

# ***The Orphaned Wells Team***

***Summary presentation of scientific and  
socio-political perspectives submitted in  
the 2018 Dragon's Den Competition***

***\*Not peer-reviewed and not intended for public distribution or citation\****



The ReDeveLoP Challenge  
Calgary, Alberta  
Apr.30 – May 4, 2018



# ***ORPHAN WELLS IN ALBERTA***

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The ReDeveLoP Challenge  
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# Outline

1. Why do we care?
2. Introduction/Terminology
3. Current overview of orphans in Alberta
4. Gas and groundwater contamination
5. Orphan well plugging, abandonment and expenditures
6. Potential for the geothermal conversion of orphan wells
7. Current orphan well policy and possible solutions



# 1. Why do we care?

- Gas and groundwater contamination
- Stakeholder's protection
  - Landowners and indigenous groups
- Who is paying for the costs associated to abandon orphan wells?
  - Cost minimization for taxpayers
  - Acceptable policy solution for the industry



Orphan Wells





## 2. Terminology: Orphan Wells

“An orphan well does not have any legally responsible and/or financially able party to deal with its abandonment and reclamation responsibilities” Orphan Well Association (OWA)



*Calgary Herald*

# 2. Terminology: Orphan Wells

Orphan Wellsite



Reclaimed Wellsite



***Well abandonment** is the proper plugging down hole and the wellhead removal at the surface. Orphan Well Association (OWA)*

***Well site reclamation** is returning specified land to equivalent land capability that existed before an activity was conducted on the land. Alberta Energy Regulator (AER)*



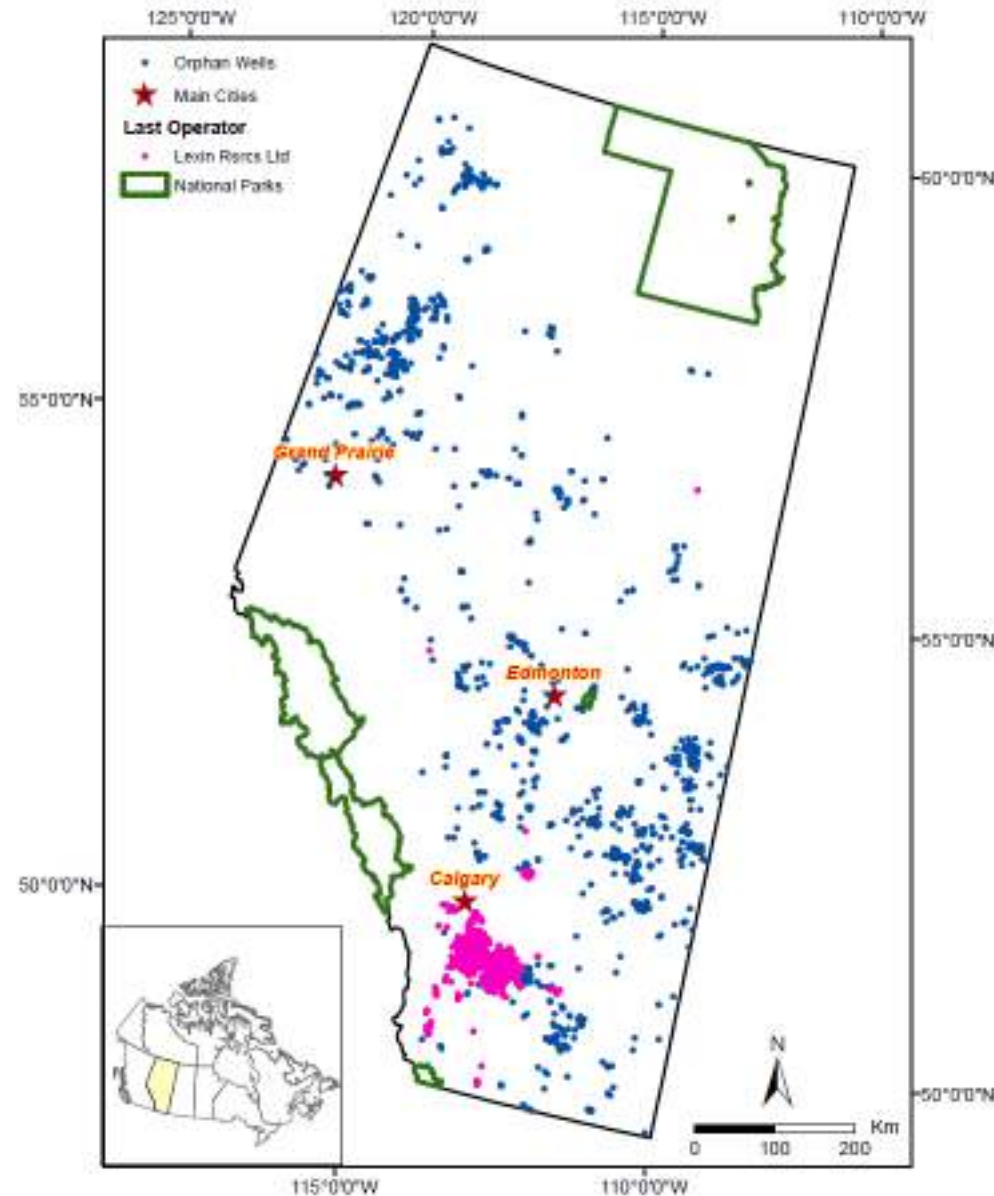
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# 3. Current Overview

