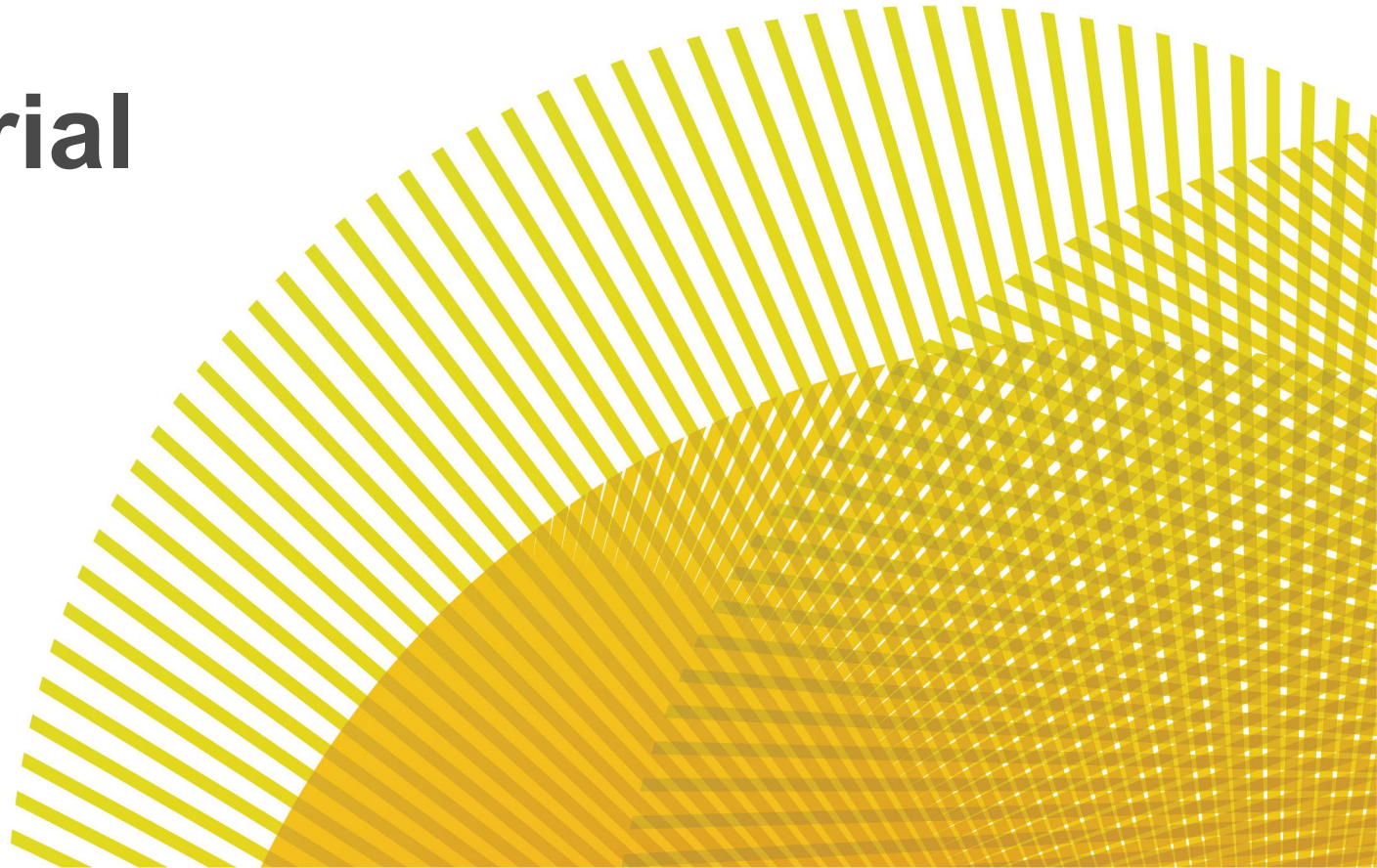
EDL

Wellfield Automation Byron Center LoCI Trial

By Kyle Tucker



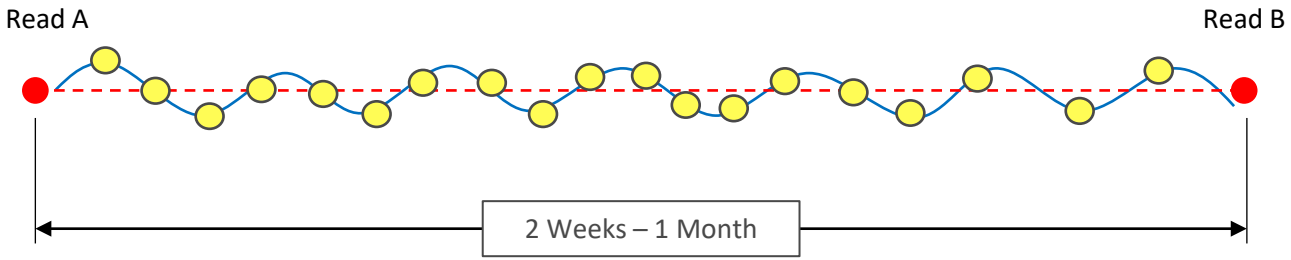
Landfill Gas Well Tuning (Concept)

