



Low-Cost Energy Production Solutions for Ongoing Production and Energy Generation

-Keith Hirsche



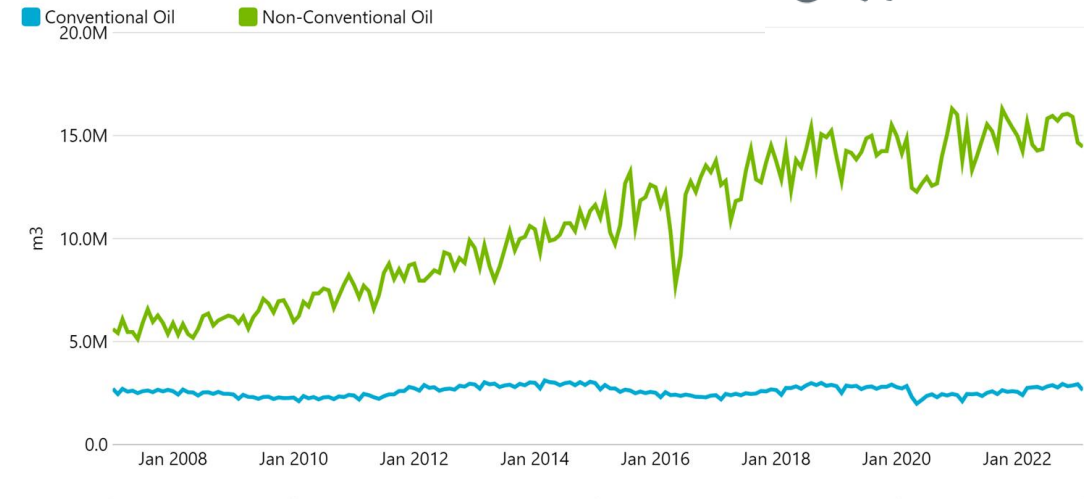
www.renuwellenergy.com

Motivation: 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:
 - Oilsands and shale plays
 - Even higher production costs
- Major impact on employment and rural economies

Alberta oil production (2008-2022)

