

NAME SEU-119 Ser11 Start Date: 13.01.2021
 Description Steam methane reforming with hydrogen extraction at 750 °C, 7.5 bar

Stack ID# 66-010
 Electrode: Ni-BCZY-Protonic
 Number of cells 36
 Total electrode area 531 cm²

Reaction Conditions				
Temperature:	750	C		
Pressure:	7.5	bar		
Feed:	Flow			Conc. mol%
	CH4	0.55	NL/min	23.5
	H2	0.34	NL/min	14.5
	He	0.03	NL/min	1.2
Sweep:	Flow			Conc. mol%
	H2O	1.14	g/min	60.7
	N2	1.5	NL/min	45.2
	H ₂ O	1.5	g/min	54.8

Current A	GC raw data - averaged integrated area of peaks							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
	He	H2	CH4	CO	N2	CO2	H2	N2
3.4	779921	68996002	1612227	757081	433621	14523643	9280126	7576904
20.1	923829	61015368	1225337	1058263	480680	22030708	34741768	5475998
35.1	1148258	50612440	649704	1320558	567440	33561420	47811569	4395531
50.2	1607244	31438040	173086	1415661	748672	60637428	56423408	3694778
57.2	2006736	15756094	65699	1074598	916667	90262692	59680154	3441326
61.2	2248003	4703787	30861	503280	1074176	115539529	61284204	3313660
62.2	2273763	2936901	23689	347146	1115482	120949669	61614871	3291231

Current	Concentration of gases - determined from GC peak areas (mol%)							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
A	He	H2	CH4	CO	N2	CO2	H2	N2
3.4	1.18 %	70.44 %	7.03 %	9.28 %	4.73 %	8.95 %	10.31 %	94.77 %
20.1	1.40 %	63.25 %	5.35 %	12.98 %	5.25 %	13.58 %	37.19 %	65.90 %
35.1	1.74 %	53.50 %	2.84 %	16.19 %	6.21 %	20.68 %	50.19 %	51.83 %
50.2	2.44 %	34.42 %	0.76 %	17.36 %	8.23 %	37.37 %	58.46 %	42.99 %
57.2	3.05 %	17.73 %	0.29 %	13.18 %	10.12 %	55.63 %	61.53 %	39.84 %
61.2	3.41 %	5.40 %	0.14 %	6.17 %	11.90 %	71.21 %	63.03 %	38.27 %
62.2	3.45 %	3.38 %	0.10 %	4.26 %	12.37 %	74.54 %	63.34 %	37.99 %

Summary							
Current	Current density	H2 flux	CH ₄ conv	CO yield	CO ₂ yield	Hydrogen recovery	Carbon balance
A	A cm ⁻²	NmL/min cm ²	%	%	%	%	%
3.4	0.038	0.29	71.7	35.6	36.1	8.3	110
20.1	0.227	1.52	83.2	40.7	42.6	38.3	120
35.1	0.397	2.62	92.8	40.8	52.1	61.1	120
50.2	0.567	3.69	98.6	31.3	67.3	82.8	120
57.2	0.646	4.20	99.6	19.1	80.5	93.0	120
61.2	0.692	4.46	99.8	8.0	91.9	98.1	120
62.2	0.702	4.51	99.9	5.4	94.5	98.8	120

NAME SEU-119 Ser10 Start Date: 12.01.2021
 Description Steam methane reforming with hydrogen extraction at 750 °C, 15 bar

Stack ID# 66-010
 Electrode: Ni-BCZY-Protonic
 Number of cells 36
 Total electrode area 531 cm²

Reaction Conditions				
Temperature:	750	C		
Pressure:	15	bar		
		Flow		Conc. mol%
Feed:	CH4	0.55	NL/min	23.5
	H2	0.34	NL/min	14.5
	He	0.03	NL/min	1.2
	H2O	1.14	g/min	60.7
		Flow		Conc. mol%
Sweep:	N2	1.5	NL/min	45.2
	H ₂ O	1.5	g/min	54.8