- As of April 2 2018, there are 2888 orphan wells in Alberta
- 1785 orphan wells should be abandoned and 1103 orphans should be suspended (*Lexin Resources wells*)
- Some *Lexin wells* were found to have elevated concentrations of  $H_2S$  (OWA)





# 3. Current Overview

- **Another 3,000 wells will be added to the OWA's inventory with the bankruptcy of Sequoia Resources**
- Abandonment of each well is expected to cost \$61,000. Reclamation costs additional \$20,000 per well (OWA report)
- The current levy of \$45 million insufficient to deal with the problem
- Immediate cost of \$611 million for existing wells. However, the social cost can be upwards of \$8.6 billion with nearly insolvent firms (C.D. Howe Report)

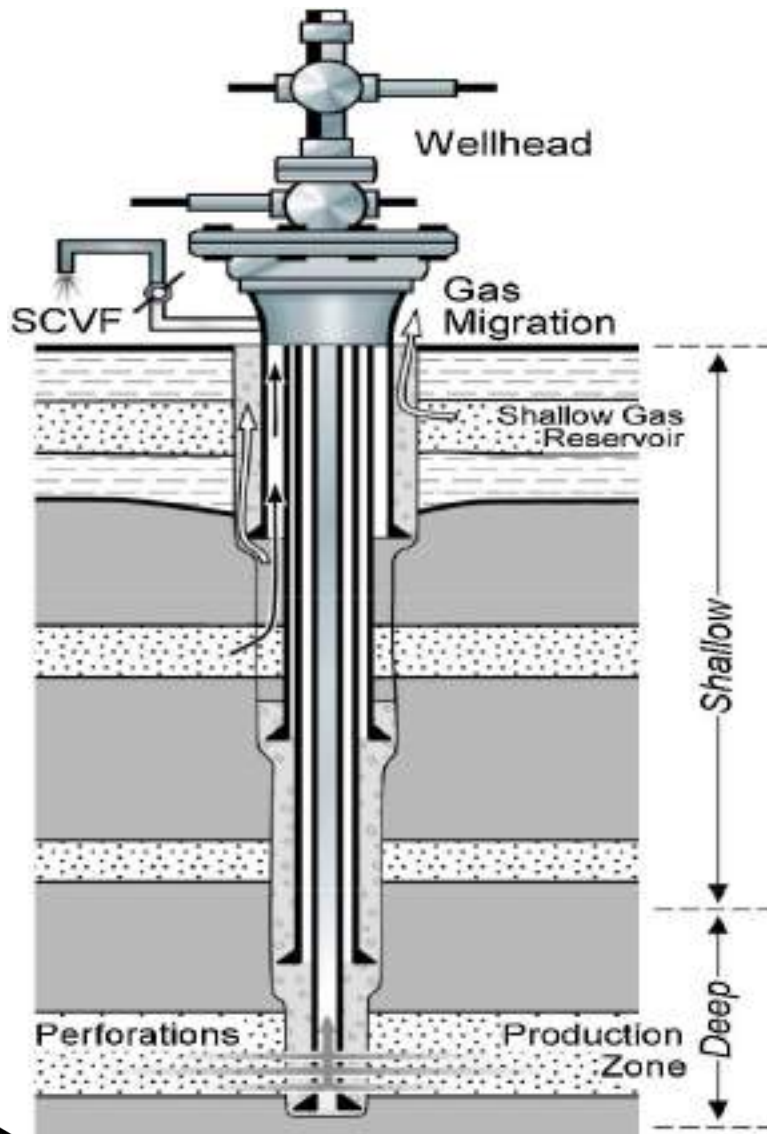


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# 4. Gas and groundwater contamination



