**300 MW interconnect**

**No penalties**

Chart, shape

Description automatically generated

FINISHED

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

RUN PARAMETERS

objective: aep

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 300.0

absolute\_min\_energy: 0.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 1

shadow\_type: 1

design variables: array([1.3650793650793651e+03, 2.2000000000000000e+01,

0.0000000000000000e+00, 1.0000000000000000e+00,

1.3015873015873017e+03, 4.0000000000000000e+03,

1.2466637514245216e-01, 2.3935944027350806e+00,

2.4521797323946398e+03, 1.9055394553748747e+03,

7.3015873015873012e+02, 5.6648426484499396e+02,

1.6332146967832705e+02, 4.1142446564719539e+03,

4.7910994606655067e+03, 6.0000000000000000e+02])

capacity solar: 953.6304655347187

capacity wind: 119.0

capacity battery: 600.0

cost solar: 1006.4665690019319

cost wind: 179.55189823489337

cost\_battery: 422.3223446089376

cost\_om: 61.8873272247846

annual cost: 163.21279837106763

total energy: 1835.5809908897952

penalty: 0.0

coe: 88.91615198736095

aep: -1.835580990889795

pro: 53.077938917679965

opt\_val: -1835580.9908897951

run time: 2903.8715550899506

function calls: 13358

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: coe

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 300.0

absolute\_min\_energy: 0.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 1

shadow\_type: 1

design variables: array([ 1.3968253968253969e+03, 0.0000000000000000e+00,

0.0000000000000000e+00, 8.0000000000000000e+00,

2.0571428571428569e+03, 2.1650793650793648e+03,

-1.4211966766239541e+00, 4.3882564050143147e+00,

6.5219769518815974e+02, -1.0949470755469579e+03,

2.5396825396825398e+02, 1.9378991503356456e+03,

2.2926990077518858e+03, 1.5428417461769827e+03,

6.9688719427861915e+03, 0.0000000000000000e+00])

capacity solar: 303.92064637432463

capacity wind: 0.0

capacity battery: 0.0

cost solar: 327.59221800222093

cost wind: 0.0

cost\_battery: 0.0

cost\_om: 11.245063915850011

annual cost: 31.883373649989935

total energy: 912.6436052821543

penalty: 0.0

coe: 34.93518550445858

aep: -0.9126436052821543

pro: -22.875242666939332

opt\_val: 34.93518550445858

run time: 1131.676591873169

function calls: 6170

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: pro

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 300.0

absolute\_min\_energy: 0.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 1

shadow\_type: 1

design variables: array([ 3.8095238095238096e+02, 2.2000000000000000e+01,

1.1000000000000000e+01, 1.0000000000000000e+01,

1.5714285714285716e+03, 9.7777777777777783e+02,

8.2279807594018406e-01, 4.8869219055841233e+00,

-1.7477783544204801e+03, 2.6798585601288969e+03,

9.3650793650793651e+02, 1.2521917075903198e+03,

9.3764057443234833e+02, 2.5714029102949712e+03,

2.3229573142620638e+03, 0.0000000000000000e+00])

capacity solar: 295.2046375898578

capacity wind: 182.0

capacity battery: 0.0

cost solar: 318.6380216173995

cost wind: 269.08533413928853

cost\_battery: 0.0

cost\_om: 17.65657159082474

annual cost: 54.683143003496085

total energy: 1431.143079969312

penalty: 0.0

coe: 38.209417191654

aep: -1.4311430799693121

pro: -16.87401099496951

opt\_val: -16.87401099496951

run time: 2947.447278022766

function calls: 11528

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: pro

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 300.0

absolute\_min\_energy: 0.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 2

shadow\_type: 1

design variables: array([ 1.2698412698412699e+02, 1.0000000000000000e+00,

4.0000000000000000e+00, 1.4000000000000000e+01,

7.0793650793650795e+02, 2.3269841269841272e+03,

1.4211966766239543e+00, 2.6927937030769655e+00,

-7.1921719030249164e+02, -2.2383808269868359e+02,

8.8888888888888891e+02, -2.0906320757931430e+03,

-2.2383808269868359e+02, 7.9713490219144105e+03,

1.7422179856965479e+03, 0.0000000000000000e+00])