Current A	GC raw data - averaged integrated area of peaks							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
	He	H2	CH4	CO	N2	CO2	H2	N2
3.3	874006	62609658	2527995	599045	855257	14606210	9564473	7502914
20.1	1028535	54081340	2083570	789057	1015601	22395959	35568460	5358656
35.1	1220438	44600762	1332169	1011902	1163433	33563513	48503190	4288680
50.2	1542651	29409058	467924	1147378	1463225	53869155	57141006	3591466
57.2	1831856	16872895	204793	988401	1716431	73652313	60409923	3338898
62.2	2057639	6038587	76227	562460	2016044	94270868	62503072	3175166
64.2	2150146	2514266	36798	263203	2066412	105088492	63139849	3127356
65.2	2166590	1582322	21289	140436	2102007	108484007	63345849	3115584

Current	Concentration of gases - determined from GC peak areas (mol%)							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
A	He	H2	CH4	CO	N2	CO2	H2	N2
3.3	1.33 %	64.71 %	10.97 %	7.35 %	9.43 %	9.00 %	10.62 %	93.72 %
20.1	1.56 %	56.80 %	9.06 %	9.68 %	11.23 %	13.80 %	38.02 %	64.35 %
35.1	1.85 %	47.67 %	5.81 %	12.41 %	12.91 %	20.69 %	50.86 %	50.47 %
50.2	2.34 %	32.31 %	2.05 %	14.07 %	16.34 %	33.20 %	59.14 %	41.70 %
57.2	2.78 %	18.95 %	0.90 %	12.12 %	19.28 %	45.39 %	62.21 %	38.58 %
62.2	3.12 %	6.91 %	0.33 %	6.90 %	22.79 %	58.10 %	64.16 %	36.57 %
64.2	3.26 %	2.90 %	0.16 %	3.23 %	23.39 %	64.77 %	64.75 %	35.99 %
65.2	3.29 %	1.83 %	0.09 %	1.72 %	23.81 %	66.86 %	64.94 %	35.84 %

Current	Summary						
	Current density	H2 flux	CH ₄ conv	CO yield	CO ₂ yield	Hydrogen recovery	Carbon balance
	A cm ⁻²	NmL/min cm ²	%	%	%	%	%
3.3	0.037	0.28	59.8	26.9	33.0	9.7	109
20.1	0.227	1.48	72.2	29.7	42.4	42.9	110
35.1	0.397	2.54	85.1	31.9	53.2	64.5	111
50.2	0.567	3.57	95.8	28.5	67.3	82.7	111
57.2	0.646	4.07	98.5	20.8	77.7	91.7	111
62.2	0.702	4.39	99.5	10.6	88.9	97.3	110
64.2	0.725	4.52	99.8	4.7	95.0	98.9	110
65.2	0.736	4.54	99.9	2.5	97.4	99.3	110

NAME SEU-119 Ser9 Start Date: 11.01.2021
 Description Steam methane reforming with hydrogen extraction at 750 °C, 30 bar

Stack ID# 66-010
 Electrode: Ni-BCZY-Protonic
 Number of cells 36
 Total electrode area 531 cm²

Reaction Conditions				
Temperature:	750	C		
Pressure:	30	bar		
Flow				Conc. mol%
Feed:	CH4	0.55	NL/min	23.5
	H2	0.34	NL/min	14.5
	He	0.03	NL/min	1.2
	H2O	1.14	g/min	60.7
Flow				Conc. mol%
Sweep:	N2	1.5	NL/min	45.2
	H ₂ O	1.5	g/min	54.8

Current A	GC raw data - averaged integrated area of peaks							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
	He	H2	CH4	CO	N2	CO2	H2	N2
3.4	832208	48634769	3468167	342970	2151250	11385947	11048049	7426221
20.1	1009374	39779870	3444294	449249	2338717	18892137	38705136	5135129
35.1	1165845	31876441	2621037	620052	2462189	29607135	51488671	4079918
50.2	1406092	21689507	1383646	788195	2545151	47412413	59377568	3441669
57.2	1586924	14112764	761208	755348	2655056	61635735	62246854	3214941
62.2	1733101	6899374	412098	544259	2858869	75434302	64187956	3065970
65.2	1778036	3938619	222230	332266	2986101	83076528	65233649	2984318
67.2	1816798	1956838	66525	119217	3048283	90264443	65762964	2944663