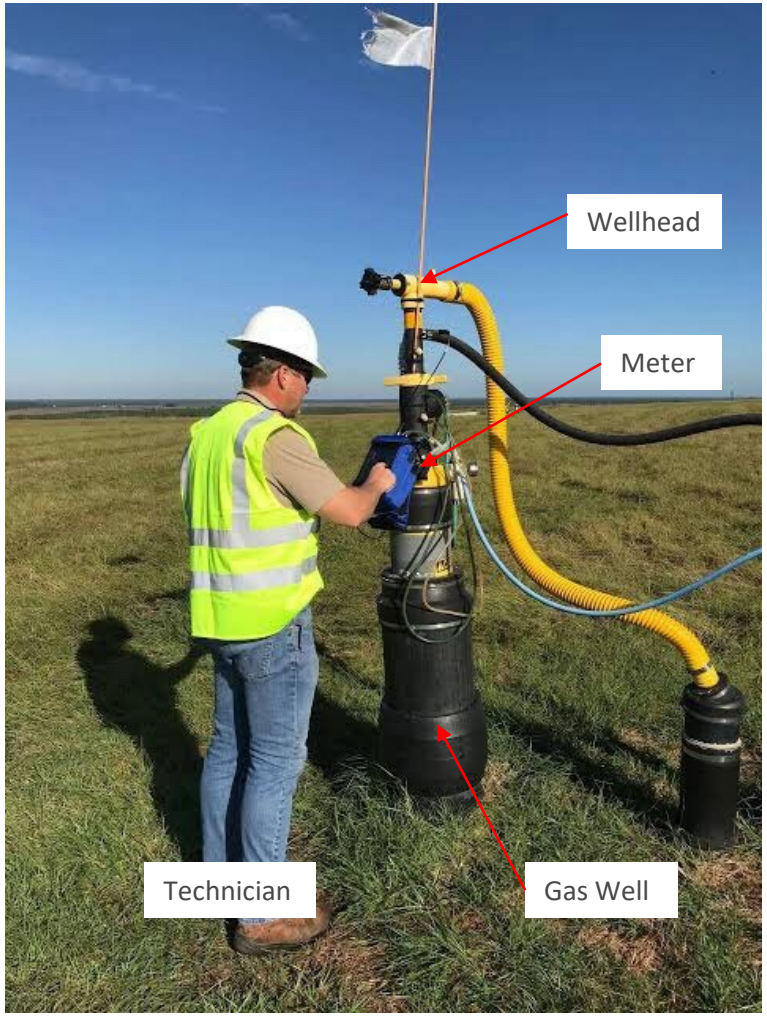
Weather/Atmospheric Changes

Barometric Pressure

Moisture (Rain/Snow)

Temperature





Byron Center LoCI Trial – Site Introduction

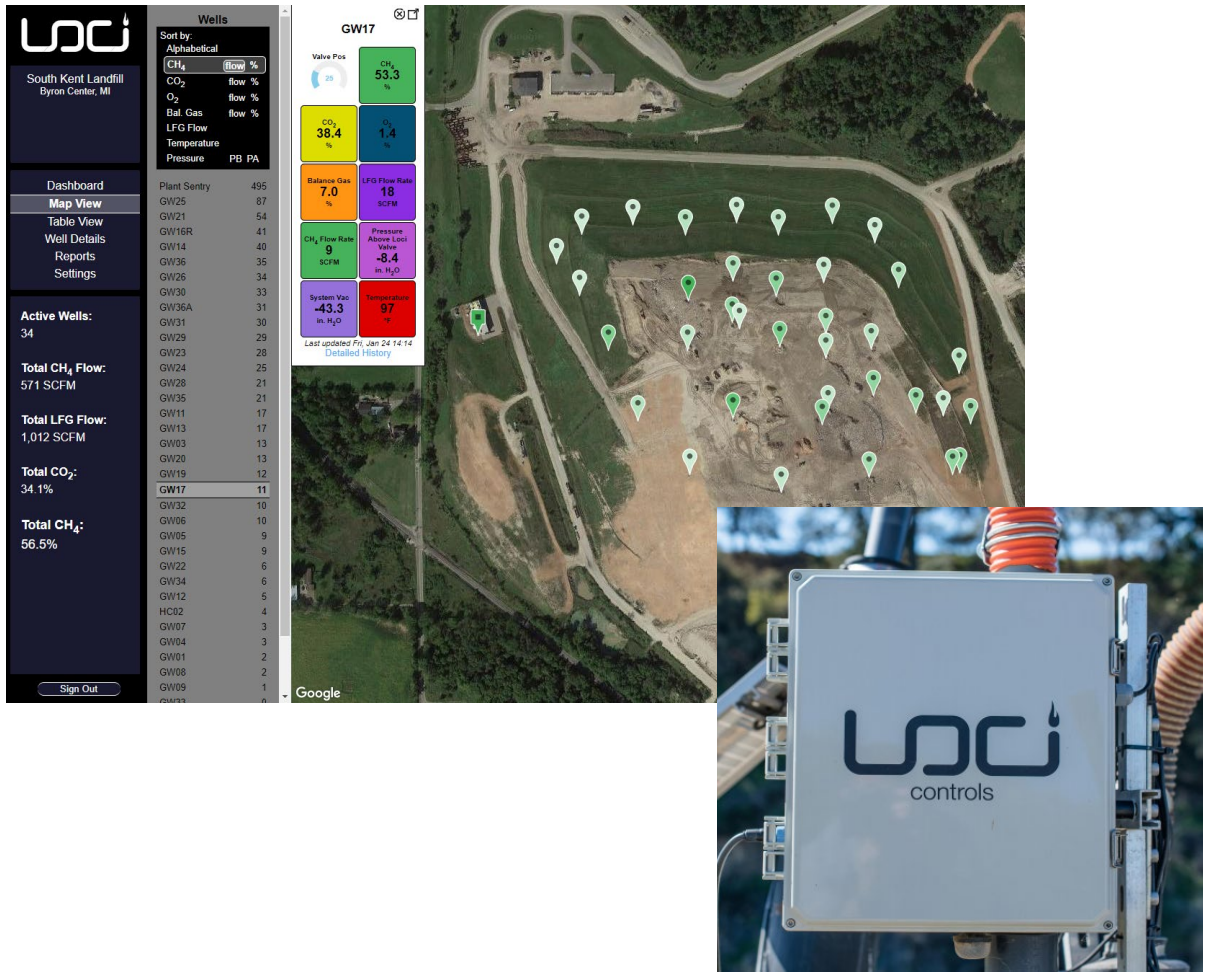
- **Perfect Site For A Trial**
  - **EDL Operates Gas Field**
  - **Non-NSPS Site**
  - **Lone Operator Site**
  - **Gas Short & Additional Capacity For Generation**
  - **Small Quantity Of Wells (36 In Total)**
  - **Support Of Landfill Partner**

