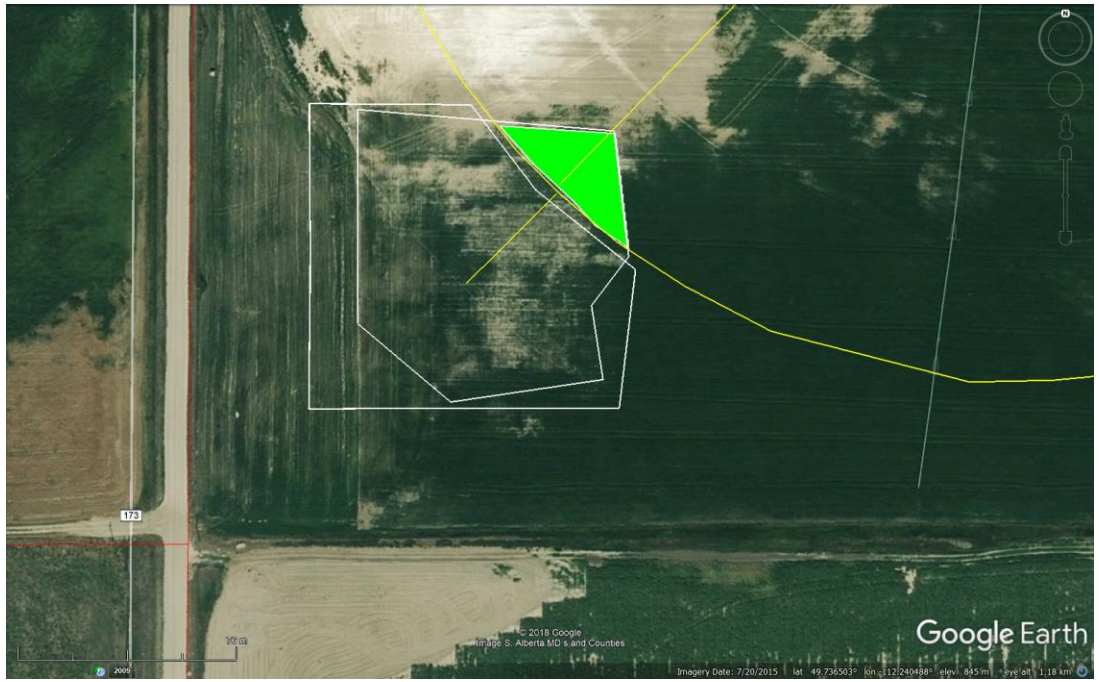
Demonstration project location :
7 km SW of Taber, Alberta



Lease characteristics

Lease Size	Approx. 2.7 acres (2 overlapping leases)
Usable area	2.5 acres (0.25 acres inside pivot track)
Distance to powerline	Approx. 50 meters
Lease status	Pending reclamation due to residual contamination (June, 2018)
Lease Plans	Install solar array (2019) Initiate bioremediation