Current	Concentration of gases - determined from GC peak areas (mol%)							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
A	He	H2	CH4	CO	N2	CO2	H2	N2
3.4	1.26 %	51.60 %	14.98 %	4.21 %	24.39 %	7.02 %	12.24 %	92.63 %
20.1	1.53 %	42.90 %	14.88 %	5.51 %	26.63 %	11.64 %	41.19 %	61.41 %
35.1	1.77 %	34.87 %	11.37 %	7.60 %	28.11 %	18.25 %	53.75 %	47.82 %
50.2	2.13 %	24.16 %	6.04 %	9.66 %	29.10 %	29.22 %	61.25 %	39.85 %
57.2	2.41 %	15.93 %	3.33 %	9.26 %	30.43 %	37.99 %	63.92 %	37.06 %
62.2	2.63 %	7.89 %	1.81 %	6.67 %	32.91 %	46.49 %	65.72 %	35.24 %
65.2	2.70 %	4.52 %	0.97 %	4.07 %	34.47 %	51.20 %	66.68 %	34.24 %
67.2	2.76 %	2.26 %	0.29 %	1.46 %	35.23 %	55.63 %	67.17 %	33.76 %

Summary							
Current	Current density	H2 flux	CH ₄ conv	CO yield	CO ₂ yield	Hydrogen recovery	Carbon balance
A	A cm ⁻²	NmL/min cm ²	%	%	%	%	%
3.4	0.038	0.24	42.8	16.1	26.8	9.9	109
20.1	0.227	1.31	53.5	17.2	36.3	46.3	110
35.1	0.397	2.29	69.5	20.4	49.0	68.1	111
50.2	0.567	3.32	86.6	21.5	65.0	84.4	111
57.2	0.646	3.82	93.4	18.3	75.1	91.4	111
62.2	0.702	4.14	96.7	12.1	84.6	96.2	110
65.2	0.736	4.29	98.3	7.3	91.0	97.9	110
67.2	0.759	4.39	99.5	2.5	96.9	99.0	110

NAME SEU-119 Ser14 Start Date: 21.01.2021
 Description Steam methane reforming with hydrogen extraction at 700 °C, 20 bar

Stack ID# 66-010
 Electrode: Ni-BCZY-Protonic
 Number of cells 36
 Total electrode area 531 cm²

Reaction Conditions				
Temperature:	700	C		
Pressure:	20	bar		
Flow				Conc. mol%
Feed:	CH4	0.55	NL/min	23.5
	H2	0.34	NL/min	14.5
	He	0.03	NL/min	1.2
	H2O	1.14	g/min	60.7
Flow				Conc. mol%
Sweep:	N2	1.5	NL/min	45.2
	H ₂ O	1.5	g/min	54.8

Current A	GC raw data - averaged integrated area of peaks							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
	He	H2	CH4	CO	N2	CO2	H2	N2
2.1	1146520	51951753	6023099	225166	1243083	11919644	5936331	7837599
20.1	1293421	35763647	5355640	320502	2024467	22431205	36777415	5290890
35.1	1415033	27562762	3853631	474488	2237344	36202644	49873765	4202907
50.2	1631399	17237563	2234000	586022	2392347	56206344	58381163	3514129
57.2	1858540	8270971	1465685	460173	2478251	75481829	61185041	3292578
62.2	1926317	3624324	820099	264375	2652420	87152325	63310549	3131011
65.9	2000120	1583836	346509	107828	2616231	97151966	64205477	3063606