capacity solar: 333.22318982966385

capacity wind: 0.0

capacity battery: 0.0

cost solar: 357.68326744657617

cost wind: 0.0

cost\_battery: 0.0

cost\_om: 12.329258023697562

annual cost: 34.863303872831864

total energy: 985.6511464617973

penalty: 0.0

coe: 35.370834800914146

aep: -0.9856511464617973

pro: -18.041044117440364

opt\_val: -18.041044117440364

run time: 1045.5818798542023

function calls: 5536

Chart, radar chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: pro

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 300.0

absolute\_min\_energy: 0.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 3

shadow\_type: 1

design variables: array([1.3650793650793651e+03, 2.1000000000000000e+01,

1.3000000000000000e+01, 1.1000000000000000e+01,

1.4634920634920636e+03, 6.0000000000000000e+02,

7.2306497582622242e-01, 4.3882564050143147e+00,

2.1950394413651425e+03, 7.4406079824384278e+02,

7.9365079365079373e+02, 3.9505740415866239e+02,

5.5048102205533769e+02, 1.1571313096327372e+03,

2.9036966428275800e+03, 0.0000000000000000e+00])

capacity solar: 166.05260864429508

capacity wind: 224.0

capacity battery: 0.0

cost solar: 185.1159839674901

cost wind: 327.09312528301626

cost\_battery: 0.0

cost\_om: 14.431946519838919

annual cost: 46.70112040262082

total energy: 1229.255041289913

penalty: 0.0

coe: 37.991400347331684

aep: -1.229255041289913

pro: -7.9007364355506

opt\_val: -7.9007364355506

run time: 2804.3121960163116

function calls: 10017

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: coe

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 300.0

absolute\_min\_energy: 0.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.9

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 1

shadow\_type: 1

design variables: array([ 3.8095238095238096e+02, 1.5000000000000000e+01,

1.2000000000000000e+01, 5.0000000000000000e+00,

1.6793650793650793e+03, 3.7301587301587301e+03,

-1.0721308262250882e+00, 1.0970641012535787e+00,

-1.8334917847636459e+03, -1.2885268517354632e+03,

7.6190476190476193e+02, 2.9664603144536336e+03,

-1.2885268517354632e+03, 2.8285432013244681e+03,

0.0000000000000000e+00, 0.0000000000000000e+00])

capacity solar: 0.0

capacity wind: 119.0

capacity battery: 0.0

cost solar: 0.0

cost wind: 179.55189823489337

cost\_battery: 0.0

cost\_om: 4.403

annual cost: 15.714769588798283

total energy: 410.7718009607952

penalty: 0.0

coe: 38.2566903376557

aep: -0.4107718009607952

pro: -4.823820459241478

opt\_val: 38.2566903376557

run time: 1255.100135087967

function calls: 6590

**600 MW interconnect**

**No penalties**

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: aep

interconnect: 600.0

max\_capacity: 1e+16

penalty\_min\_energy: 600.0

absolute\_min\_energy: 0.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 1

shadow\_type: 1

design variables: array([ 5.7142857142857144e+02, 2.2000000000000000e+01,

1.5000000000000000e+01, 3.0000000000000000e+00,

2.2190476190476193e+03, 3.1365079365079364e+03,

-1.3214635765099922e+00, 5.9839860068377018e+00,

2.0236125806788109e+03, 2.8734383363174020e+03,

9.0476190476190482e+02, -8.9064405098882298e+02,

2.2926990077518858e+03, 7.0713580033111712e+03,

9.0014595927654973e+03, 1.2000000000000000e+03])