Oil Production by Type

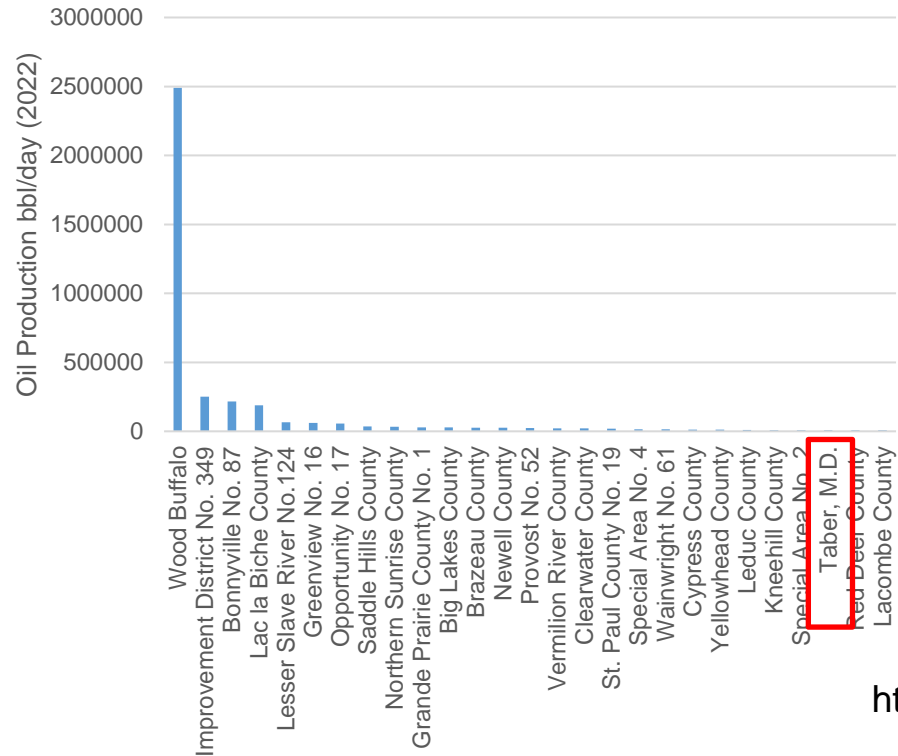


<https://economicdashboard.alberta.ca/dashboard/oil-production/>

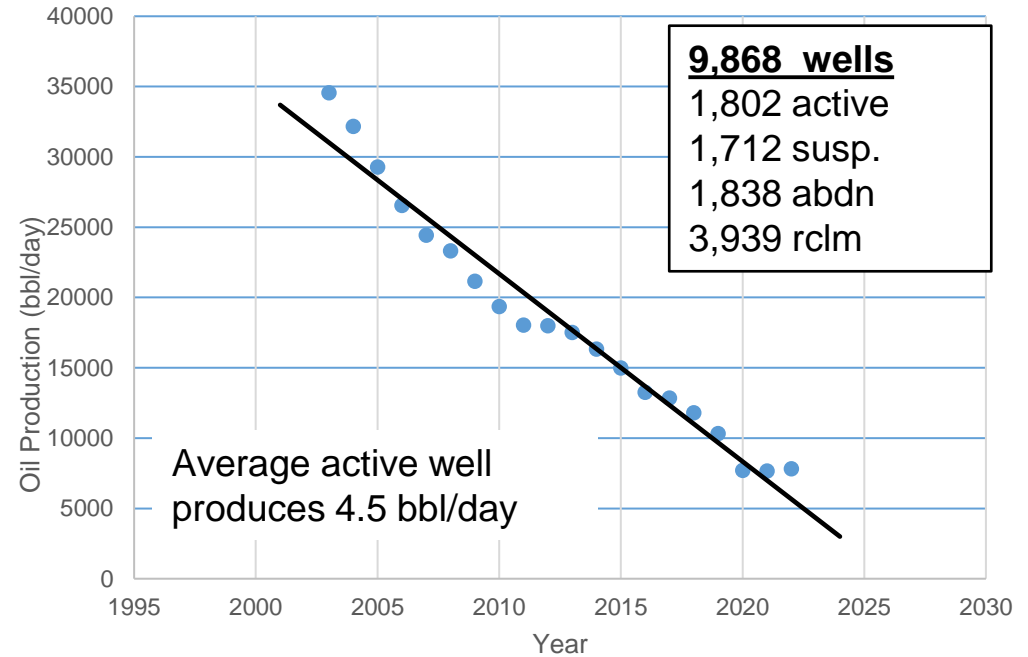


Alberta Oil Production (2022)

Daily Oil Production by Municipality



Daily Oil Production - MD of Taber



<https://regionaldashboard.alberta.ca/region/taber-m-d/oil-production/#/bymunicipality>



Motivation: Rapid increase in O&G liabilities

- More than 170,000 inactive leases in Alberta on more than 340,000 acres.
- Significant delays in lease reclamation
- Many mature oil and gas fields were sold to smaller companies without adequate financial resources for reclamation
- More than 30 O&G companies in receivership
- From 2012 to 2022, Orphan Well Association inventory increased from 74 to 9,558 sites.
- **Over \$268 million outstanding taxes owing to Alberta municipalities (2022, Rural Municipalities of Alberta)**
- Weed control problems from neglected leases
- **Government of Alberta compensating landowners for unpaid lease rentals**

Alberta ranchers, farmers furious over oil and gas companies' failure to clean up their geriatric wells

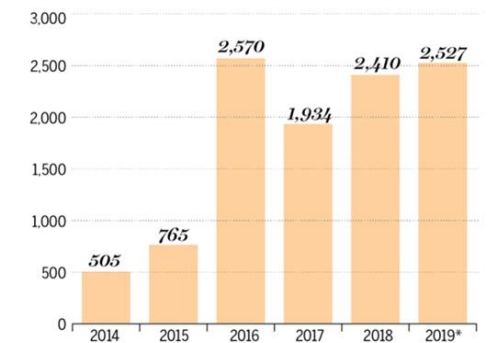
And they're concerned an extra 93,805 wells could become orphaned given Alberta's economic outlook, completely overwhelming clean-up efforts



An oil gauge likely from the 1970s at an old well site. *Alexa Althoff for Nat*

FARMERS FIGHT TO RECOVER UNPAID RENT

Surface Rights Board Recovery of Rental Applications



As of Sept. 30, 2019
SOURCE: GOVERNMENT OF ALBERTA
NATIONAL POST



Geoffrey Morgan



Geriatric orphan wells, boom to mining towns in the age of renewable energy
Alberta's forgotten small communities with changes in the broader economy



Photos by Brian Peers, MD of Taber

Challenges: Rapid expansion of renewable energy

- Renewable energy now less expensive than fossil fuels*
 - Wind (\$37/MWh)
 - Solar (\$48/MWh)
- Lowest cost projects are usually the largest
 - Require major land allocations
 - Significant land-use concerns
 - Frequently rely on experienced, out-of-province crews and expertise
- * \$50/MWh ~ \$20.00/bbl

Calgary

Renewable energy pause welcome in parts of rural Alberta as some say review long overdue

Landowners' group says 'orphan' fund needed to ensure expired wind and solar facilities get cleaned up



Joel Dryden · CBC News · Posted: Aug 22, 2023 6:00 AM MDT | Last Updated: August 22, 2023

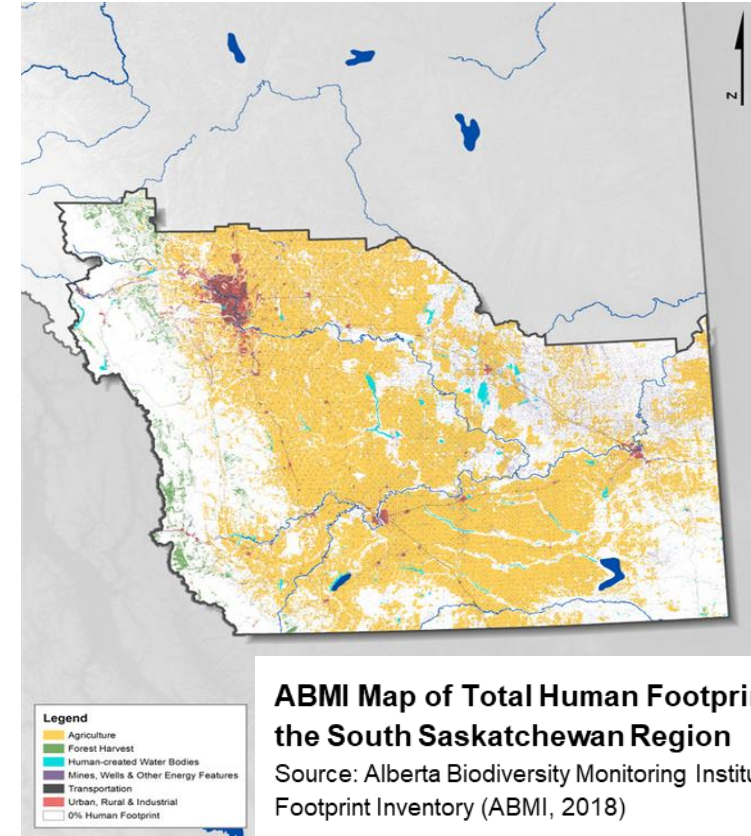


In a file photo, landowner Duane Olson and his dog Bella walk past solar panels at the opening of the Michichi Solar project near Drumheller, Alta. on July 11. (Jeff McIntosh/The Canadian Press)