Why Automate The Gas Field?

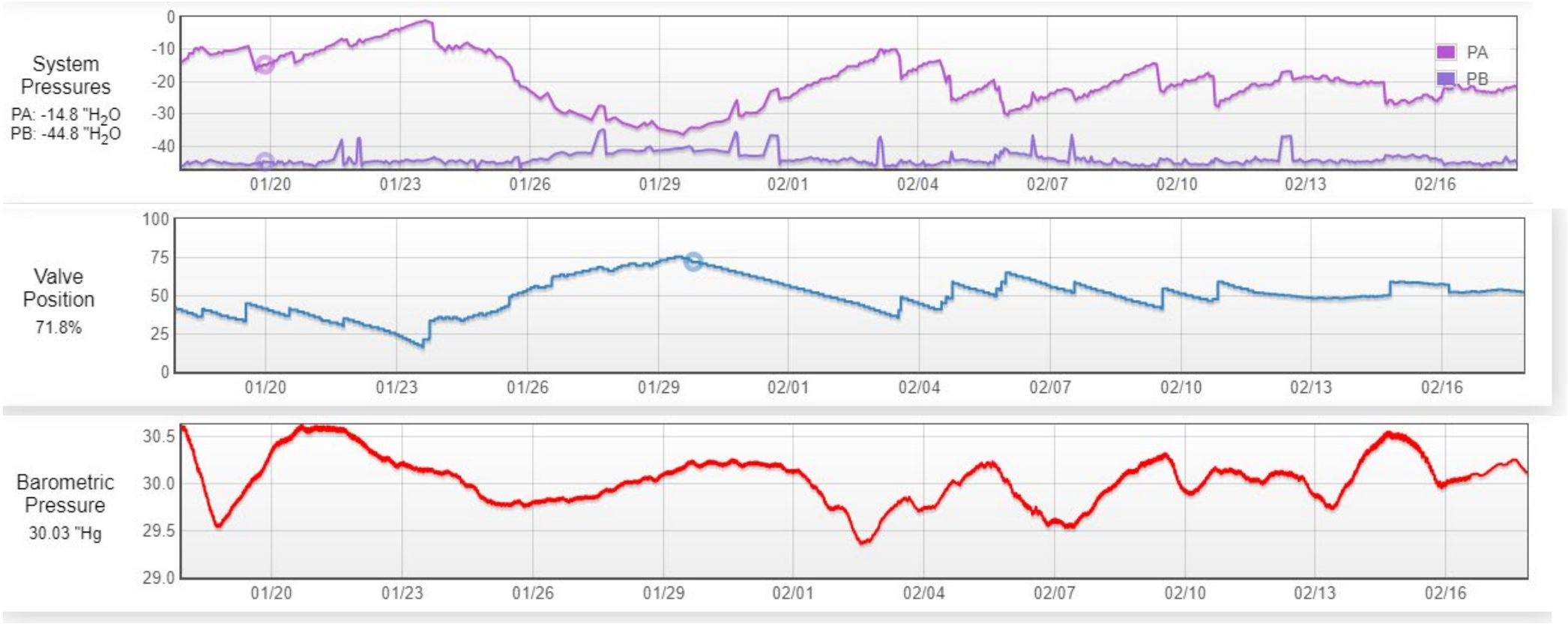
- **Frequent Tuning Intervals**
- **Realtime Adjustments To Changes**
- **Full Visibility Of Wellfield**
- **Less Time Spent In Wellfield**
- **Onsite & Technical Assistance By LoCI Staff**
- **Better Data Management**