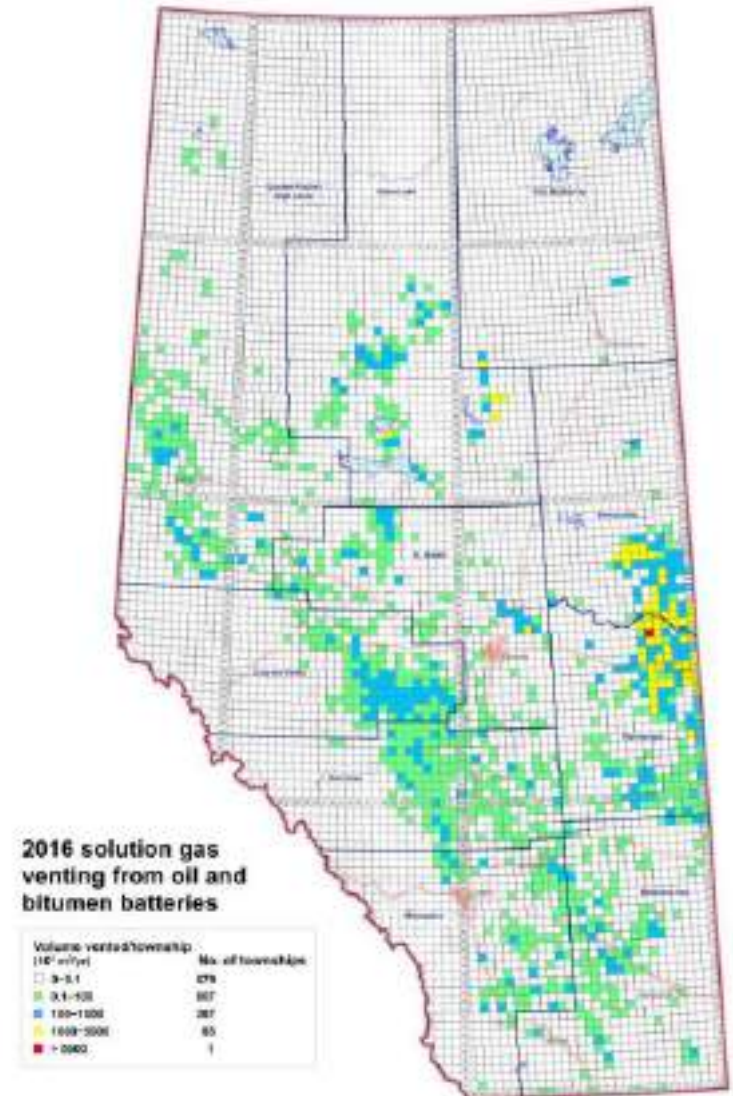
## Gas:

- Fugitive  $\text{H}_2\text{S}$ ,  $\text{CH}_4$  &  $\text{CO}_2$
- Surface Casing Vent Flow (SCVF)
- Gas Migration (GM)
- Monitored by AER since 1995



# 4. Gas and groundwater contamination

- In 2016, **81 million** m<sup>3</sup> of methane was released by gas venting (SCVF and GM)
- **9530** inactive wells (7% of total wells in Alberta) are reported with gas venting issues
- Gas venting mostly occurs within the **Edmonton, Cold Lake, Lloydminster** areas and **Rocky Mountain Thrust/Fold belt**



AER ST60B-2017



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# 5. Well plugging and abandonment

- The most common material used to plug wells is **cement**
- A cement plug is applied to **fill the case** to prevent vertical migration of fluids
- **Tagging top** or **performing tests** are required to evaluate the plugging effect
- Need to **report** before well abandonment