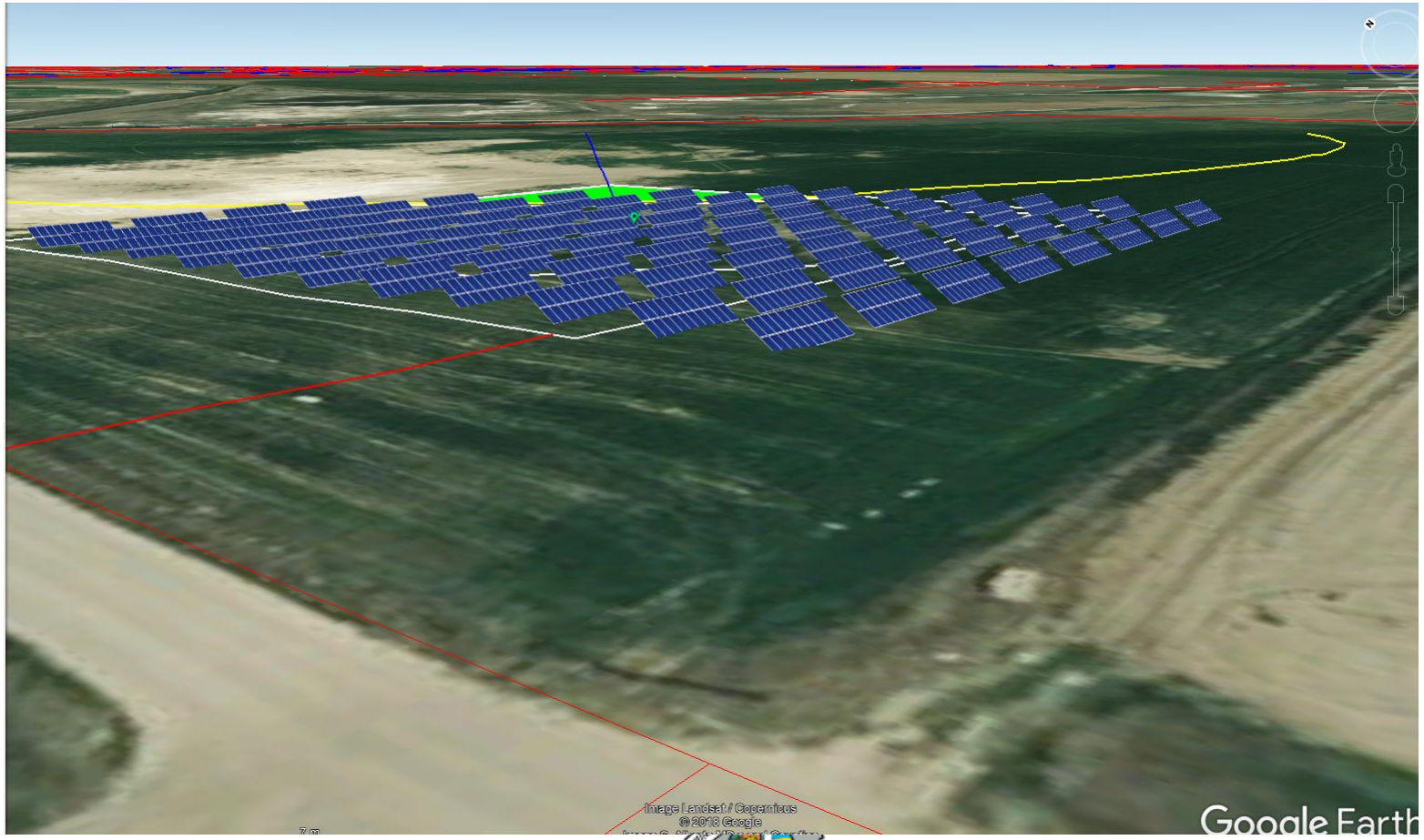
September 2015



Proposed Solar Array

Array Size	515 kWdc
Solar panel modules	Canadian Solar CS6U-335
Number of modules	1,536
Mounting system	Ground mount Fixed tilt at 30 degrees
Total land area	2.4 acres
Set-backs	50 m. from road centre 30 m. from property line

View from intersection SW of lease (from 25 meters above ground level)



Performance predictions
Based on 515 kW fixed array (30 degrees tilt)

Weather data sources

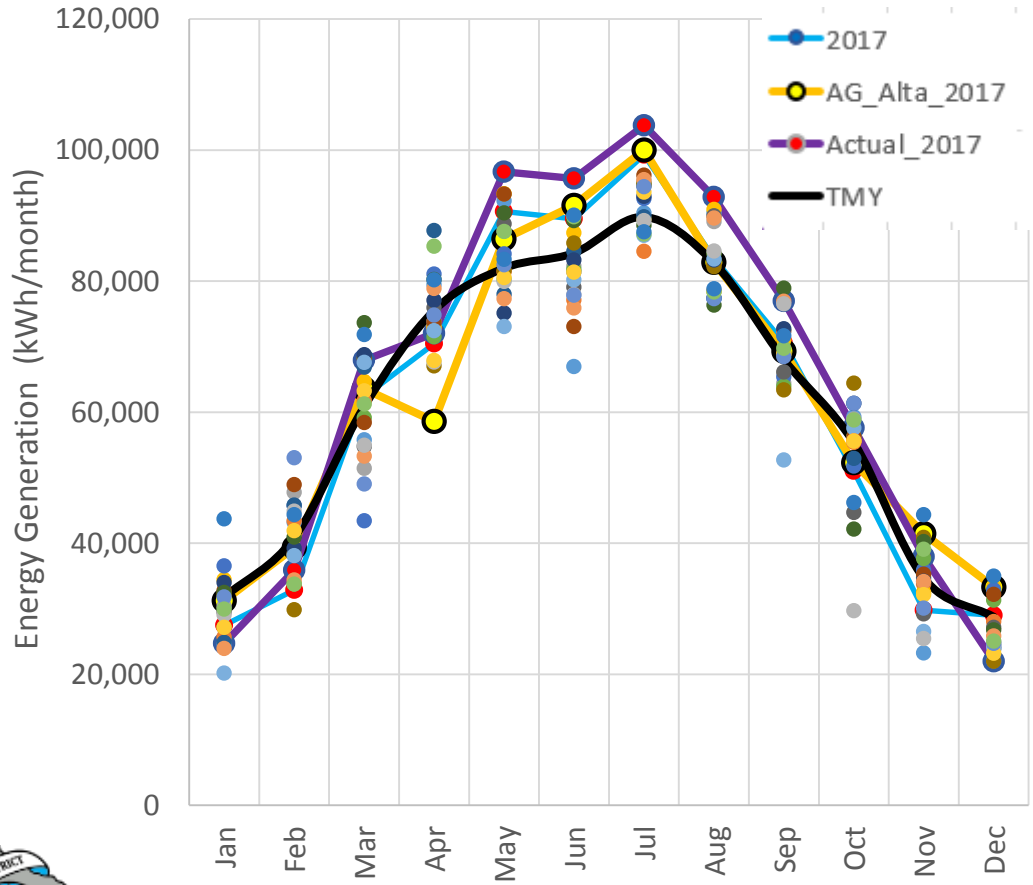
- NREL NRSDB database for years 1998 to 2017
- 2017 from Alta Agriculture Barnwell station
- 2017 data from solar array 25 km East

NREL SAM program used for modelling

Simulated hourly and summed by month

Power generation estimates (1998 to 2017)

Annual	Energy (kWh)	GHG credits (mt)
Min	682,417	382
Max	802,206	449
Average	736,452	412



Municipal Climate Change Action Centre

ELEMENTAL energy INC.
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