LoCI Tuning Process

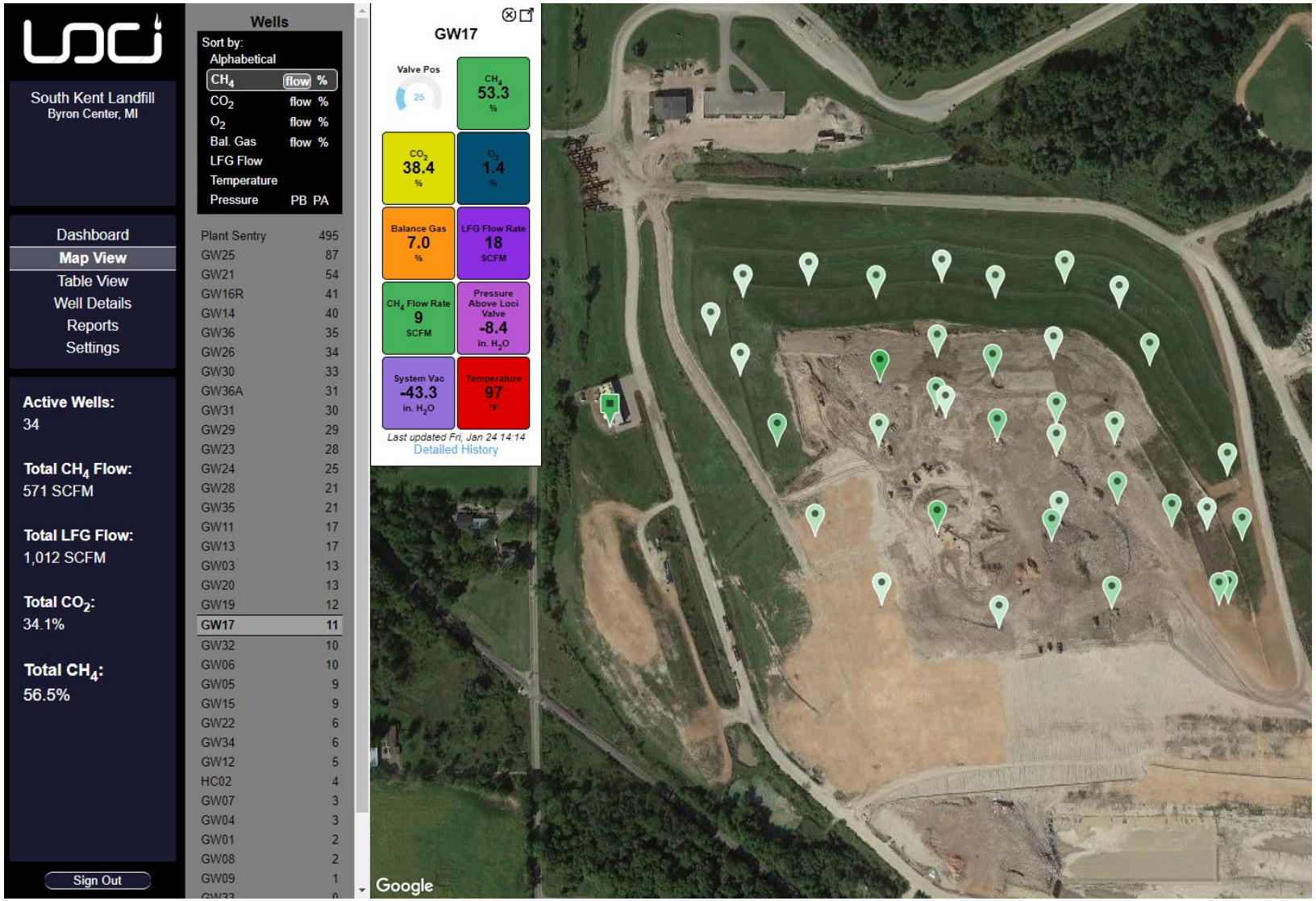
- Devices take a reading every hour (can be adjusted to less).
- Adjusts valve position based on reading.
- The unit takes an additional gas reading to confirm the change.
- An additional reading is taken, and the unit will make an adjustment if necessary.
- The cycle continues to tune based on the inputs the end user provides to LoCI.
  - At Byron Center CH4 was 51%, O2 < 0.5%.
- The unit has its own calibration gases. Units calibrate every week.
- LoCI control room monitors the data and sensor drift to determine if device is malfunctioning.