RenuWell Project Motivations : Competing Land Uses in Highly Developed Region

- Southern Alberta already heavily developed with agriculture and energy development.
- Planned irrigation expansion to increase agricultural production.
- Heavy concentration of abandoned O&G infrastructure.
- Excellent solar and wind resources drive renewable energy development
- **Land use conflicts led to renewable energy moratorium and subsequent regulatory restrictions**

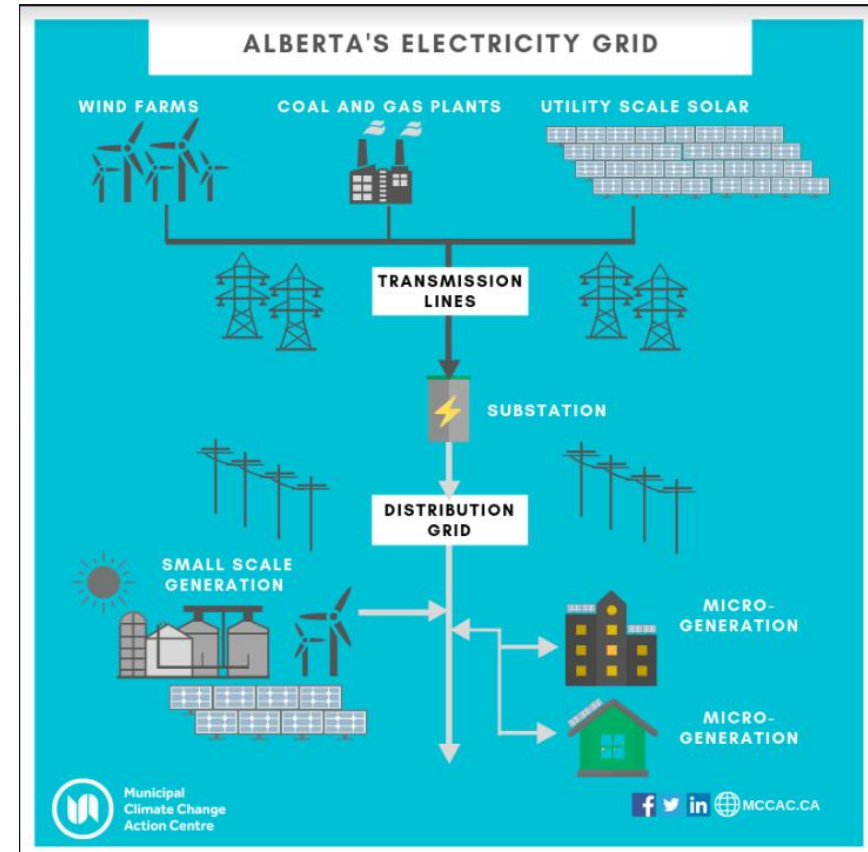


ABMI Map of Total Human Footprint (circa 2016) in the South Saskatchewan Region
Source: Alberta Biodiversity Monitoring Institute 2016 (ABMI) Human Footprint Inventory (ABMI, 2018)



Electricity Delivery Costs 101

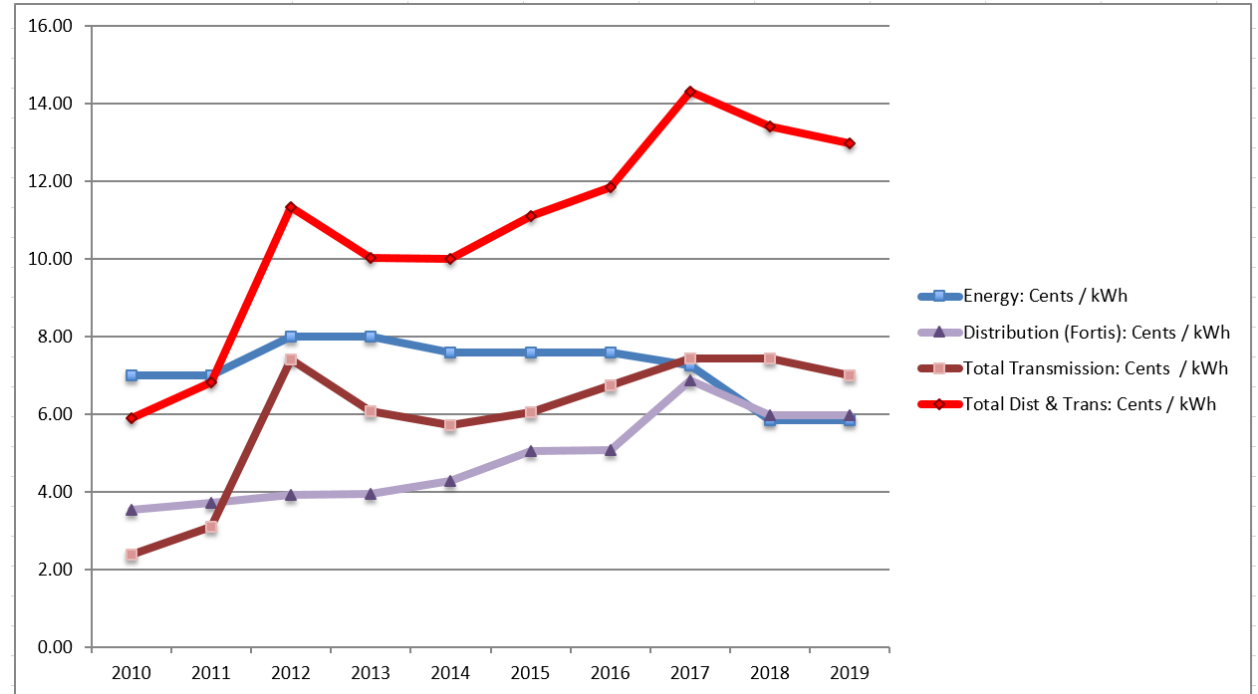
- Large utility scale generation projects often require costly transmission upgrades
- Transmission upgrade costs are passed along directly to customers.
- Fastest growing component of Alberta's electricity bills



