Importing Gas, Water Oil Analysis Data

==================== Gas Analysis Data available ====================

['Gas Analysis #', 'Well Identifier', 'Well Status', 'Well Name', 'Formation', 'KB(m)', 'TVD(m)', 'Ground Level(m)', 'Deviated Depth(m)', 'Laboratory Name', 'Laboratory Number', 'Date Sampled', 'Date Received', 'Date Reported', 'Test Type', 'Sampling Point Type', 'Sampling Point Desc', 'Interval Top(m)', 'Interval Base(m)', 'Recovery Description', 'Gauge Pressure Separator(kPa)', 'Gauge Temp. Separator(C)', 'Gauge Pressure Treater(kPa)', 'Gauge Temp. Treater(C)', 'Gauge Pressure Received(kPa)', 'Gauge Temp. Received(C)', 'Vapour Pressure(kPa)', 'Gross Heating Value(MJ/m3)', 'GHV Acid Free(MJ/m3)', 'Net Heating Value(MJ/m3)', 'NHV Acid Free(MJ/m3)', 'Relative Density', 'Rel. Dens. Acid Free', 'Pseudo Critical Pressure(kPa)', 'Pseudo Critical Temperature(K)', 'Pseudo Crit. Pr. Acid Free(kPa)', 'Pseudo Crit. Temp. Acid Free(K)', 'Relative Molecular Mass', 'H2S(gm3)', 'Remarks', 'H2 Air Free', 'H2 Acid Free', 'He Air Free', 'He Acid Free', 'N2 Air Free', 'N2 Acid Free', 'CO2 Air Free', 'H2S

Air Free', 'C1 Air Free', 'C1 Acid Free', 'C2 Air Free', 'C2 Acid Free', 'C3 Air Free', 'C3 Acid Free', 'iC4 Air Free', 'iC4 Acid Free', 'nC4 Air Free', 'nC4 Acid Free', 'iC5 Air Free', 'iC5 Acid Free', 'nC5 Air Free', 'nC5 Acid Free', 'C6 Air Free', 'C6 Acid Free', 'C7 Air Free', 'C7 Acid Free', 'C8 Air Free', 'C8 Acid Free', 'C9 Air Free', 'C9 Acid Free', 'C10 Air Free', 'C10 Acid Free', 'Total: Air Free', 'Total: Acid Free', 'Dominant Fluid', 'Hydrocarbon Liquids Production', 'Sample Type', 'Gas Liquid Ratio', 'Comment on Sample', 'Molal Fraction Air Free', 'Molal Fraction Acid Gas/Air Free', 'Liquid Volume(ml/m3)', 'Lab File Number', 'Container ID', 'Location of H2S Measurement', 'Method of Field Analysis', 'Field Gas H2S', 'Lab H2S Analysis', 'Density of C7+', 'Mole Weight of C7+ ']

~~~~~~~~~~~~~~ GAS DATA ANALYSIS ~~~~~~~~~~~~~~

Number of wells with gas analysis data; 40953

Number of wells with follow-up gas analysis reports; 26441

AVERAGE OF WELLS

Gas Analysis #, 1.93518

Gross Heating Value(MJ/m3), 39.17336

Net Heating Value(MJ/m3), 35.36024

Relative Density, 0.62665

N2 Air Free, 0.02448

CO2 Air Free, 0.01139

H2S Air Free, 0.00152

C1 Air Free, 0.89640

C2 Air Free, 0.03897

C3 Air Free, 0.01476

iC4 Air Free, 0.00253

nC4 Air Free, 0.00375

iC5 Air Free, 0.00115

nC5 Air Free, 0.00101

C6 Air Free, 0.00084

C7 Air Free, 0.00106

C8 Air Free, 0.00002

C9 Air Free, 0.00000

C10 Air Free, 0.00000

OPGEE Requires Gas Components to Sum to Exactly 100%

We Adjust the Average Field Methane Content to ensure sum is 100%

Average C1 content; 89.64002

Adjusted C1 content; 89.852

OPGEE Composition Sum Check; 100.0

==================== Oil Analysis Data available ====================

['Oil Analysis #', 'Well Identifier', 'Well Status', 'Well Name', 'Formation', 'KB(m)', 'TVD(m)', 'Ground Level(m)', 'Deviated Depth(m)', 'Laboratory Name', 'Laboratory Number', 'Date Sampled', 'Date Received', 'Date Reported', 'Test Type', 'Sampling Point Type', 'Sampling Point Desc', 'Interval Top(m)', 'Interval Base(m)', 'Color', 'Water Fraction', 'Sediment Fraction', 'Total Fraction', 'Received Relative Density(/gl)', 'Cleaned Relative Density(/gl)', 'Received Absolute Density(kg/m3)', 'Cleaned Absolute Density(kg/m3)', 'API Reported', 'Pour USBM', 'Pour ASTM', 'Sulphur(grams/kg)', 'Salt(kg/m3)', 'Distillation Method', 'Barometric Pressure(kPa)', 'Room Temperature(C)', 'Initial Boiling Point(C)', 'Distilled Volume Fraction', 'Naptha', 'Light Gas Oil', 'Kerosene', 'Recovered', 'Distillate Loss', 'Residue', 'Viscosity Temperature 1(C)', 'Viscosity Absolute 1(mPa.s)', 'Viscosity Kinematic 1(mm2/s)', 'Viscosity Temperature 2(C)', 'Viscosity Absolute 2(mPa.s)', 'Viscosity Kinematic 2(mm2/s)', 'Viscosity Temperature 3(C)', 'Viscosity Absolute 3(mPa.s)', 'Viscosity Kinematic 3(mm2/s)', 'Remarks', 'Well Fluid Type', 'Container ID', 'Sample Pressure(kPaA)', 'Sample Temperature(C)', 'Received Pressure(kPaA)', 'Received Temperature(C)', 'Color Number', 'Total Sulphur Mass Fraction', 'Reid Vapour Pressure(kPaA)', 'Carbon Risidue Conradson Fraction', 'Carbon Risidue Ramsbottom Fraction ']