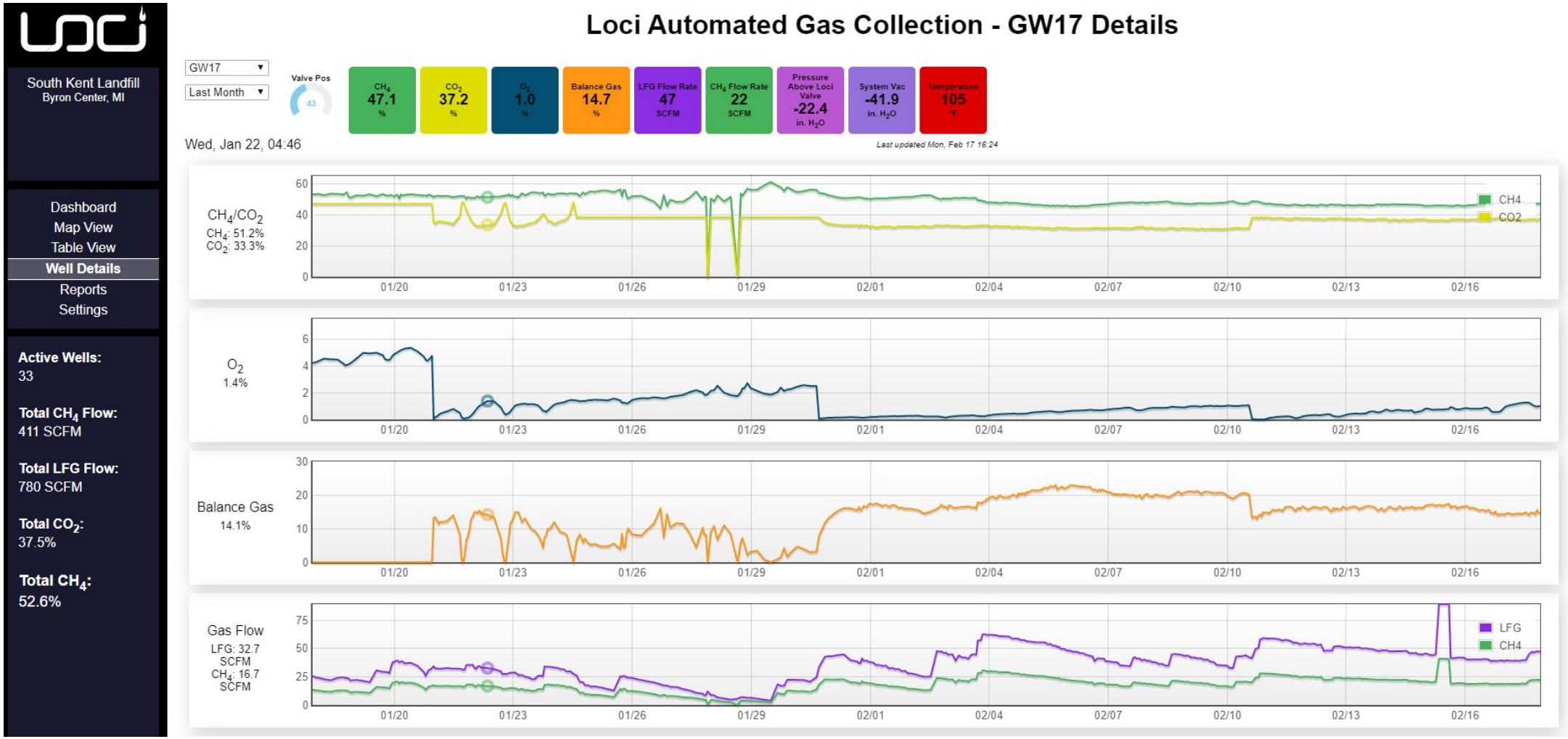
Real-Time Adjustments



Full Visibility



Full Visibility (cont.)



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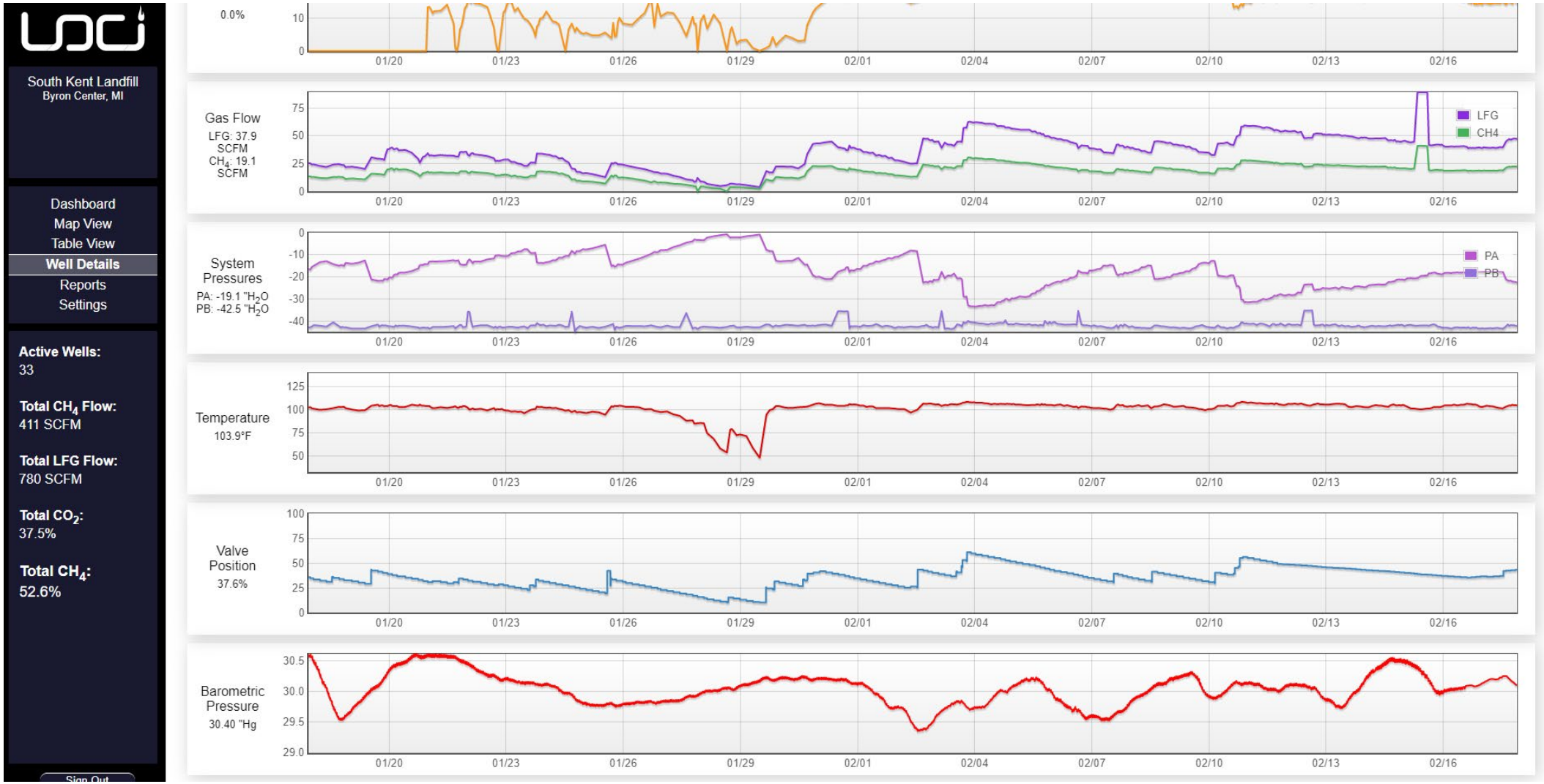
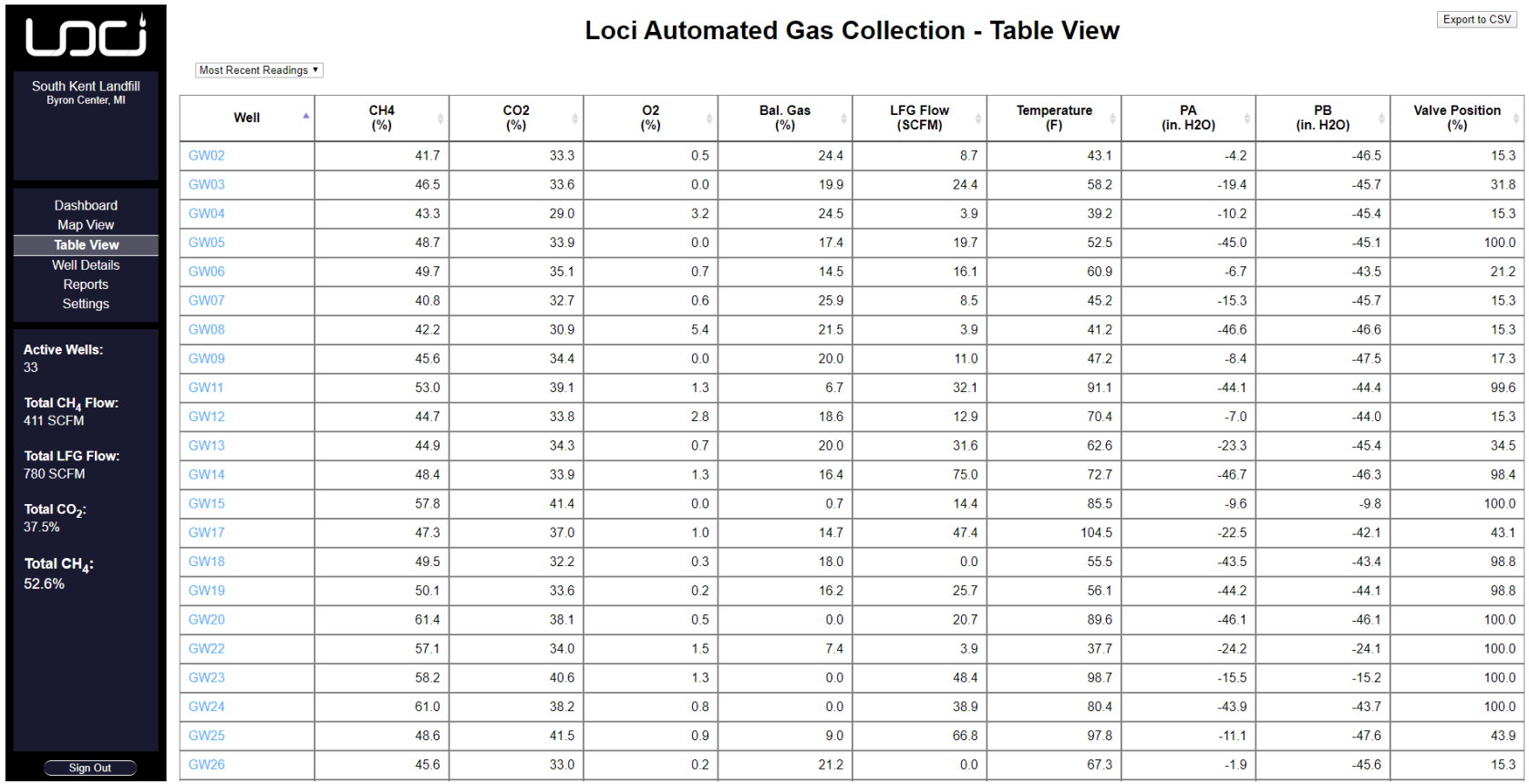