<https://www.youtube.com/watch?v=3DKkbT14X2c>

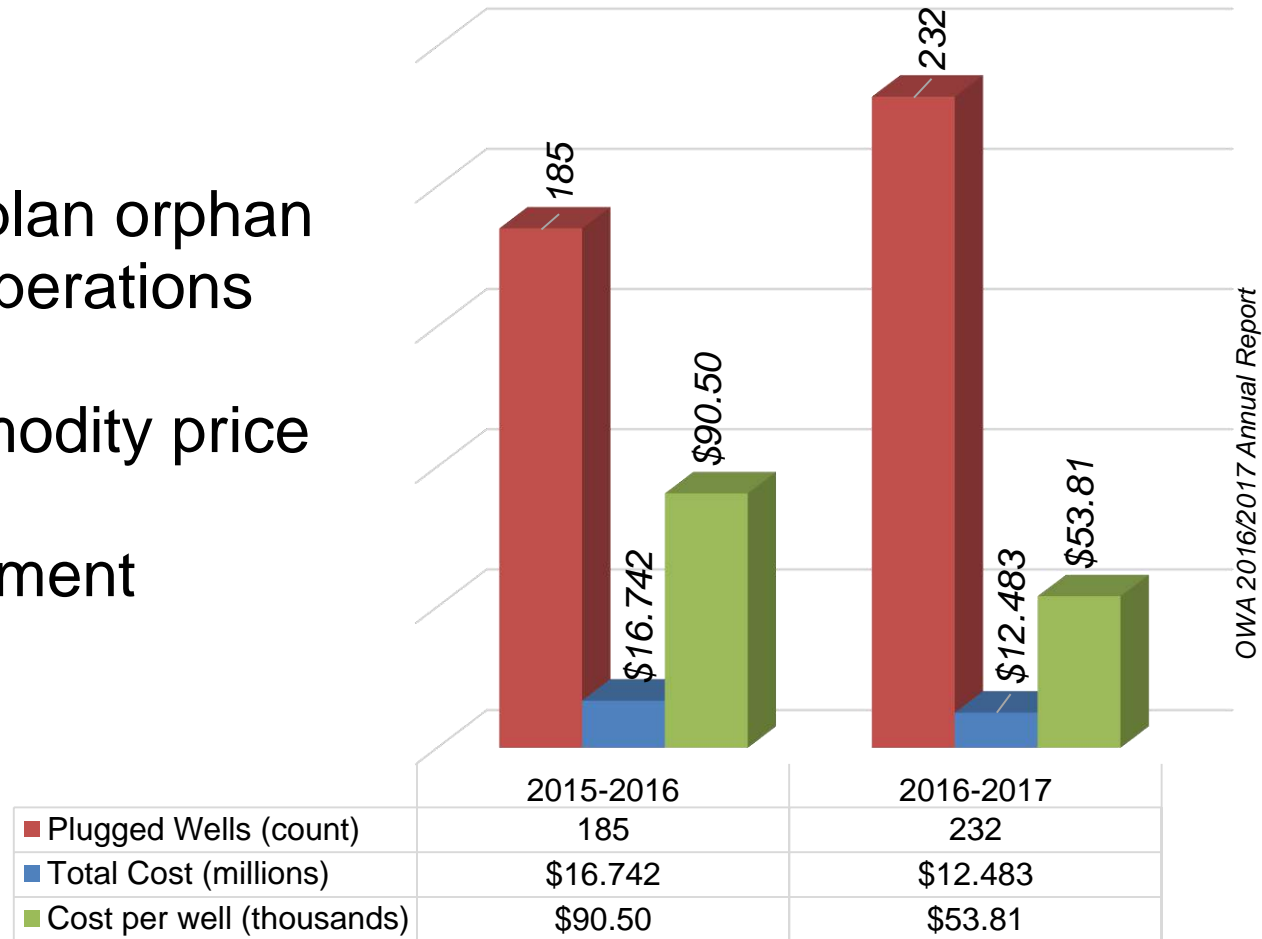




# 5. Well plugging and abandonment

Expenditures of well abandonment in 2016/17 decreased from \$90.5k per well in the prior year to \$53.8k per well (OWA)

- The integrated plan orphan abandonment operations
- The lower commodity price
- Changes of payment practices



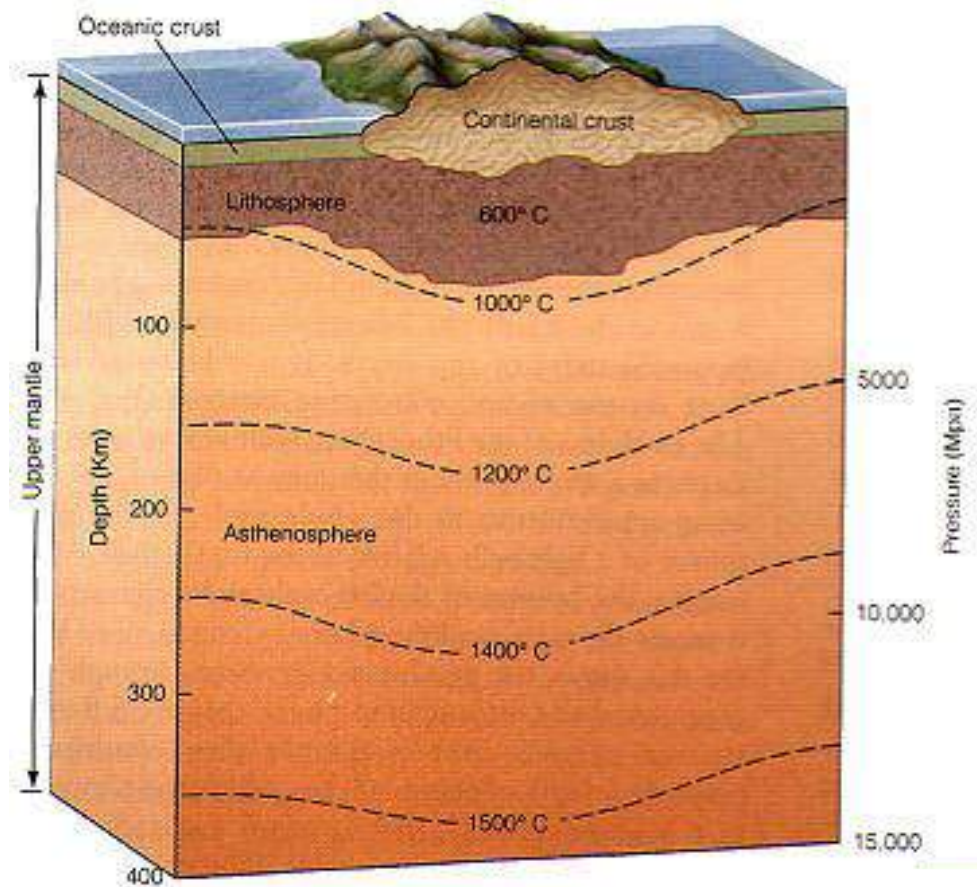
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# 6. Geothermal conversion of orphans