~~~~~~~~~~~~~ OIL DATA ANALYSIS ~~~~~~~~~~~~~~~~

Number of wells with API measurements; 2343

Number of Wells with follow-up APIs; 729

~~~~~~~~~~~ Statistical Summary of OIL API GRAVITY ~~~~~~~~~~~

Count; 3410

Average; 46.26

Median; 46.70

Minimum; 8.63

Maximum; 84.70

10th Percentile; 29.62

90th Percentile; 62.72

Computational Time (s): 6900.5740

========Importing Alberta Water Source Data========

File Location: C:/Users/Parissa/Desktop/Alex//Project Data\_new/AER/HF\_WaterSourceData.csv

==================== Data available ====================

['Submitter Licencee BA ID', 'Submission Date Time', 'Submitted UWI', 'Water Source Type', 'Water Source Latitude', 'Water Source Longitude', 'Water Source Supplier',

'Water Source Geological Zone', 'Water Source Water Well Identifier', 'Water Source Well UWI Label', 'Water Source Facility Name', 'Water Source Facility Licence Number', 'Water Source Reporting Facility ID', 'Water Diversion Authorization ID', 'Water Diversion Authorization Type', 'Water Diversion Start Date', 'Water Diversion End

Date', 'Water Diversion Max Rate', 'Water Diversion Max Rate Units of Measurement', 'Water Diversion Average Daily Rate', 'Total Water Volume', 'TDS Content', '', '',

'']

Computational Time (s): 0.6010

~~~~~~~~~~~~~~~~~~~WATER SOURCE ANALYSIS OF ALBERTAN WELLS~~~~~~~~~~~~~~~~~~~

data reprisents the volume of water "sourced" for treatments. Hence, it does not reprisent the

volume of water being injected. This data is in a different AER dataset (Water use).

Total number of AB wells with water data entries: 17538

Count of Completed Wells; 5810

Water Source Type and Total Volume (m3)

Central Water Distribution Facility (m3); 6053163.0

Groundwater - Non-saline greater than 150m deep (m3); 333001.0

Groundwater - Non-saline less than or equal to 150m deep (m3); 6197329.0

Groundwater - Saline (m3); 92010.0

Municipal Water (m3); 1222102.0

Oilfield Produced Water (m3); 448645.0

Recycled Fracturing Water (treated at independent stand-alone facility) (m3); 270621.0

Recycled Fracturing Water (treated at well site) (m3); 2845260.0

Surface Water - Lake (m3); 5970552.0

Surface Water - River (m3); 19033610.0

Surface Water - Runoff (m3); 10791794.0

Waste Water - Industrial (Non-oilfield) (m3); 1910.0

Waste Water - Municipal (m3); 1265703.0

Waste Water - Oilfield (m3); 3513.0

Total Volume (m3); 54529213.0

Analysis of the 5810 wells that have been fractured in Alberta:

Number of wells above the 1000000 m3 of injected water limit; 0

Number of zero volume injected wells; 0

Mean volume injected (m3); 9385.41

Number of wells assessed; 5810

Median volume injected (m3); 3879.00

Standard Deviation of volume injected (m3); 14974.87

Variance of volume injected (m3); 224246604.02

Max of volume injected (m3); 141452.00

Min of volume injected (m3); 5.00

25th percentaile of volume injected (m3); 1151.00

75th percentile of volume injected (m3); 8722.00

Analysis of Completed Well Lengths

Count TVDs; 5810

Count Measured Depths; 5810

Count Horizontal Lengths; 5810

Count Missing Length Data; 0

Mean TVD (m); 2404.9876764199653

Mean TVD (ft); 7890.379768305679

Mean Measured Depth (m); 4022.2487091222033

Mean Measured Depth (ft); 13196.35445483649

Mean Horizontal Length (m); 1251.2181064346091

Mean Horizontal Length (ft); 4105.046412314923

Analysis of Well Drill Year

Analysis of Volume Sourced By Well Drill Year

========Importing B.C Water Data========

File Location: C:/Users/Parissa/Desktop/Alex//Project Data\_new/BCOGC/hydraulic\_fracture/hydraulic\_fracture.csv

==================== Data available ====================

['WA NUM', 'DRILLNG EVENT', 'COMPLTN EVENT', 'UWI', 'WELL NAME', 'COMPLTN DATE', 'FRAC START TIME', 'COMPLTN TOP DEPTH (m)', 'COMPLTN BASE DEPTH (m)', 'COMPLTN TYPE',