Current	Concentration of gases - determined from GC peak areas (mol%)							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
A	He	H2	CH4	CO	N2	CO2	H2	N2
2.1	1.74 %	54.78 %	25.70 %	2.76 %	13.82 %	7.35 %	6.62 %	98.49 %
20.1	1.96 %	38.85 %	22.93 %	3.93 %	22.90 %	13.82 %	39.25 %	63.46 %
35.1	2.15 %	30.38 %	16.62 %	5.82 %	25.42 %	22.31 %	52.19 %	49.38 %
50.2	2.48 %	19.35 %	9.71 %	7.19 %	27.27 %	34.64 %	60.31 %	40.74 %
57.2	2.82 %	9.43 %	6.39 %	5.64 %	28.30 %	46.52 %	62.94 %	38.01 %
62.2	2.92 %	4.17 %	3.59 %	3.24 %	30.40 %	53.71 %	64.91 %	36.03 %
65.9	3.04 %	1.83 %	1.52 %	1.32 %	29.96 %	59.88 %	65.74 %	35.21 %

Summary							
Current	Current density	H2 flux	CH ₄ conv	CO yield	CO ₂ yield	Hydrogen recovery	Carbon balance
A	A cm ⁻²	NmL/min cm ²	%	%	%	%	%
2.1	0.023	0.17	28.2	7.7	20.5	8.8	108
20.1	0.227	1.40	43.6	9.7	34.0	56.5	109
35.1	0.397	2.38	62.8	13.0	49.8	75.6	110
50.2	0.567	3.40	81.1	14.0	67.1	88.9	110
57.2	0.646	3.90	89.1	9.6	79.4	95.5	109
62.2	0.702	4.20	94.1	5.4	88.7	98.2	109
65.9	0.745	4.41	97.6	2.1	95.5	99.3	109

NAME SEU-119 Ser13 Start Date: 20.01.2021
 Description Steam methane reforming with hydrogen extraction at 725 °C, 20 bar

Stack ID# 66-010
 Electrode: Ni-BCZY-Protonic
 Number of cells 36
 Total electrode area 531 cm²

Reaction Conditions				
Temperature:	725	C		
Pressure:	20	bar		
Flow				Conc. mol%
Feed:	CH4	0.55	NL/min	23.5
	H2	0.34	NL/min	14.5
	He	0.03	NL/min	1.2
	H2O	1.14	g/min	60.7
Flow				Conc. mol%
Sweep:	N2	1.5	NL/min	45.2
	H ₂ O	1.5	g/min	54.8

Current A	GC raw data - averaged integrated area of peaks							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
	He	H2	CH4	CO	N2	CO2	H2	N2
2.6	980667	57372459	4552425	362181	1020035	13762908	7477037	7743566
20.1	1117910	42582703	4150667	458222	1699680	22616262	36499374	5340499
35.1	1263381	32790095	3054706	617891	1991949	34749946	49788210	4240696
50.2	1499436	20872534	1651968	766182	2223956	53904911	58288520	3548267
57.2	1728174	11738541	964397	710095	2322103	71402169	61255230	3308586
50.9	1823758	4714386	490687	420452	2654818	84535719	63741863	3117505
65.9	1916061	1664224	206128	139821	2663798	96552209	64419107	3064637

Current	Concentration of gases - determined from GC peak areas (mol%)							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
A	He	H2	CH4	CO	N2	CO2	H2	N2
2.6	1.49 %	59.89 %	19.56 %	4.44 %	11.29 %	8.48 %	8.32 %	97.14 %
20.1	1.70 %	45.69 %	17.87 %	5.62 %	19.09 %	13.94 %	38.97 %	64.11 %
35.1	1.92 %	35.81 %	13.22 %	7.58 %	22.51 %	21.42 %	52.11 %	49.86 %
50.2	2.28 %	23.28 %	7.20 %	9.39 %	25.26 %	33.22 %	60.22 %	41.16 %
57.2	2.62 %	13.30 %	4.22 %	8.71 %	26.43 %	44.01 %	63.00 %	38.21 %
50.9	2.77 %	5.41 %	2.15 %	5.16 %	30.43 %	52.10 %	65.31 %	35.87 %
65.9	2.91 %	1.92 %	0.90 %	1.71 %	30.54 %	59.51 %	65.93 %	35.22 %