- Existing wells are potentially deep enough to extract significant heat
- Potential recovery of abandonment costs
- Potential for geothermal industry to save drilling costs

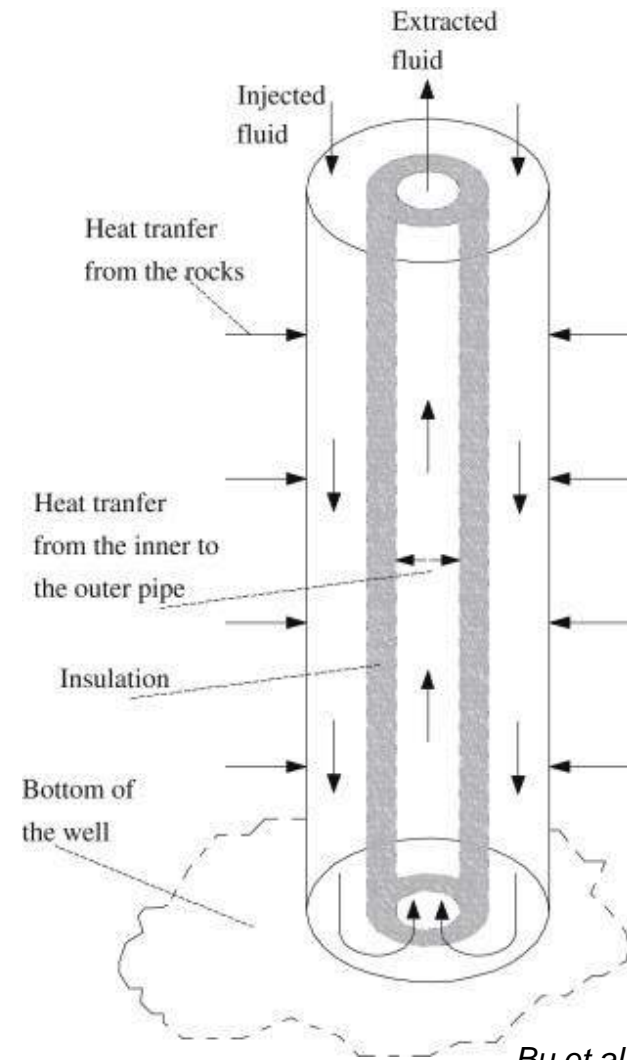


Hartai Éva (2011)



# Potential well configuration

- Double pipe heat exchanger
- Extraction pipe with insulation installed in existing well
- Injected fluid heated on outside