'COMPLETION WORKOVER KEY', 'FRAC SUMMARY KEY', 'FRAC STAGE NUM', 'BASE FLUID', 'VISCOSITY GEL TYPE', 'ENERGIZER', 'ENERGIZER TYPE', 'PLUG BACK TOTAL DEPTH (m)', 'ACID

SPEARHEAD AMOUNT (m3)', 'ACID TYPE', 'BREAK DOWN PRESSURE (MPa)', 'INST SHUT IN PRESSURE (MPa)', 'MAX TREATING PRESSURE (MPa)', 'AVG TREATING PRESSURE (MPa)', 'AVG RATE (m3/min)', 'FRAC GRADIENT (KPa/m)', 'TOTAL FLUID PUMPED (m3)', 'TOTAL CO2 PUMPED (m3)', 'TOTAL N2 PUMPED (scm)', 'TOTAL CH4 PUMPED (e3m3)', 'RADIOACTIVE FLAG', 'RADIOACTIVE TRACER TYPE', 'CHEMICAL TRACER FLAG', 'CHEMICAL TRACER TYPE', 'PROPPANT TYPE1', 'PROPPANT TYPE1 PUMPED (t)', 'PROPPANT TYPE1 PLACED (t)', 'PROPPANT TYPE2', 'PROPPANT TYPE2 PUMPED (t)', 'PROPPANT TYPE2 PLACED (t)', 'PROPPANT TYPE3', 'PROPPANT TYPE3 PUMPED (t)', 'PROPPANT TYPE3 PLACED (t)', 'PROPPANT TYPE4', 'PROPPANT TYPE4 PUMPED (t)', 'PROPPANT TYPE4 PLACED (t)']