Motivation: 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 have tripled

(LeRon Torrie, 2020)



The RenuWell Project represents an innovative and scalable solution to **oil & gas liability management, sustainable land use and grid decarbonization objectives** within and outside of Alberta.



Photo credit: Jamie Tanner



MD of Taber RenuWell Project (funded by MCCAC): Stakeholder consultation (April 2019 – May 2020)

Strong cooperation from:

- Landowners
- Alberta Energy Regulator
- Orphan Well Association
- Alberta Agriculture
- Alberta Environment and Parks
- Alberta Utilities Commission
- EQUS
- Renewable Energy Industry
- Oil and Gas sector

Ongoing dialogue:

Electrical Utility sector



MD of Taber RenuWell Pilot Project: Funded by MCCAC, Alberta Innovates and IRRICAN

- RenuWell Project awarded \$2.3M through MCCAC's Municipal Community Generation Challenge
- Irrigation Canal Power Co-operative (IRRICAN) contributed \$1.5M and is the owner and operator of the solar sites
- SkyFire Energy built 1.45 MW of community solar on two orphan well sites in MD of Taber for the pilot project
- Iron and Earth, together with Medicine Hat College, developed and delivered a Renuwell training program for Oil and Gas and Indigenous workers



Photo credit: Jamie Tanner



Fincastle Solar Project Site: Before



Fincastle Solar Project Site: After



Proven: RenuWell Projects - Completed March 2022

Key Objectives Met!

- ✓ Increased electricity to support seasonal irrigation power requirements.
- ✓ Conserved land for agriculture.
- ✓ Accelerated oilfield reclamation.
- ✓ Supported local employment and economic diversification.
- ✓ Provided customized workforce training program.
- ✓ Generated revenue for M.D. and irrigation districts.
- ✓ Improved regulatory clarity for no-wire electrical connections.
- ✓ Created and trained stakeholder network.

The Numbers:

- ✓ **1.45 MW solar, on 8 acres of less productive farmland.**
 - ✓ Enough for 300+ households or 90+ irrigation systems (>11,000 acres).
- ✓ **Reduced reclamation time by 5 years & costs by >80%.**
- ✓ **ROI in 5-years, hedges electricity prices for SMRID.**



1.45 MW solar on 2 orphan oil & gas leases

Solar arrays generating ~ 9 MWh/day

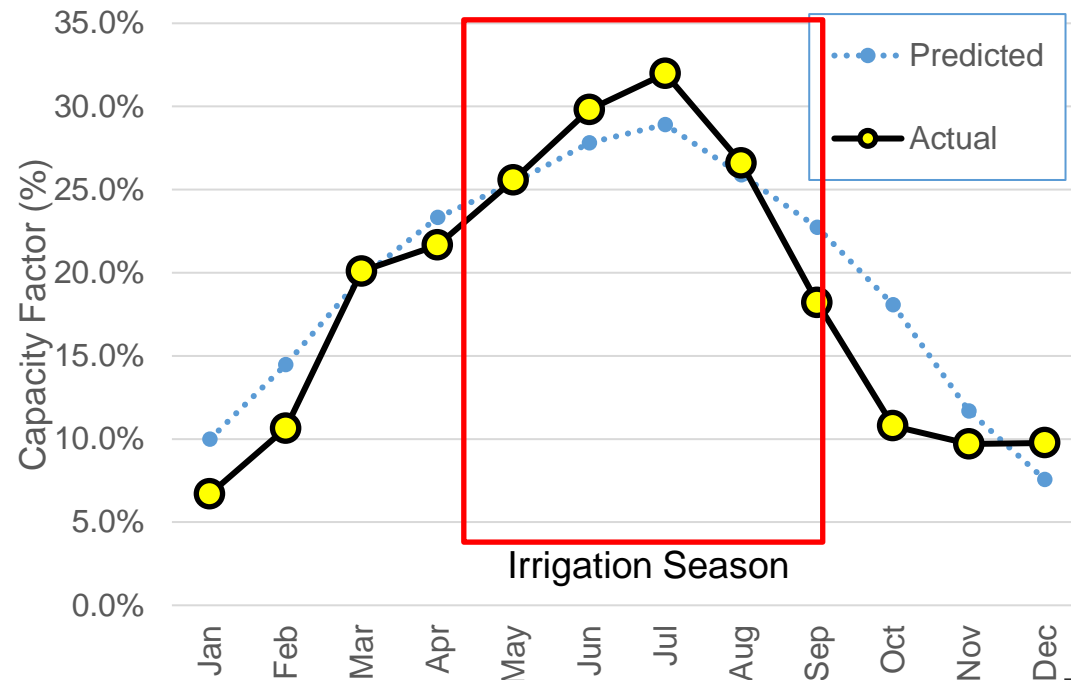
- Enough electricity for:
 - 300+ households
 - 90+ irrigation systems (> 11,000 acres)
- Or drive an electric car for 55,000 km