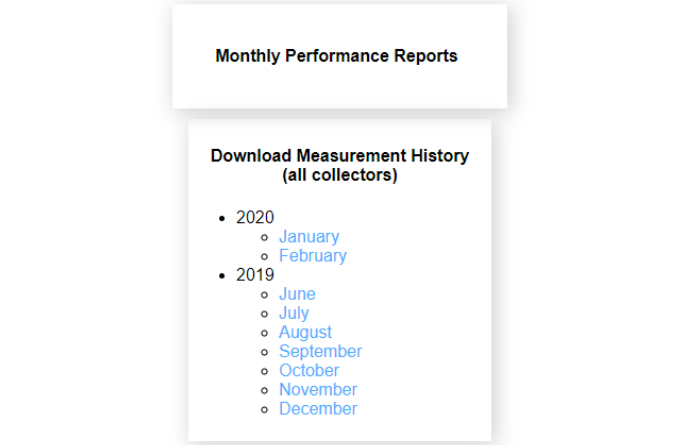
LoCI Technical Assistance & Reduced Labor Time

- **LoCI monitors system remotely**
- **LoCI technicians service & supports all LoCI hardware & calibration gases.**
- **LoCI technician is on call for field support (Product Related Tasks).**
- **LoCI analyzes data and makes field recommendations based on that analysis to increase production & efficiency.**
- **EDL operator estimated 60% reduction in time spent in gas field.**
- **EDL operator was freed up to take on more plant tasks.**
- **EDL operator is exposed less to high risk work environment**