Computational Time (s): 1.6430

~~~~~~~~~~~~~~~~~~~WATER ANALYSIS OF BC WELLS~~~~~~~~~~~~~~~~~~~

Total number of BC wells with water data entries: 3841

Count of Completed Wells; 2470

Water Type Injected and Total Volume (m3)

ACID (m3) ; 300.0

FRESH WATER (m3) ; 22073405.0

OIL (m3) ; 83.7

OTHER (m3) ; 138697.8

PROPANE (m3) ; 18919.1

SALINE WATER (m3) ; 13320716.8

SURFACTANT (m3) ; 16096.9

Total Volume (m3); 35568219.3

Analysis of the 2470 wells that have been fractured in B.C;

Number of wells above the 1000000 m3 of injected water limit; 0

Number of zero volume injected wells; 0

Mean volume injected (m3); 14400.09

Number of wells assessed; 2470

Median volume injected (m3); 12336.35

Standard Deviation of volume injected (m3); 10791.13

Variance of volume injected (m3); 116448387.56

Max of volume injected (m3); 140883.30

Min of volume injected (m3); 53.90

25th percentile of volume injected (m3); 9090.47

75th percentile of volume injected (m3); 16579.75

Analysis of Completed Well Lengths

Count TVDs; 2464

Count Measured Depths; 2464

Count Horizontal Lengths; 2464

Count Missing Length Data; 6

Mean TVD (m); 2123.784862012987

Mean TVD (ft); 6967.798326686689

Mean Measured Depth (m); 4209.385714285714

Mean Measured Depth (ft); 13810.321026857142

Mean Horizontal Length (m); 987.1316704776171

Mean Horizontal Length (ft); 3238.621069769785

Analysis of Well Drill Year

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Facility Data Selection

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Monthly Facility Data is Available from 2014-01 to 2019-12

Enter The Date Range For Assessment (5-10 seconds per month)

['2019-01', '2019-02', '2019-03', '2019-04', '2019-05', '2019-06', '2019-07', '2019-08', '2019-09', '2019-10', '2019-11', '2019-12']

Period Assessed for Facilities ['2019-01', '2019-02', '2019-03', '2019-04', '2019-05', '2019-06', '2019-07', '2019-08', '2019-09', '2019-10', '2019-11', '2019-12']

Importing All Facility Data for :2019-01

('!!!!!!', OrderedDict())

Computational Time (s): 7.6140

Getting facility list for selected wells

Number of AB facilities connected to project wells (this month): 6053

Number of project wells producing to facilities (total): 46434

Computational Time (s): 78.0560

Adding GP facilities connected to batteries

Getting facility data for selected wells

Computational Time (s): 0.0220

Calculating All Facility Summary Data

Computational Time (s): 0.9510

Importing All Facility Data for :2019-02

('!!!!!!', OrderedDict())

Computational Time (s): 8.4950

Getting facility list for selected wells

Number of AB facilities connected to project wells (this month): 6020

Number of project wells producing to facilities (total): 46441

Computational Time (s): 76.9130

Adding GP facilities connected to batteries

Getting facility data for selected wells

Computational Time (s): 0.0180

Calculating All Facility Summary Data

Computational Time (s): 0.8950

Importing All Facility Data for :2019-03

('!!!!!!', OrderedDict())

Computational Time (s): 7.2140

Getting facility list for selected wells

Number of AB facilities connected to project wells (this month): 5967

Number of project wells producing to facilities (total): 46449

Computational Time (s): 78.5940

Adding GP facilities connected to batteries

Getting facility data for selected wells

Computational Time (s): 0.0210

Calculating All Facility Summary Data

Computational Time (s): 0.9120

Importing All Facility Data for :2019-04

('!!!!!!', OrderedDict())

Computational Time (s): 9.3010

Getting facility list for selected wells

Number of AB facilities connected to project wells (this month): 5927

Number of project wells producing to facilities (total): 46462

Computational Time (s): 75.2690

Adding GP facilities connected to batteries

Getting facility data for selected wells

Computational Time (s): 0.0220

Calculating All Facility Summary Data

Computational Time (s): 0.9030

Importing All Facility Data for :2019-05

('!!!!!!', OrderedDict())

Computational Time (s): 7.9270

Getting facility list for selected wells

Number of AB facilities connected to project wells (this month): 5891

Number of project wells producing to facilities (total): 46473

Computational Time (s): 73.8100

Adding GP facilities connected to batteries

Getting facility data for selected wells

Computational Time (s): 0.0190

Calculating All Facility Summary Data

Computational Time (s): 0.9140

Importing All Facility Data for :2019-06

('!!!!!!', OrderedDict())

Computational Time (s): 7.8500

Getting facility list for selected wells

Number of AB facilities connected to project wells (this month): 5866

Number of project wells producing to facilities (total): 46485

Computational Time (s): 73.5910

Adding GP facilities connected to batteries

Getting facility data for selected wells

Computational Time (s): 0.0200

Calculating All Facility Summary Data

Computational Time (s): 0.8690

Importing All Facility Data for :2019-07