*Bu et al. (2012)*

# Previous studies

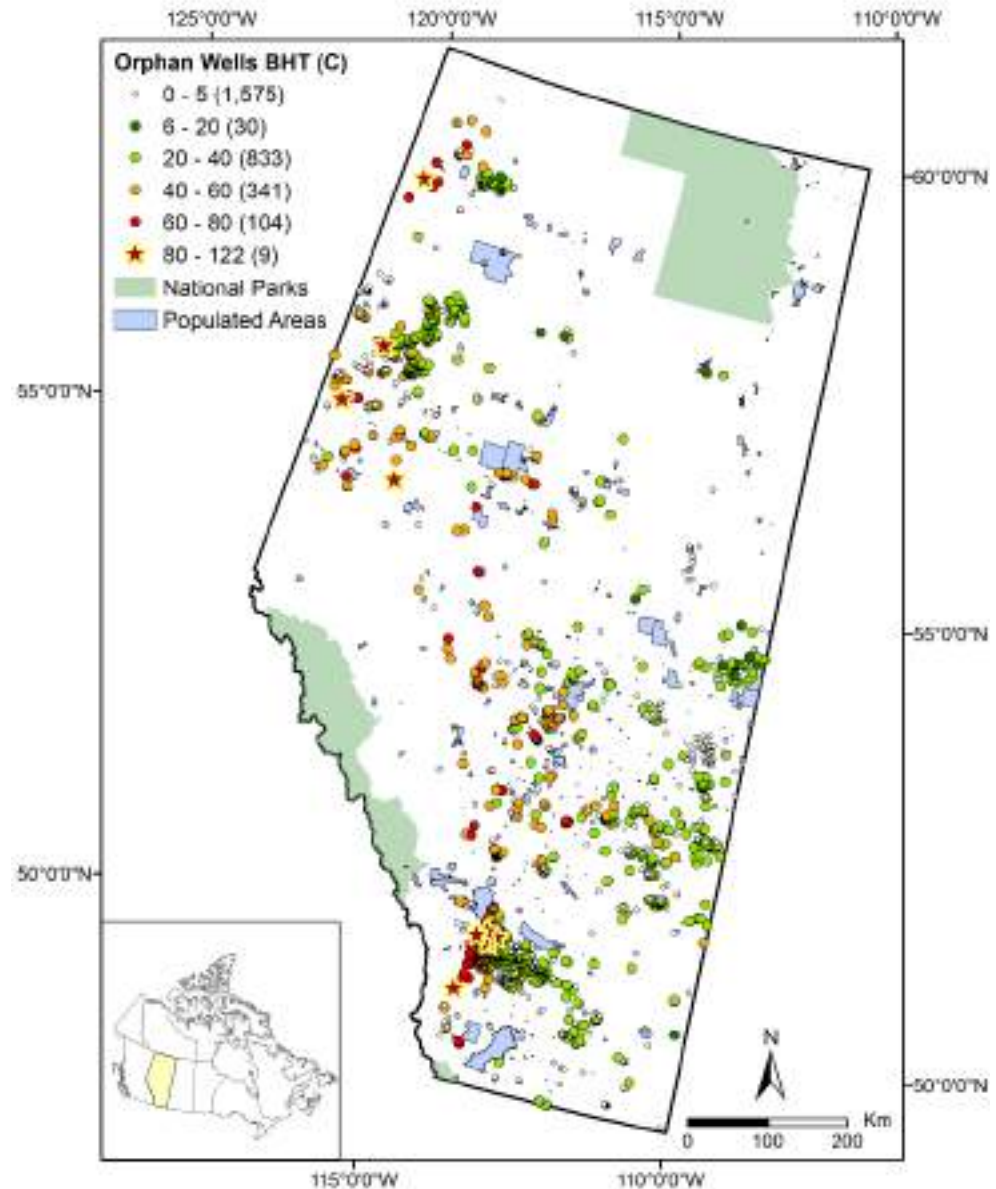
Study	Example Location	Geothermal Gradient (°C/km)	Well depth range considered (m)	Estimated heat energy rate from well with $T_{\text{out}} > 80\text{ °C}$ (kW)
Davis & Michaelides (2009)	Southern Texas	40	3000	3400 ( $T=157\text{ °C}$ )
Bu et al. (2012)	Huabei Oil region - China	45	2500 – 4000	816
Wight & Bennett (2015)	Chena, Alaska / Rocky Mountain Oil Field Testing Centre, Wyoming	31	4200 – 6800	109 – 652
Templeton et al. (2014)	Persian Gulf	30	2500 – 4000	502
Kujawa et al. (2006)	Jachowka, Poland	25	3950	140
Cheng et al. (2014)	China	40/50	1000 – 6000	508 – 651 (at 4km)