Summary							
Current	Current density	H2 flux	CH ₄ conv	CO yield	CO ₂ yield	Hydrogen recovery	Carbon balance
A	A cm ⁻²	NmL/min cm ²	%	%	%	%	%
2.6	0.029	0.21	39.8	13.7	26.1	8.9	115
20.1	0.227	1.39	52.2	15.0	37.2	48.7	116
35.1	0.397	2.36	68.7	18.0	50.7	69.9	116
50.2	0.567	3.36	85.5	18.9	66.7	85.8	115
57.2	0.646	3.88	92.6	15.3	77.3	93.4	114
50.9	0.703	4.19	96.4	8.7	87.7	97.5	113
65.9	0.745	4.36	98.5	2.8	95.8	99.2	113

NAME SEU-119 Ser12 Start Date: 19.01.2021
 Description Steam methane reforming with hydrogen extraction at 750 °C, 20 bar

Stack ID# 66-010
 Electrode: Ni-BCZY-Protonic
 Number of cells 36
 Total electrode area 531 cm²

Reaction Conditions				
Temperature:	750	C		
Pressure:	20	bar		
			Flow	Conc. mol%
Feed:	CH4	0.55	NL/min	23.5
	H2	0.34	NL/min	14.5
	He	0.03	NL/min	1.2
	H2O	1.14	g/min	60.7
			Flow	Conc. mol%
Sweep:	N2	1.5	NL/min	45.2
	H ₂ O	1.5	g/min	54.8

Current A	GC raw data - averaged integrated area of peaks							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
	He	H2	CH4	CO	N2	CO2	H2	N2
3.6	802412	57215862	2895618	482222	1381940	13721480	10348841	7512829
20.1	903548	47538088	2473828	612988	1763147	20211989	37560001	5256254
35.2	1013900	37704404	1731852	780077	2176494	28065444	51267552	4119222
50.2	1229894	26191226	775811	954428	2447069	42823431	59668490	3442328
50.2	1387172	26821016	717027	1022174	1921564	50832308	58380181	3547006
57.2	1566374	16686902	289242	941862	2222444	64844845	61697778	3285395
62.2	1721332	8134526	135541	657647	2489440	79690715	63751842	3129098
65.9	1834388	1797867	127097	160570	2706089	95361636	64775791	3051044

Current	Concentration of gases - determined from GC peak areas (mol%)							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
A	He	H2	CH4	CO	N2	CO2	H2	N2
3.6	1.22 %	59.74 %	12.54 %	5.91 %	15.41 %	8.46 %	11.47 %	93.86 %
20.1	1.37 %	50.54 %	10.74 %	7.52 %	19.82 %	12.46 %	40.04 %	63.00 %
35.2	1.54 %	40.81 %	7.54 %	9.57 %	24.69 %	17.30 %	53.54 %	48.32 %
50.2	1.87 %	28.94 %	3.39 %	11.70 %	27.93 %	26.39 %	61.52 %	39.85 %
50.2	2.11 %	29.61 %	3.14 %	12.53 %	21.68 %	31.33 %	60.31 %	41.15 %
57.2	2.38 %	18.75 %	1.27 %	11.55 %	25.24 %	39.96 %	63.41 %	37.92 %
62.2	2.61 %	9.28 %	0.59 %	8.06 %	28.43 %	49.11 %	65.32 %	36.01 %
65.9	2.78 %	2.07 %	0.56 %	1.97 %	31.05 %	58.77 %	66.26 %	35.06 %

Summary							
Current	Current density	H2 flux	CH ₄ conv	CO yield	CO ₂ yield	Hydrogen recovery	Carbon balance
A	A cm ⁻²	NmL/min cm ²	%	%	%	%	%
3.6	0.041	0.27	53.4	22.0	31.4	9.2	116
20.1	0.227	1.34	65.0	24.5	40.6	40.2	118
35.2	0.397	2.25	78.1	27.8	50.3	60.9	118
50.2	0.567	3.22	91.8	28.2	63.6	79.2	117
50.2	0.567	3.43	93.3	26.7	66.7	81.8	118
57.2	0.646	3.88	97.6	21.9	75.7	90.1	117
62.2	0.702	4.19	99.0	14.0	85.0	95.6	116
65.9	0.744	4.33	99.1	3.2	95.9	99.1	116