('!!!!!!', OrderedDict())

Computational Time (s): 7.9040

Getting facility list for selected wells

Number of AB facilities connected to project wells (this month): 5850

Number of project wells producing to facilities (total): 46493

Computational Time (s): 72.7850

Adding GP facilities connected to batteries

Getting facility data for selected wells

Computational Time (s): 0.0160

Calculating All Facility Summary Data

Computational Time (s): 0.9320

Importing All Facility Data for :2019-08

('!!!!!!', OrderedDict())

Computational Time (s): 7.8600

Getting facility list for selected wells

Number of AB facilities connected to project wells (this month): 5820

Number of project wells producing to facilities (total): 46498

Computational Time (s): 72.1770

Adding GP facilities connected to batteries

Getting facility data for selected wells

Computational Time (s): 0.0180

Calculating All Facility Summary Data

Computational Time (s): 0.8800

Importing All Facility Data for :2019-09

('!!!!!!', OrderedDict())

Computational Time (s): 8.0160

Getting facility list for selected wells

Number of AB facilities connected to project wells (this month): 5708

Number of project wells producing to facilities (total): 46514

Computational Time (s): 71.6590

Adding GP facilities connected to batteries

Getting facility data for selected wells

Computational Time (s): 0.0190

Calculating All Facility Summary Data

Computational Time (s): 0.8970

Importing All Facility Data for :2019-10

('!!!!!!', OrderedDict())

Computational Time (s): 8.7110

Getting facility list for selected wells

Number of AB facilities connected to project wells (this month): 5644

Number of project wells producing to facilities (total): 46535

Computational Time (s): 73.9170

Adding GP facilities connected to batteries

Getting facility data for selected wells

Computational Time (s): 0.0170

Calculating All Facility Summary Data

Computational Time (s): 0.9000

Importing All Facility Data for :2019-11

('!!!!!!', OrderedDict())

Computational Time (s): 8.3730

Getting facility list for selected wells

Number of AB facilities connected to project wells (this month): 5584

Number of project wells producing to facilities (total): 46550

Computational Time (s): 74.2150

Adding GP facilities connected to batteries

Getting facility data for selected wells

Computational Time (s): 0.0180

Calculating All Facility Summary Data

Computational Time (s): 0.9080

Importing All Facility Data for :2019-12

('!!!!!!', OrderedDict())

Computational Time (s): 7.3790

Getting facility list for selected wells

Number of AB facilities connected to project wells (this month): 5564

Number of project wells producing to facilities (total): 46562

Computational Time (s): 75.0530

Adding GP facilities connected to batteries

Getting facility data for selected wells

Computational Time (s): 0.0140

Calculating All Facility Summary Data

Computational Time (s): 0.9130

Importing AB data from geoSCOUT export

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Summary of All Connected facilities

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('Total Number of Connected Facilities', 0)

FACILITY TYPE AND COUNT

('Total Number of Connected Project Wells', 46562)

('Year-Month', ['PROD GAS', 'FLARE GAS', 'VENT GAS', 'FUEL GAS', 'PROD COND', 'PROD OIL', 'REC GAS', 'DISP GAS', 'PURREC GAS', 'INJ CO2', 'INJ WATER'])

2019-01, [9701486.4, 10902.0, 1692.7, 436131.3, 242863.2, 1015417.3, 9095204.2, 17812911.7, 5151.1, 9156.7, 877287.0]

2019-02, [8546645.6, 12779.8, 1523.1, 398137.0, 202660.9, 881188.7, 7989230.4, 15658710.9, 6425.3, 6987.3, 748853.2]

2019-03, [9409588.7, 12654.4, 1743.4, 422319.1, 231528.9, 999233.6, 8868391.8, 17308965.5, 6907.8, 9433.7, 826334.0]

2019-04, [8710100.1, 11941.9, 1790.1, 400650.1, 209412.1, 976949.9, 8574592.5, 16215029.8, 7103.6, 7609.0, 813163.9]

2019-05, [8655466.1, 10859.6, 1845.9, 392120.2, 214302.4, 953408.9, 8367437.8, 15958169.0, 7340.3, 7149.6, 811189.1]

2019-06, [8017817.3, 11871.0, 1736.5, 368383.5, 183421.4, 862269.3, 7856336.1, 14793460.5, 6443.5, 8845.5, 719905.3]

2019-07, [8289785.3, 14321.1, 1981.3, 385102.9, 171280.0, 969213.2, 8554211.6, 15634903.1, 6227.5, 9088.5, 851952.5]

2019-08, [8330244.4, 11461.6, 2750.4, 397808.1, 173264.6, 941769.5, 8485950.8, 15648359.8, 6842.6, 8259.7, 843075.9]

2019-09, [7793675.7, 16280.7, 3702.1, 378982.6, 165842.8, 893773.0, 7825264.7, 14579298.4, 6172.2, 9310.3, 831431.3]

2019-10, [8426366.7, 16582.4, 4155.5, 431858.7, 349369.4, 937398.9, 8272219.1, 15479632.9, 6418.5, 11223.1, 851957.3]

2019-11, [8495787.5, 13459.5, 4171.1, 443708.9, 375732.7, 913437.0, 8017237.4, 15482244.0, 6852.2, 9398.9, 819296.3]

2019-12, [9097943.8, 12502.9, 4563.9, 469371.7, 393341.0, 965364.2, 8228978.7, 16234322.7, 6503.3, 11017.4, 891743.8]

('Totals', [103474908.0, 155617.0, 31656.0, 4924574.0, 2913019.0, 11309423.0, 100135055.0, 190806008.0, 78388.0, 107480.0, 9886190.0])