Data Management



Well	CH4 (%)	CO2 (%)	O2 (%)	Bal. Gas (%)	LFG Flow (SCFM)	Temperature (F)	PA (in. H2O)	PB (in. H2O)	Valve Position (%)
GW02	41.7	33.3	0.5	24.4	8.7	43.1	-4.2	-46.5	15.3
GW03	46.5	33.6	0.0	19.9	24.4	58.2	-19.4	-45.7	31.8
GW04	43.3	29.0	3.2	24.5	3.9	39.2	-10.2	-45.4	15.3
GW05	48.7	33.9	0.0	17.4	19.7	52.5	-45.0	-45.1	100.0
GW06	49.7	35.1	0.7	14.5	16.1	60.9	-6.7	-43.5	21.2
GW07	40.8	32.7	0.6	25.9	8.5	45.2	-15.3	-45.7	15.3
GW08	42.2	30.9	5.4	21.5	3.9	41.2	-46.6	-46.6	15.3
GW09	45.6	34.4	0.0	20.0	11.0	47.2	-8.4	-47.5	17.3
GW11	53.0	39.1	1.3	6.7	32.1	91.1	-44.1	-44.4	99.6
GW12	44.7	33.8	2.8	18.6	12.9	70.4	-7.0	-44.0	15.3
GW13	44.9	34.3	0.7	20.0	31.6	62.6	-23.3	-45.4	34.5
GW14	48.4	33.9	1.3	16.4	75.0	72.7	-46.7	-46.3	98.4
GW15	57.8	41.4	0.0	0.7	14.4	85.5	-9.6	-9.8	100.0
GW17	47.3	37.0	1.0	14.7	47.4	104.5	-22.5	-42.1	43.1
GW18	49.5	32.2	0.3	18.0	0.0	55.5	-43.5	-43.4	98.8
GW19	50.1	33.6	0.2	16.2	25.7	56.1	-44.2	-44.1	98.8
GW20	61.4	38.1	0.5	0.0	20.7	89.6	-46.1	-46.1	100.0
GW22	57.1	34.0	1.5	7.4	3.9	37.7	-24.2	-24.1	100.0
GW23	58.2	40.6	1.3	0.0	48.4	98.7	-15.5	-15.2	100.0
GW24	61.0	38.2	0.8	0.0	38.9	80.4	-43.9	-43.7	100.0
GW25	48.6	41.5	0.9	9.0	66.8	97.8	-11.1	-47.6	43.9
GW26	45.6	33.0	0.2	21.2	0.0	67.3	-1.9	-45.6	15.3



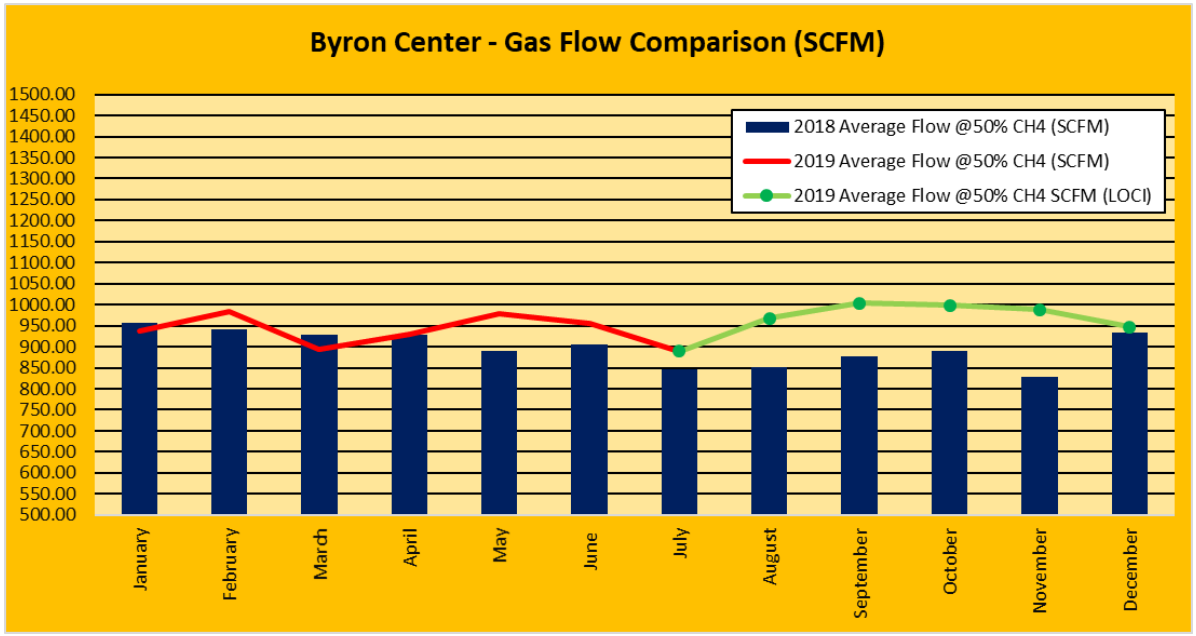
Results Of Byron Center Trial (Overview)