Geothermal gradient must be at least 30°C/km and depth at least 3000m

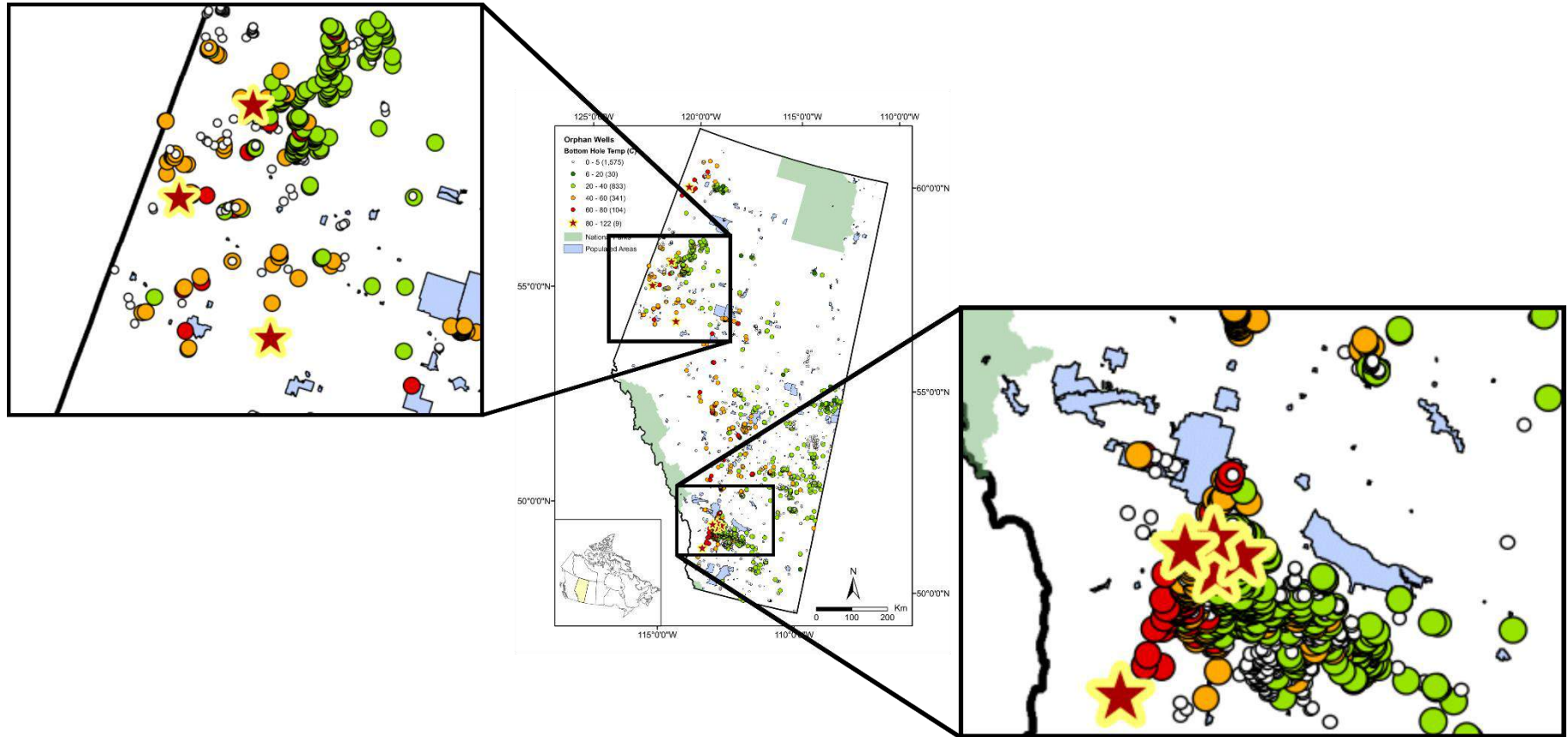


# Geothermal trends in Alberta

- Orphan well bottom hole temperature
- Few feasible resources in Western Alberta with temperature greater than 80°C
- At best, feasible for geothermal heating



# Geothermal trends in Alberta



*Data from GeoSCOUT database*



# ***Additional considerations***

- Additional equipment on site
  - Heat exchanger (Binary fluid configuration)
  - Pumps for fluid
- Distribution network with sufficient insulation
- Customers willing to reconfigure existing heating systems
- Potential significant initial cost



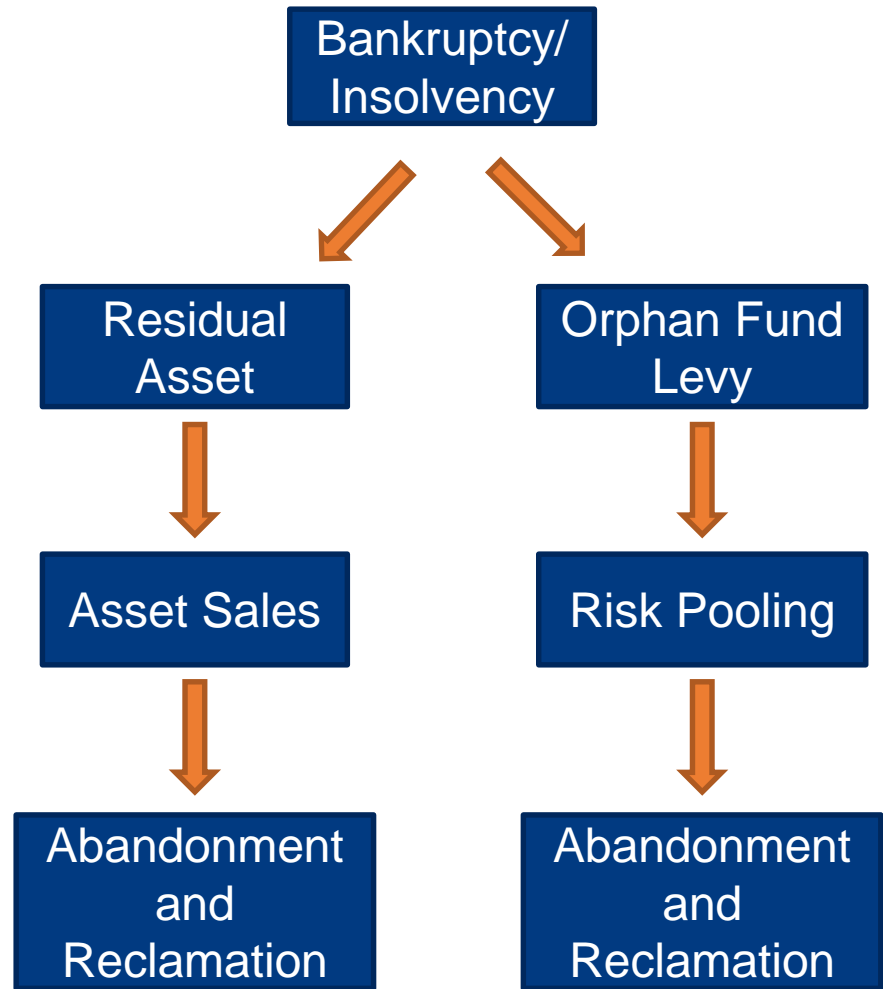
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# 7. Current orphan well policy