Gas Consumption (percent of inlet)

Fuel Gas ("%"); 2.419

Flare Gas ("%"); 0.076

Vent Gas ("%"); 0.016

Facility Gas Oil Ratio (scf/bbl); 40849.17

Fuel Flare Vent Rates (scf/bbl)

Fuel Rate (scf/bbl); 1944.09

Flare Rate (scf/bbl); 61.43

Vent Rate (scf/bbl); 12.5

Collecting OPGEE FFV inputs for wells

Unique FFV Data added to 0 wells

Impossible FFV rates (>100%) were found for 0 wells

Fuel, flare and vent rates for these wells have been set to zero

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BC FACILITY ANALYSIS

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['2019-01', '2019-02', '2019-03', '2019-04', '2019-05', '2019-06', '2019-07', '2019-08', '2019-09', '2019-10', '2019-11', '2019-12']

Getting BC Facility to Well Connections

Available Data - Indexed by well WA

['FACILITYID', 'FACILITYNAME', 'FACILITYTYPE\_CODE', 'FROMWANUM', 'FROMFACILITYID', 'CANCELDATE', 'REMOVALDATE', 'SUSPENDEDDATE', 'EFFECTIVEDATE', 'TERMINATIONDATE', 'LINKAGEPRODUCT', 'LINKAGETYPE']

Getting BC Facility Information (e.g Type etc)

Getting List of BC facilities Connected to Project Wells

('list of connecgted wells:', [], 'list of connected facilities:', [])

Total Number of Connected Wells in Our Dataset: 0

Total Number of Connected facilities: 0

Getting BC facility Data for 2019

Available Data - Indexed by well FAC\_ID\_CODE

['FAC\_ID\_CODE', 'PROD GAS', 'FUEL GAS', 'FLARE GAS', 'VENT GAS', 'REC GAS', 'DISP GAS', 'PROD OIL', 'PROD\_PERIOD']

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BC FACILITY SUMMARY : ALL

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FACILITY TYPE AND COUNT

Total; 0

CONNECTED WELLS

Total Number of Project Wells Connected; 0

Facility Totals Over Period

Date, ['PROD GAS', 'FLARE GAS', 'VENT GAS', 'FUEL GAS', 'PROD COND', 'PROD OIL', 'REC GAS', 'DISP GAS', 'PURREC GAS']

2019-01, [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]

2019-02, [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]

2019-03, [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]

2019-04, [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]

2019-05, [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]

2019-06, [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]

2019-07, [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]

2019-08, [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]

2019-09, [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]

2019-10, [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]

2019-11, [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]

2019-12, [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]

Total Over Period

[0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]

('@@@@@@OIL PRODUCTION=@@@@@@@@@@', 0.0)

('\*\*\*\*\*\*\*\*\*GAS PRODUCTION=\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*', 0.0)

Gas Consumption (percent of inlet)

Fuel Gas ("%"); 0.0

Flare Gas ("%"); 0.0

Vent Gas ("%"); 0.0

Facility Gas Oil Ratio (scf/bbl); 0.0

Fuel Flare Vent Rates (scf/bbl)

Fuel Rate (scf/bbl); 0.0

Flare Rate (scf/bbl); 0.0

Vent Rate (scf/bbl); 0.0

Collecting OPGEE FFV inputs for wells

Unique FFV Data added to 0 wells

Impossible FFV rates (>100%) were found for 0 wells

Fuel, flare and vent rates for these wells have been set to zero

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SK FACILITY ANALYSIS

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Getting SK Facility Well Links

Getting SK Facilities Connected to Project Wells

('Total Number of SK Facilities Connected to Project Wells (All Time)', 623)

('Total Number of Project Wells Connected to SK Facilities (All Time)', 5494)

Getting SK facility Data for 2019

Computational Time(s): 2.15799999237

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Summary of Facility; ALL

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('Total Number of Connected Facilities Over Period Assessed', 151)

FACILITY TYPE AND COUNT

CRUDE OIL MULTIWELL PRORATION BATTERY; 46

CRUDE OIL MULTIWELL SWAB PAPER BATTERY; 3

CRUDE OIL SINGLE-WELL BATTERY; 21

DISPOSAL; 1

GAS MULTIWELL GROUP BATTERY; 22

GAS MULTIWELL PRORATION OUTSIDE SW SK BATTERY; 3

GAS MULTIWELL PRORATION SW SK BATTERY; 23

GAS SINGLE WELL BATTERY; 18

HEAVY CRUDE OIL MULTIWELL PRORATION BATTERY; 7

HEAVY CRUDE OIL PAPER BATTERY; 1

HEAVY CRUDE OIL SINGLE-WELL BATTERY; 5

THERMAL IN-SITU BATTERY; 1

Number of project wells connected over period; 2959

SUMMARY OF VOLUMES

Year-month, ['PROD GAS', 'FLARE GAS', 'VENT GAS', 'FUEL GAS', 'PROD COND', 'PROD OIL', 'REC GAS', 'DISP GAS', 'PURREC GAS']

2019-01, [0, 2052.3, 713.6, 7010.8, 0, 0, 0, 0, 0]

2019-02, [0, 2016.7, 419.8, 6118.5, 0, 0, 0, 0, 0]

2019-03, [0, 2690.7, 561.8, 6669.4, 0, 0, 0, 0, 0]

2019-04, [0, 2898.1, 541.9, 6318.1, 0, 0, 0, 0, 0]

2019-05, [0, 3338.7, 571.5, 6083.5, 0, 0, 0, 0, 0]

2019-06, [0, 3161.2, 521.0, 5755.5, 0, 0, 0, 0, 0]

2019-07, [0, 2365.0, 567.3, 5465.1, 0, 0, 0, 0, 0]

2019-08, [0, 2841.2, 424.6, 5368.4, 0, 0, 0, 0, 0]