NAME SEU-119 Ser15 Start Date: 22.01.2021
 Description Steam methane reforming with hydrogen extraction at 775 °C, 20 bar

Stack ID# 66-010
 Electrode: Ni-BCZY-Protonic
 Number of cells 36
 Total electrode area 531 cm²

Reaction Conditions				
Temperature:	775		C	
Pressure:	20		bar	
Flow				Conc. mol%
Feed:	CH4	0.55	NL/min	23.5
	H2	0.34	NL/min	14.5
	He	0.03	NL/min	1.2
	H2O	1.14	g/min	60.7
Flow				Conc. mol%
Sweep:	N2	1.5	NL/min	45.2
	H ₂ O	1.5	g/min	54.8

Current A	GC raw data - averaged integrated area of peaks							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
	He	H2	CH4	CO	N2	CO2	H2	N2
3.6	880409	63169159	2440920	645987	874796	14055676	9837991	7541902
20.1	1015005	53881837	1923111	822297	1144113	21171319	36140946	5355006
35.1	1186746	43902345	1213657	1019521	1404184	31109258	49330145	4256094
50.2	1470834	29233497	398779	1144067	1803398	48647562	58213274	3535164
57.2	1751575	17904736	118191	1005130	1991326	67376486	61154242	3304522
61.2	1951623	9013231	42138	712754	2213261	83362255	62721926	3182265
64.2	1992109	4638847	20367	414870	2461915	91441905	64097868	3074834
65.2	2045861	2194804	12111	203783	2548153	97925854	64456254	3047892

Current	Concentration of gases - determined from GC peak areas (mol%)							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
A	He	H2	CH4	CO	N2	CO2	H2	N2
3.6	1.34 %	65.22 %	10.60 %	7.92 %	9.65 %	8.66 %	10.92 %	94.27 %
20.1	1.54 %	56.61 %	8.37 %	10.08 %	12.69 %	13.05 %	38.60 %	64.30 %
35.1	1.80 %	46.99 %	5.30 %	12.50 %	15.67 %	19.17 %	51.66 %	50.05 %
50.2	2.23 %	32.13 %	1.75 %	14.03 %	20.29 %	29.98 %	60.15 %	41.00 %
57.2	2.66 %	20.08 %	0.52 %	12.32 %	22.50 %	41.52 %	62.91 %	38.16 %
61.2	2.96 %	10.26 %	0.19 %	8.74 %	25.13 %	51.38 %	64.36 %	36.66 %
64.2	3.02 %	5.32 %	0.09 %	5.09 %	28.10 %	56.36 %	65.64 %	35.34 %
65.2	3.10 %	2.53 %	0.05 %	2.50 %	29.14 %	60.35 %	65.97 %	35.02 %

Summary							
Current	Current density	H2 flux	CH ₄ conv	CO yield	CO ₂ yield	Hydrogen recovery	Carbon balance
A	A cm ⁻²	NmL/min cm ²	%	%	%	%	%
3.6	0.040	0.29	61.0	29.1	31.9	9.9	107
20.1	0.227	1.47	73.4	32.0	41.4	42.4	108
35.1	0.397	2.50	85.7	33.8	51.9	63.9	108
50.2	0.567	3.53	96.2	30.7	65.5	81.9	108
57.2	0.646	4.02	99.0	22.7	76.4	90.7	108
61.2	0.692	4.28	99.7	14.5	85.2	95.8	107
64.2	0.725	4.45	99.9	8.3	91.6	97.9	107
65.2	0.736	4.50	99.9	4.0	95.9	99.0	107

NAME SEU-119 Ser25 Start Date: 24.03.2021
 Description Steam methane reforming of biogas with hydrogen extraction at 750 °C, 20 bar

Stack ID# 66-010
 Electrode: Ni-BCZY-Protonic
 Number of cells 36
 Total electrode area 531 cm²