Addressing grid stability issues

Seasonal Generation matches Irrigation Energy Usage

Fincastle Solar Output

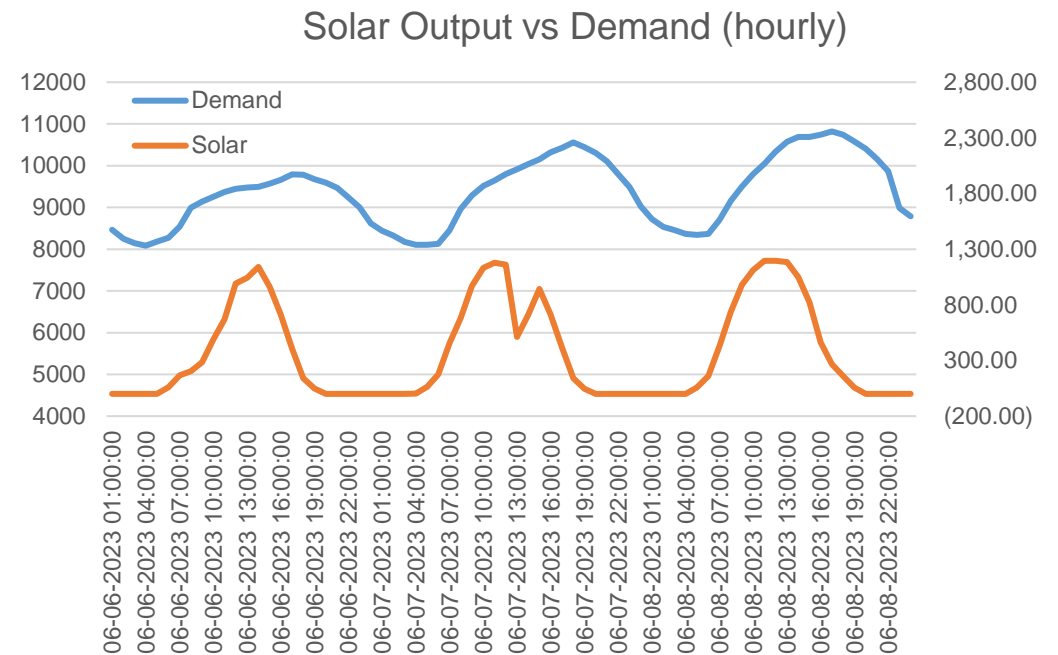


Fincastle Area Substation Load

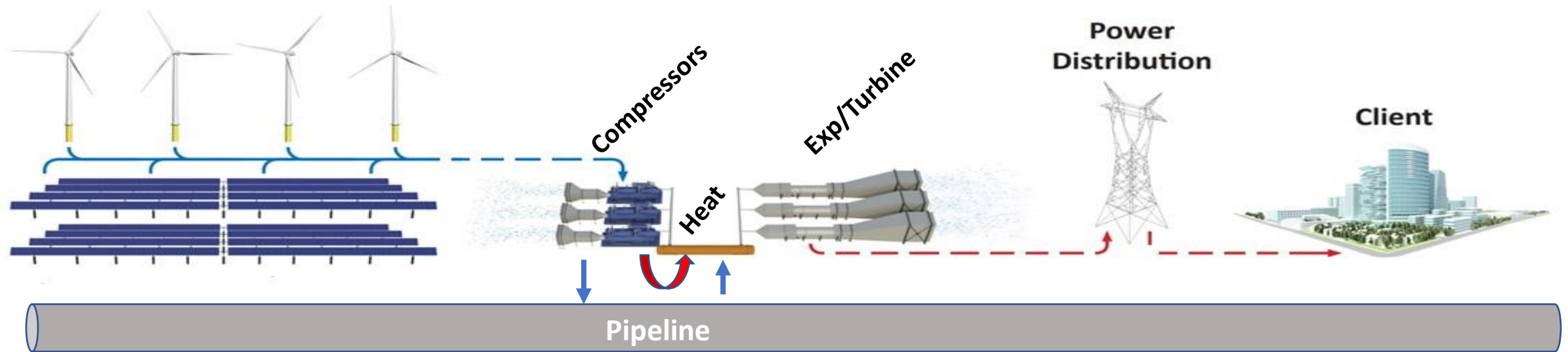


Demand variability vs Solar Output (Hourly)

- Solar generation output varies throughout the day
- Demand also varies on an hourly basis
- Mismatch between decline in solar and decline in demand provides storage opportunity