2019-09, [0, 3129.7, 458.5, 5415.5, 0, 0, 0, 0, 0]

2019-10, [0, 2204.2, 454.2, 5873.4, 0, 0, 0, 0, 0]

2019-11, [0, 2114.2, 439.3, 5871.2, 0, 0, 0, 0, 0]

2019-12, [0, 2710.0, 434.9, 5993.8, 0, 0, 0, 0, 0]

Period Totals

[0.0, 31522.0, 6108.4, 71943.2, 0.0, 0.0, 0.0, 0.0, 0.0]

Gas Consumption (percent of inlet)

Fuel Gas ("%"); 0.0

Flare Gas ("%"); 0.0

Vent Gas ("%"); 0.0

Facility Gas Oil Ratio (scf/bbl); 0.0

Fuel Flare Vent Rates (scf/bbl)

Fuel Rate (scf/bbl); 0.0

Flare Rate (scf/bbl); 0.0

Vent Rate (scf/bbl); 0.0

Collecting OPGEE FFV inputs for wells

Unique FFV Data added to 2959 wells

Impossible FFV rates (>100%) were found for 2956 wells

Fuel, flare and vent rates for these wells have been set to zero

Print Individual Facility? (Y/N): N

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ALL PROVINCE FACILITY ASSESSMENT

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calculating FFV rates for the formation from all facility data

49521 wells have been found connected to 151 facilites

Period assessed; 2019-01 to 2019-12

year\_month, ['PROD GAS', 'FLARE GAS', 'VENT GAS', 'FUEL GAS', 'PROD COND', 'PROD OIL', 'REC GAS', 'DISP GAS']

('2019-01', [9701486.4, 12954.3, 2406.3, 443142.1, 242863.2, 1015417.3, 9095204.2, 17812911.7])

('2019-02', [8546645.6, 14796.5, 1942.9, 404255.5, 202660.9, 881188.7, 7989230.4, 15658710.9])

('2019-03', [9409588.7, 15345.1, 2305.2, 428988.5, 231528.9, 999233.6, 8868391.8, 17308965.5])

('2019-04', [8710100.1, 14840.0, 2332.0, 406968.2, 209412.1, 976949.9, 8574592.5, 16215029.8])

('2019-05', [8655466.1, 14198.3, 2417.4, 398203.7, 214302.4, 953408.9, 8367437.8, 15958169.0])

('2019-06', [8017817.3, 15032.2, 2257.5, 374139.0, 183421.4, 862269.3, 7856336.1, 14793460.5])

('2019-07', [8289785.3, 16686.1, 2548.6, 390568.0, 171280.0, 969213.2, 8554211.6, 15634903.1])

('2019-08', [8330244.4, 14302.8, 3175.0, 403176.5, 173264.6, 941769.5, 8485950.8, 15648359.8])

('2019-09', [7793675.7, 19410.4, 4160.6, 384398.1, 165842.8, 893773.0, 7825264.7, 14579298.4])

('2019-10', [8426366.7, 18786.6, 4609.7, 437732.1, 349369.4, 937398.9, 8272219.1, 15479632.9])

('2019-11', [8495787.5, 15573.7, 4610.4, 449580.1, 375732.7, 913437.0, 8017237.4, 15482244.0])

('2019-12', [9097943.8, 15212.9, 4998.8, 475365.5, 393341.0, 965364.2, 8228978.7, 16234322.7])

Totals; 2019-01 to 2019-12

PROD GAS , 103474907.6

FLARE GAS , 187138.9

VENT GAS , 37764.4

FUEL GAS , 4996517.3

PROD COND , 2913019.4

PROD OIL , 11309423.5

REC GAS , 100135055.1

DISP GAS , 190806008.3

Gas Consumption (percent of inlet)

Fuel Gas ("%"); 2.454

Flare Gas ("%"); 0.092

Vent Gas ("%"); 0.019

Facility Gas Oil Ratio (scf/bbl); 51370.39

Fuel Flare Vent Rates (scf/bbl)

Fuel Rate (scf/bbl); 2480.53

Flare Rate (scf/bbl); 92.91

Vent Rate (scf/bbl); 18.75

Pecentage of total project wells with facility data; 67.8741776316

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Getting OPGEE Drilling and Development Data

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Importing Alberta Water Use Data

File Location: C:/Users/Parissa/Desktop/Alex//Project Data\_new/AER/HF\_WaterUseData.csv

==================== Data available ====================

['Well Licence Number', 'Last Submission Date', 'Licensee', 'Field Centre', 'UWI', 'Well Name', 'Number of Stages', 'Bottom Hole Latitude', 'Bottom Hole Longitude', 'Production Fluid Type', 'Max True Vertical Depth', 'Total Water Volume', 'Start Date', 'End Date', 'Component Type', 'Component Trade Name', 'Component Supplier Name',

'Additive Purpose', 'Ingredient Name', 'CAS # HMIRC #', 'Concentration Component ', 'Concentration HFF']

Computational Time (s): 2.5190

========Importing B.C Water Data========

File Location: C:/Users/Parissa/Desktop/Alex//Project Data\_new/BCOGC/hydraulic\_fracture/hydraulic\_fracture.csv

==================== Data available ====================

['WA NUM', 'DRILLNG EVENT', 'COMPLTN EVENT', 'UWI', 'WELL NAME', 'COMPLTN DATE', 'FRAC START TIME', 'COMPLTN TOP DEPTH (m)', 'COMPLTN BASE DEPTH (m)', 'COMPLTN TYPE',

'COMPLETION WORKOVER KEY', 'FRAC SUMMARY KEY', 'FRAC STAGE NUM', 'BASE FLUID', 'VISCOSITY GEL TYPE', 'ENERGIZER', 'ENERGIZER TYPE', 'PLUG BACK TOTAL DEPTH (m)', 'ACID

SPEARHEAD AMOUNT (m3)', 'ACID TYPE', 'BREAK DOWN PRESSURE (MPa)', 'INST SHUT IN PRESSURE (MPa)', 'MAX TREATING PRESSURE (MPa)', 'AVG TREATING PRESSURE (MPa)', 'AVG RATE (m3/min)', 'FRAC GRADIENT (KPa/m)', 'TOTAL FLUID PUMPED (m3)', 'TOTAL CO2 PUMPED (m3)', 'TOTAL N2 PUMPED (scm)', 'TOTAL CH4 PUMPED (e3m3)', 'RADIOACTIVE FLAG', 'RADIOACTIVE TRACER TYPE', 'CHEMICAL TRACER FLAG', 'CHEMICAL TRACER TYPE', 'PROPPANT TYPE1', 'PROPPANT TYPE1 PUMPED (t)', 'PROPPANT TYPE1 PLACED (t)', 'PROPPANT TYPE2', 'PROPPANT TYPE2 PUMPED (t)', 'PROPPANT TYPE2 PLACED (t)', 'PROPPANT TYPE3', 'PROPPANT TYPE3 PUMPED (t)', 'PROPPANT TYPE3 PLACED (t)', 'PROPPANT TYPE4', 'PROPPANT TYPE4 PUMPED (t)', 'PROPPANT TYPE4 PLACED (t)']

Computational Time (s): 2.4020