Reaction Conditions				
Temperature:	750	C		
Pressure:	20	bar		
Flow				Conc. mol%
Feed:	CH4	0.55	NL/min	20.3
	CO2	0.80	NL/min	13.6
	H2	0.34	NL/min	12.6
	He	0.03	NL/min	1.1
	H2O	1.14	g/min	52.5
Flow				Conc. mol%
Sweep:	N2	1.5	NL/min	57.9
	H ₂ O	0.9	g/min	42.1

Current A	GC raw data - averaged integrated area of peaks							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
	He	H2	CH4	CO	N2	CO2	H2	N2
2.6	938179	52058466	3282403	1118805	66164	33679422	8997855	7585208
20.1	1020172	41775902	2296325	1272213	451998	44528926	34946428	5570174
35.1	1073473	34337654	1190085	1362091	763217	54798633	47978806	4490100
50.2	1058979	28154730	247160	1114611	1327554	64465388	57031453	3757542
57.2	1474676	13838659	66675	927647	612977	105845474	59542672	3543416
64.2	1622533	5135429	8404	111953	563399	136851464	61684236	3355114

Current	Concentration of gases - determined from GC peak areas (mol%)							
	Retentate - MS5A TCD					Retentate - PPU TCD	Permeate - MS5A TCD	
A	He	H2	CH4	CO	N2	CO2	H2	N2
2.6	1.42 %	54.88 %	14.19 %	13.72 %	0.72 %	20.76 %	10.00 %	94.89 %
20.1	1.55 %	44.89 %	9.97 %	15.60 %	4.94 %	27.44 %	37.39 %	67.16 %
35.1	1.63 %	37.40 %	5.20 %	16.70 %	8.40 %	33.77 %	50.35 %	53.04 %
50.2	1.61 %	31.00 %	1.08 %	13.67 %	14.79 %	39.73 %	59.04 %	43.77 %
57.2	2.24 %	15.62 %	0.29 %	11.37 %	6.72 %	65.23 %	61.40 %	41.10 %
64.2	2.46 %	5.89 %	0.04 %	1.37 %	6.17 %	84.34 %	63.40 %	38.78 %

Summary							
Current	Current density	H2 flux	CH ₄ conv	CO yield	CO ₂ yield	Hydrogen recovery	Carbon balance
A	A cm ⁻²	NmL/min cm ²	%	%	%	%	%
2.6	0.029	0.30	50.5	46.5	5.3	13.3	104
20.1	0.227	1.52	66.1	46.8	23.3	49.1	108
35.1	0.397	2.48	83.2	47.8	37.4	66.6	108
50.2	0.567	3.23	96.4	40.1	56.7	75.5	107
57.2	0.646	4.09	99.3	24.4	75.0	91.9	104
64.2	0.725	4.53	99.9	2.7	97.3	97.4	102

NAME	SEU-119 Ser8	Start Date:	08.01.2021
Description	Steam methane reforming with hydrogen extraction at 750 °C, 25 bar and various Δp		

Stack ID#	66-010
Electrode:	Ni-BCZY-Protonic
Number of cells	36
Total electrode area	531 cm ²

Reaction Conditions				
Temperature:	750	C		
Pressure:	25	bar		
Current:	61.2	A		
Flow				Conc. mol%
Feed:	CH4	0.55	NL/min	23.5
	H2	0.34	NL/min	14.5
	He	0.03	NL/min	1.2
	H2O	1.14	g/min	60.7
Flow				Conc. mol%
Sweep:	N2	0.0	NL/min	0.0
	H ₂ O	0.6	g/min	100.0

Δp bar	GC raw data - averaged integrated area of permeate peaks		
	MS5A TCD		PPU TCD
	CH4	CO	CO2
0.00	18037	27797	52465
0.49	13553	13974	25628
0.98	11624	9340	15264
2.00	9353	4628	6890
3.98	7247	1170	1570
5.99	5932	0	0

Δp bar	Impurity concentrations in permeate (ppm)		
	MS5A TCD		PPU TCD
	CH4	CO	CO2
0.00	164	225	237
0.49	125	125	116
0.98	107	86	69
2.00	87	44	31
3.98	68	11	7
5.99	56	0	0