Reuse Pipelines to Generate Electricity



Solar & Wind Power

Air Compression & Release
Heat Storage & Reuse
Power Generation

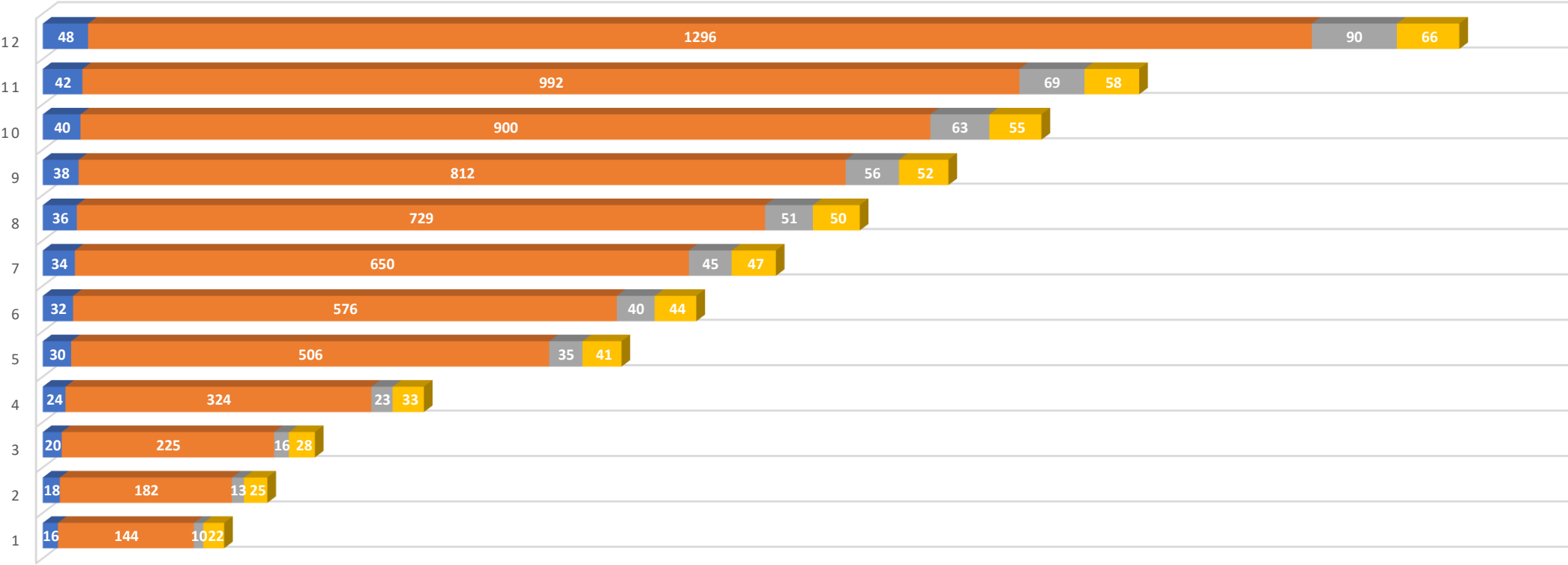
Breeze IP for generating electricity
using compressed air in pipelines

All off-the-shelf equipment

Breeze Numbers by Diameter and Miles

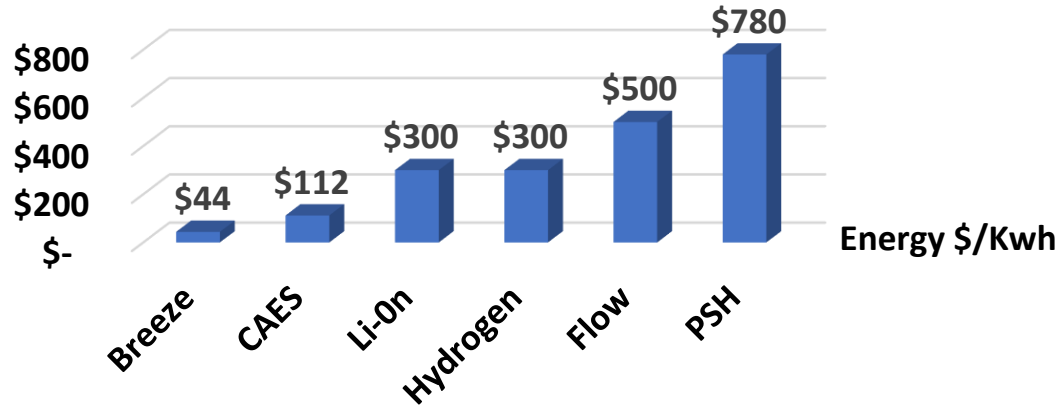
PIPE DIAMETER VS CAPACITY FOR 200 MILES

■ Pipeline Diameter (NPS)
 ■ Storage Capacity*(MWh)
 ■ Power Capacity (MW)
 ■ CAPEX *(\$USD M)

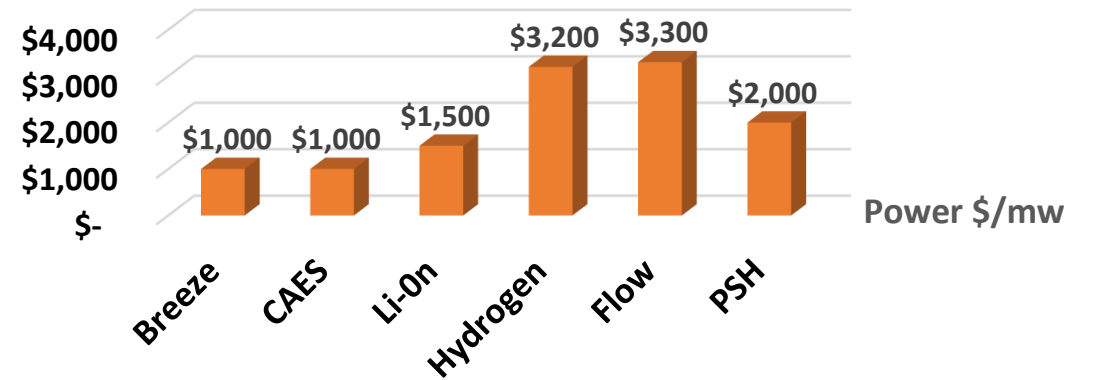


Lowest CAPEX in Storage

Breeze is the LCOEnergy



Breeze is the LCOPower



Proud member of the Long Duration Energy Storage Council initiated by McKinsey



RenuWell Advantages

- Modular and scalable solution
- Savings on well closures and solar development – **Portfolio of sites are similar cost to utility scale solar**
- Accelerated well reclamation
- Conservation of high value land
- Projects provide power to the distribution network during times of peak demand and **offset the need for transmission upgrades**
- Preserves embedded energy and carbon
- Ongoing lease rental & municipal tax revenue
- Employment for O&G workers
- Community-driven solution