- Current orphan fund levy of \$45 million annually
- Decided by the AER, CAPP, and EPAC
- Non-risk pooling solution relies on the residual asset value of the bankrupt companies
- No definitive timeline on abandonment in AB



# ***Problems with current regime***

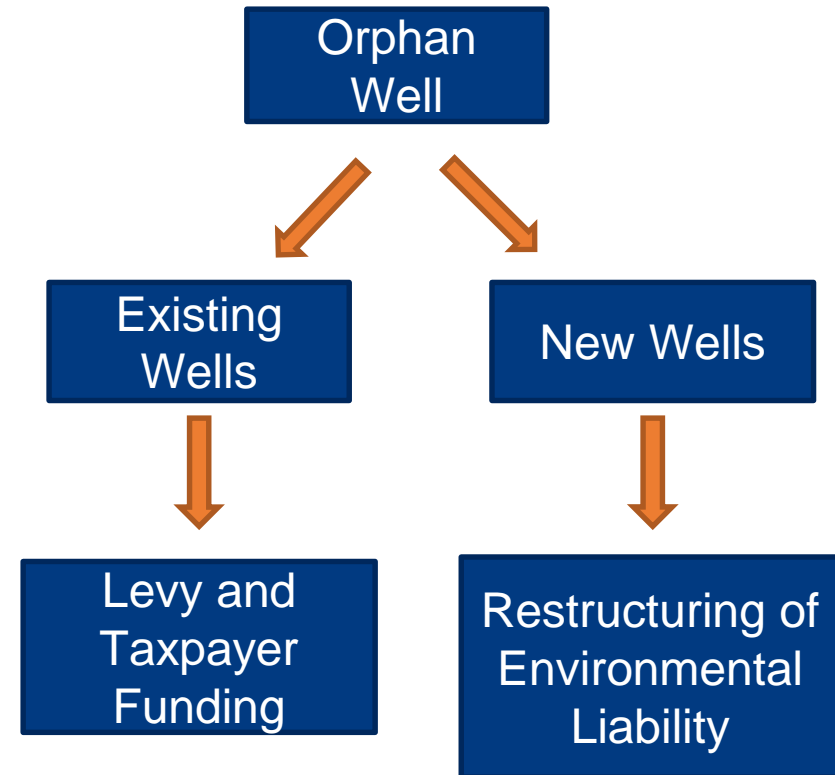
- Risk pooling structure unfairly punishes competent producers
- The orphan fund levy is good with dealing with idiosyncratic risks (bad management and bad assets)
- The current structure is bad if the problem is systemic (prolonged downturn of the industry)
- Major legal setbacks for the AER claiming residual assets value (*Redwater Case*: currently in review)





# Policy design

- Upholding polluters pay principle
- Protecting landowners and indigenous communities
- Legally sound policy framework (*Redwater* case)
- Private sector solution vs. publicly funded solution



# ***Policy solution***

## ➤ Three Considerations

1. Economic Impact on Producers
2. Taxpayers
3. Timely Abandonment of Orphan Wells

## ➤ All solutions need to be legally compliant



# ***Private solution***

1. Restructuring of Orphan Fund Levy
  - Taking 10 year average well abandonment data. Takes the cyclicity of the industry into account.
2. Accelerated Well Abandonment
  - Forced abandonment of inactive wells within a year
3. Bonding Requirement or Blanket Bond
  - Depositing bond or letter of credit to guarantee the payment of abandonment costs
  - Obtaining bankruptcy insurance
4. Adoption
  - Reallocating wells for new owners



# ***Public solution***

- The AB government is already committed to the issue with \$235 million of emergency loan given to the OWA in 2016
- AB public benefited from the resource revenue
- The government has responsibility to compensate landowners and indigenous communities
- Waiting for the levy to fully compensate the abandonment cost is not a solution
- The government may need to forgive the loan in the future



# Acknowledgements





# Questions?

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