~~~~~~~~ OPGEEE INPUTS ~~~~~~~~~

Downhole pump (NA) ; 0

Water reinjection (NA) ; 0

Natural gas reinjection (NA) ; 0

Water flooding (NA) ; 0

Gas lifting (NA) ; 0

Gas flooding (NA) ; 0

Steam flooding (NA) ; 0

Oil sands mine (integrated with upgrader) (NA) ; 0

Oil sands mine (non-integrated with upgrader) (NA) ; 0

Field location (Country) (NA) ; Canada

Field name (NA) ; 2019\_data

Field age (yr.) ; 1.0

Field depth (ft) ; 4277.151

Oil production volume (bbl/d) ; 43110.175

Number of producing wells ([-]) ; 72616

Number of water injecting wells ([-]) ; 0

Production tubing diameter (in) ; 4.5

Productivity index (bbl/psi-d) ; 3

Reservoir pressure (psi) ; 1924.718

Reservoir temperature (deg F) ; 118.98

Offshore? ([0-1]) ; 0

API gravity (deg. API) ; 46.25725460427484

Gas composition N2 (mol%) ; 2.4484

Gas composition CO2 (mol%) ; 1.13907

Gas composition C1 (mol%) ; 89.852

Gas composition C2 (mol%) ; 3.89655

Gas composition C3 (mol%) ; 1.47638

Gas composition C4+ (mol%) ; 1.03603

Gas composition H2S (mol%) ; 0.15157

Gas-to-oil ratio (GOR) (scf/bbl oil) ; 206744.876

Water-to-oil ratio (WOR) (bbl water/bbl oil) ; 4.55

Water injection ratio (bbl water/bbl oil) ; 0

Gas lifting injection ratio (scf/bbl liquid) ; 0

Gas flooding injection ratio (scf/bbl oil) ; 0

Flood gas (NA) ; 0

Percentage of newly acquired CO2 (percent) ; 0

Source of CO2 (NA) ; 0

Percentage of sequestration credit assigned to the oilfield (%) ; 0

Steam-to-oil ratio (SOR) (bbl steam/bbl oil) ; 0

Fraction of required electricity generated onsite ([-]) ; 0

Fraction of remaining natural gas reinjected ([-]) ; 0

Fraction of produced water reinjected ([-]) ; 1

Fraction of steam generation via cogeneration ([-]) ; 0

Fraction of steam generation via solar thermal ([-]) ; 0

Heater/treater (NA) ; 1

Stabilizer column (NA) ; 1

Upgrader type ([1-8]) ; 0

Associated Gas Processing Path (NA) ; 5

Flaring-to-oil ratio (scf/bbl oil) ; 190.0202

Venting-to-oil ratio (scf/bbl oil) ; 38.3458

Volume fraction of diluent ([-]) ; 0

Low carbon richness (semi-arid grasslands) (NA) ; 0

Moderate carbon richness (mixed) (NA) ; 1

High carbon richness (forested) (NA) ; 0

Low intensity field development (NA) ; 0

Moderate intensity field development (NA) ; 1

High intensity field development (NA) ; 0

Ocean tanker (Fraction Transport) ([-]) ; 0

Transport Barge (Fraction Transport) ([-]) ; 0

Pipeline (Fraction Transport) ([-]) ; 0.97

Rail (Fraction Transport) ([-]) ; 0.03

Truck (Fraction Transport) ([-]) ; 1

Ocean tanker (Distance Transport) (Mile) ; 5082

Barge (Distance Transport) (Mile) ; 500

Pipeline (Distance Transport) (Mile) ; 2143

Rail (Distance Transport) (Mile) ; 2143

Truck (Distance Transport) (Mile) ; 50

Ocean tanker size, if applicable (Ton) ; 250000

Small sources emissions (gCO2eq/MJ) ; 0.5

Distance of travel for survey (mi) ; 1000

Weight of land survey vehicle (tons) ; 25

Weight of ocean survey vehicle (tons) ; 100

Number of dry wells drilled per field found (wells) ; 0

Number of exploratory/scientific wells drilled after field discovery (wells) ; 0

Horizontal well fraction (fraction) ; 1

Length of lateral (ft) ; 3751.7555581612633

Fraction of wells fractured (fraction) ; 1

Fracturing fluid injection volume (million gal) ; 3.798

Fracture pressure gradient (psi/ft) ; 0.9752909498140273

Facility name (N/A) ; 0

Facility type (N/A) ; 0

Facility gas-to-oil ratio (scf/bbl oil) ; 51370.3881

Facility flared gas (%) ; 0.0919

Facility vented gas (%) ; 0.0185

Facility fuel gas (%) ; 2.454

Fugitive percentage alteration of base case (fraction) ; 0

Electricity Consumption (kwh/scf) ; 0

EUR boe/well (bbl) ; 100000

Coordinates ([lon,lat]) ; 0

Formation ([-]) ; 0

Province ([-]) ; 0

Area ([lon,lat]) ; 0

Project total Computational time (seconds): 12360.273

Writing data to Excel OPGEE.......

Original File Location:

C:/Users/Parissa/Desktop/Alex/Project Data/OPGEE/OPGEE\_v2.0\_tight\_oil\_edit.xlsm

------------------- Exclude Exported Wells -------------------

Exclude wells to reduce/remove calculation issues in OPGEE

Oil production must be greater than 0 bbl/day for OPGEE to run

Minimum well producing time (years); 0.1

Minimum oil production (bbl/day); 0.1

Successfully Exported!

5725 Have been exported to OPGEE

File Location:

C:/Users/Parissa/Desktop/Alex/Project Data/OPGEE/COEA - OPGEE/OPGEE\_v2.0\_2019\_data.xlsm

67236 Wells have been excluded

# Wells producing less than 0.1 bbl/day

# Less than 0.1 producing years