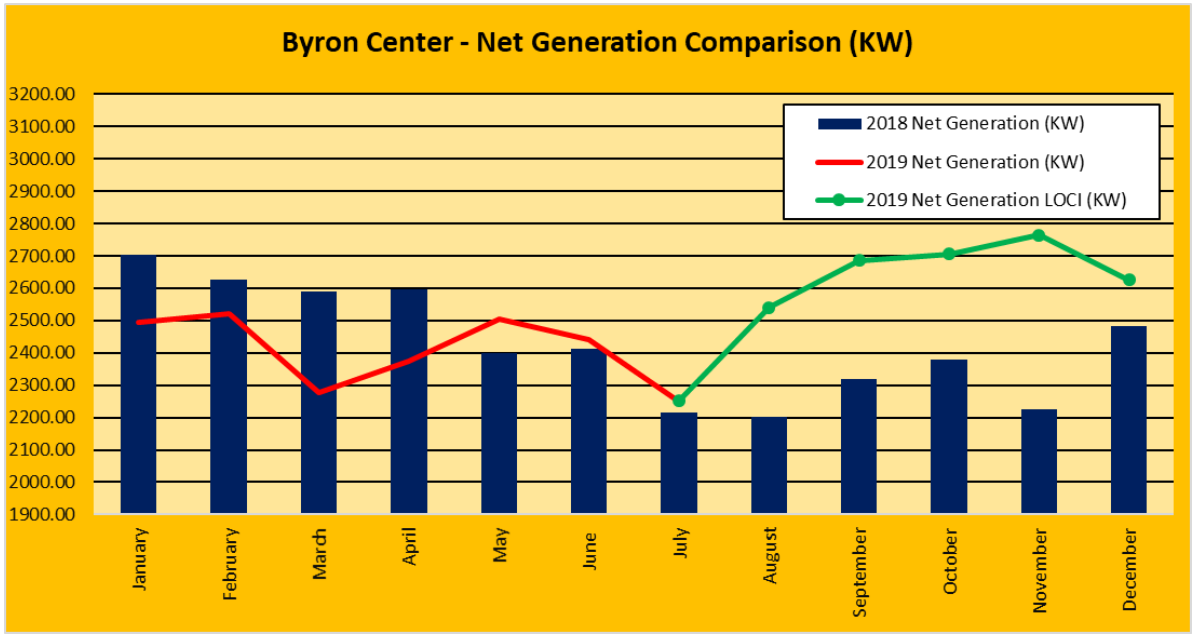
- Overall increase in average gas flow by 13.98% Or 115 SCFM
  - Best month (23.25%)
- Overall increase in average generation by 13% or 0.3MW
  - Best month (24.26%)
- Slight reduction in CH4 Quality -1.3%
- Slight increase in O2 +0.23%

Results Table

Byron Center - LoCI Controls Monthly Performance Tracker																	
Month	2018 Net Generation (KW)	2019 Net Generation (KW)	2019 Net Generation LOCI (KW)	Difference KW (±)	2018 Average Flow	2019 Average Flow	Difference (±)	2018 Average CH4%	2019 Average CH4%	2019 Average CH4% (LOCI)	Difference (±)	2018 Average O2%	2019 Average O2%	Difference (±)	2018 Average Vacuum (Inches H2O)	2019 Average Vacuum (Inches H2O)	Difference (±)	
January	2703.03	2493.13		-209.90	921.78	878.78	-43.00	51.97%	53.37%		0.01	0.32%	0.22%	-0.10%	-41.42	-44.81	-3.39	
February	2627.29	2520.30		-106.99	927.39	957.76	30.37	50.78%	51.38%		0.01	0.41%	0.93%	0.52%	-41.94	-45.90	-3.96	
March	2590.39	2278.73		-311.67	904.12	863.97	-40.16	51.38%	51.66%		0.00	0.39%	0.99%	0.60%	-43.33	-43.03	0.30	
April	2597.04	2373.22		-223.82	900.48	899.75	-0.73	51.56%	51.69%		0.00	0.21%	0.79%	0.58%	-44.79	-44.62	0.17	
May	2397.68	2503.18		105.50	840.30	924.47	84.17	52.98%	52.99%		0.00	0.12%	0.17%	0.05%	-43.58	-45.64	-2.06	
June	2411.33	2441.42		30.09	875.42	918.48	43.06	51.76%	52.04%		0.00	0.10%	0.15%	0.05%	-44.72	-44.86	-0.13	LoCI Controls Installed
July	2215.41	2251.57	2251.57	36.16	842.08	882.69	40.61	50.24%	50.40%	50.40%	0.0016	0.08%	0.31%	0.23%	-44.88	-48.10	-3.21	Late June 2019
August	2202.14		2540.81	338.67	843.87	956.07	112.20	50.38%		50.58%	0.0020	0.15%	0.38%	0.22%	-44.69	-49.55	-4.86	
September	2320.32		2686.06	365.73	845.55	1000.71	155.16	51.81%		50.18%	-0.0163	0.09%	0.26%	0.17%	-44.66	-49.44	-4.77	
October	2378.63		2706.36	327.72	834.76	986.15	151.39	53.25%		50.63%	-0.0262	0.13%	0.60%	0.47%	-44.70	-48.75	-4.05	
November	2223.88		2763.39	539.51	773.73	953.54	179.81	53.60%		51.85%	-0.0175	0.25%	0.32%	0.07%	-42.61	-49.72	-7.12	
December	2483.95		2625.16	141.21	862.58	914.70	52.13	54.15%		51.75%	-0.0240	0.12%	0.35%	0.24%	-46.02	-49.80	-3.78	

Results Trends





Return On Investment

- **2018 Average Net Generation (June-Dec) – 2.3 MW**
- **2019 Average Net Generation (June-Dec) – 2.6 MW**
  - *Percentage Generation Increase = 13%*

- **Return On Investment = 130%**
  - *Calculated After LoCI Costs*

- **ROI does NOT include reduction in labor time**

- **Reduced exposure to safety risk can't be quantified.**

Conclusions From Trial

- Automating increased flow and generation as advertised
  - *Approx 14% flow increase*
  - *Approx 13% generation increase*
- Automating helped increase vacuum without sacrificing gas quality.
- Automating reduced labor in gas field.
  - *Estimated 60%*
- Automating assists troubleshooting by having full visibility.
- Better data organization and viewing capabilities.
- Required good communication and interaction between EDL operations and LoCI to maximize success.