Photo credit: Trevor Helwig

No additional land removed from agriculture



RenuWell conserves agricultural land

Land Use: Comparative Analysis

Conventional utility-scale solar project
465 MW on 3,330 acres



Retrieved from: <https://majorprojects.alberta.ca/details/Travers-Solar-Project/3656>

Converting **48% of the inactive oil & gas lease area** in the MD of Taber could provide **465 MW** of solar generation

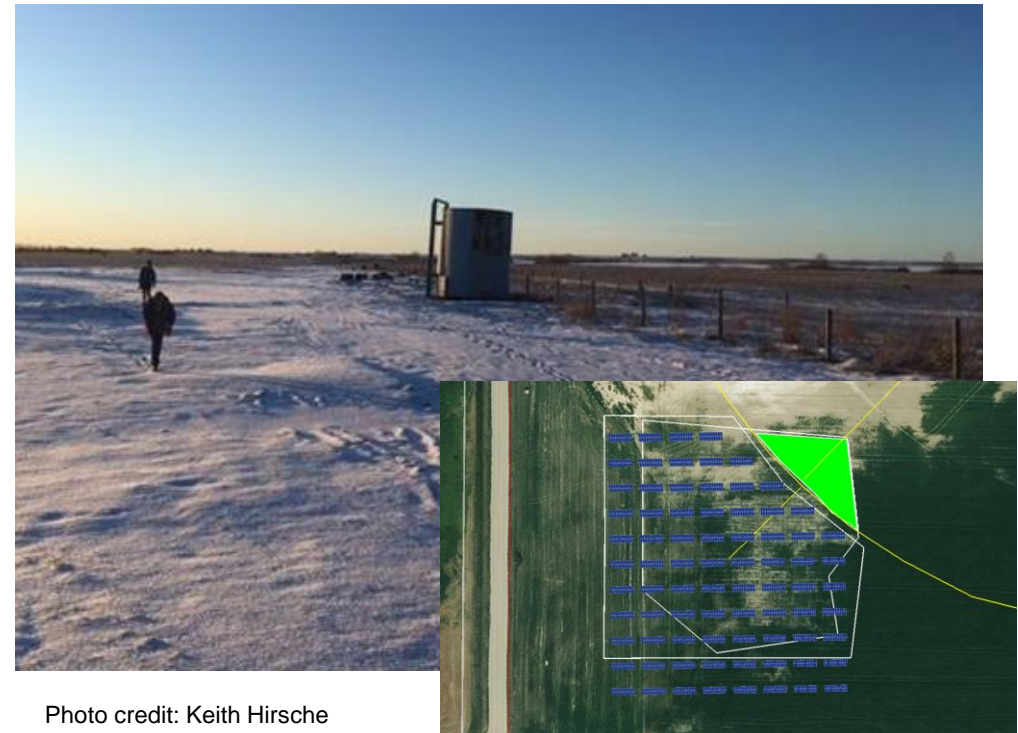


Photo credit: Keith Hirsche



Scaling RenuWell addresses increasing demand

Renuwell addresses:

- Increasing need for energy
- Depleted Oil & Gas fields
 - Increasing costs for production
 - Rapid increase in inactive wells
- Massive growth in solar and wind
 - Renewable low-cost power
 - Land use conflicts
 - Often requires transmission system upgrades

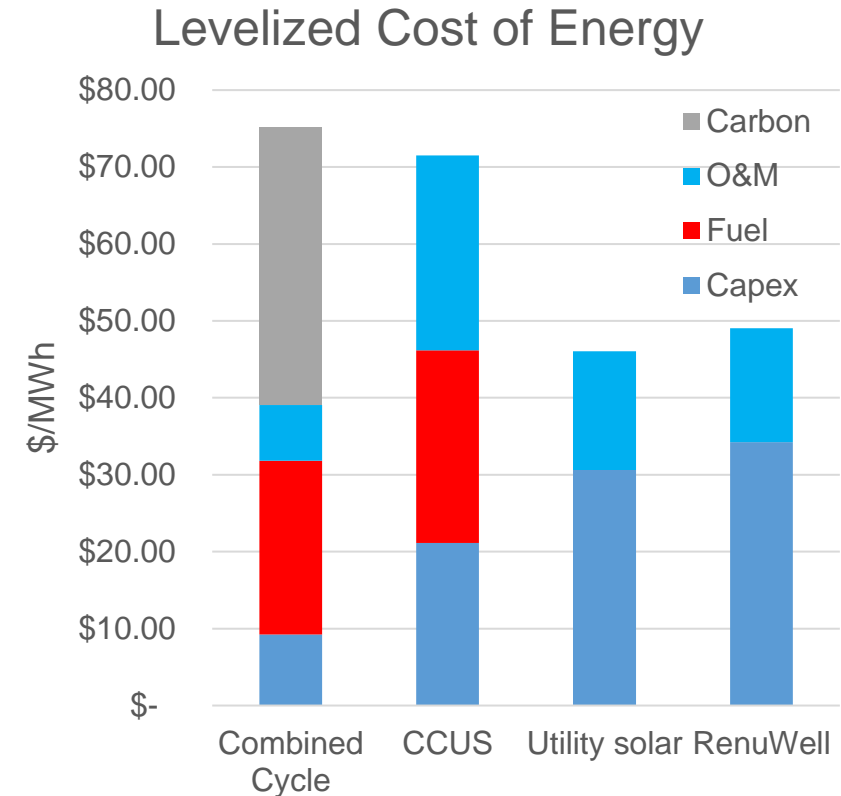
Repurposing O&G leases for solar:

- Saves O&G closure costs
- Reduces land use conflicts for solar
- Conserves transmission resources
- **Provides low-cost power**



RenuWell cost competitive with other generation

	Combined cycle	Combined Cycle + CCUS	Solar Utility scale
Pros	<ul style="list-style-type: none"> • Lower cost • Dispatchable • Reliable • Conventional 	<ul style="list-style-type: none"> • Low carbon • Dispatchable 	<ul style="list-style-type: none"> • Lower cost • No carbon or fuel • Low cost O&M
Cons	<ul style="list-style-type: none"> • Carbon emissions • Fuel cost risk • Ongoing O&M costs 	<ul style="list-style-type: none"> • Complex • New technology • Higher Capex and Opex • Fuel cost risk 	<ul style="list-style-type: none"> • Intermittent • Requires 5 acres/MW • Land use conflicts • Often requires transmission system upgrades • Benefits from energy storage

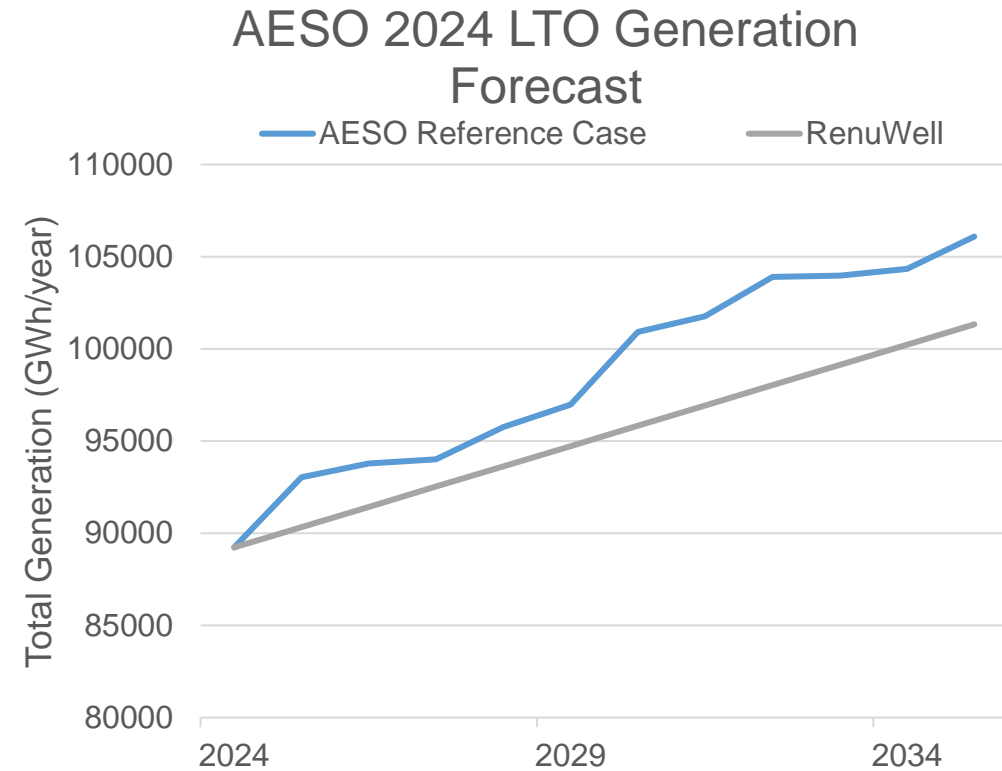


Cost estimates from AESO 2024 LTO "New Resource Inputs" **without subsidies**
 Natural gas price estimated at \$3.33/GJ (AER ST98 for 2030)
 Carbon price at \$80/mt

Scaling RenuWell addresses AESO forecast demand

RenuWell and AESO LTO Reference Case Forecast :

- 16 TWh of new generation needed by 2035
- **8 TWh could be supplied by converting 1% of inactive O&G leases to solar per year**
- Costs are competitive with natural gas generation
- Reduces risks associated with price increases of natural gas and GHG emissions



<https://www.aeso.ca/grid/grid-planning/forecasting/2024-long-term-outlook/>

RenuWell Expansion Challenges in Alberta

- SSG interconnection approval time
 - Estimated 25 weeks
 - Actual 50 – 55 weeks
- Transmission system studies & costs
 - MG vs SSG - same technical grid impact
 - Erodes project economics
- Reclamation certificate required prior to repurposing
- No access to repurpose sites on Public Lands



The RenuWell Project –A step toward a “Just Transition”

Alberta’s Oilfield Liabilities:


- 170,000 Inactive wells (> 340,000 acres)
- More than \$30 billion in liabilities
- Over \$300 million in unpaid property taxes
- Lost jobs with major impacts on rural economy




1.45 MW solar on 2 orphan oil & gas leases

Solar arrays generating ~ 9 MWh/day

- Enough electricity for:
 - 300+ households
 - 90+ irrigation systems (> 11,000 acres)
- Or drive an electric car for 55,000 km





Converting 10% of the inactive wells to solar generation:

- 7.5 GW of solar capacity
- 9,800 GWh/year : Power 85% of Alberta’s households
- Offset 5.5 million tons of GHG emissions annually
- Save \$340 million in O&G reclamation expenses
- Create over 71 thousand person/years of employment

Preserve 34,000 acres of agricultural land





Photo credits: Keith Hirsche

MCGC RenuWell Project Partners and Funders

RenuWell Pilot Construction Video



SCAN ME