capacity solar: 1119.1667106494338

capacity wind: 63.0

capacity battery: 1200.0

cost solar: 1183.9603228959727

cost wind: 101.28191722167449

cost\_battery: 847.5334505796318

cost\_om: 88.14016829402904

annual cost: 222.5050368079576

total energy: 3019.4236535315467

penalty: 0.0

coe: 73.69122797581372

aep: -3.019423653531547

pro: 71.53385413138027

opt\_val: -3019423.6535315467

run time: 1768.6012330055237

function calls: 8645

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: coe

interconnect: 600.0

max\_capacity: 1e+16

penalty\_min\_energy: 600.0

absolute\_min\_energy: 0.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 1

shadow\_type: 1

design variables: array([ 3.1746031746031747e+01, 0.0000000000000000e+00,

1.4000000000000000e+01, 2.0000000000000000e+00,

1.5714285714285716e+03, 2.5428571428571431e+03,

-1.2217304763960306e+00, 5.9839860068377018e+00,

3.0521737447967994e+03, 1.8087495672806226e+03,

9.0476190476190482e+02, -8.0493062064565743e+02,

2.6011135777257959e+02, 4.6285252385309486e+03,

3.4844359713930958e+03, 0.0000000000000000e+00])

capacity solar: 601.7956815500248

capacity wind: 0.0

capacity battery: 0.0

cost solar: 635.3560486298112

cost wind: 0.0

cost\_battery: 0.0

cost\_om: 22.26644021735092

annual cost: 62.29387128102901

total energy: 1807.4857745726708

penalty: 0.0

coe: 34.464377068614354

aep: -1.807485774572671

pro: -28.080417447604535

opt\_val: 34.464377068614354

run time: 892.3357908725739

function calls: 4831

Chart, scatter chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: coe

interconnect: 600.0

max\_capacity: 1e+16

penalty\_min\_energy: 600.0

absolute\_min\_energy: 0.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.9

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 1

shadow\_type: 1

design variables: array([ 7.9365079365079373e+02, 7.0000000000000000e+00,

7.0000000000000000e+00, 1.1000000000000000e+01,

8.6984126984126988e+02, 1.5174603174603176e+03,

-7.4799825085471117e-02, 3.0917261035328125e+00,

5.2203682785999717e+01, 1.0344304625266009e+03,

9.0476190476190482e+02, 1.9378991503356456e+03,

2.6011135777257959e+02, 5.6570864026489362e+03,

0.0000000000000000e+00, 0.0000000000000000e+00])

capacity solar: 0.0

capacity wind: 112.0

capacity battery: 0.0

cost solar: 0.0

cost wind: 169.59088621355775

cost\_battery: 0.0

cost\_om: 4.144

annual cost: 14.828225831454139

total energy: 382.02665387017515

penalty: 0.0

coe: 38.81463683550532

aep: -0.38202665387017515

pro: -4.27310686205462

opt\_val: 38.81463683550532

run time: 1237.9169228076935

function calls: 5068

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: pro

interconnect: 600.0

max\_capacity: 1e+16

penalty\_min\_energy: 600.0

absolute\_min\_energy: 0.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 1

shadow\_type: 1

design variables: array([ 3.4920634920634922e+02, 2.2000000000000000e+01,

1.4000000000000000e+01, 8.0000000000000000e+00,

1.6793650793650793e+03, 7.0793650793650795e+02,

7.2306497582622242e-01, 5.2858543060399699e+00,

-2.0906320757931430e+03, -2.8371650612435060e+03,

9.0476190476190482e+02, 1.9378991503356456e+03,

9.3764057443234833e+02, 5.1428058205899424e+03,

3.4844359713930958e+03, 0.0000000000000000e+00])

capacity solar: 630.3660591276325

capacity wind: 154.0

capacity battery: 0.0

cost solar: 665.1786677202962

cost wind: 229.79765853818964

cost\_battery: 0.0

cost\_om: 29.021544187722405

annual cost: 85.405052742007

total energy: 2357.593838414124

penalty: 0.0

coe: 36.225515756970324

aep: -2.3575938384141244

pro: -32.47463917869921

opt\_val: -32.47463917869921

run time: 2113.1163759231567

function calls: 8055

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: pro

interconnect: 600.0

max\_capacity: 1e+16

penalty\_min\_energy: 600.0

absolute\_min\_energy: 0.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 2

shadow\_type: 1

design variables: array([ 1.0476190476190477e+03, 0.0000000000000000e+00,

1.2000000000000000e+01, 1.0000000000000000e+01,

1.6253968253968253e+03, 9.7777777777777783e+02,

-1.2715970264530114e+00, 6.0837191069516630e+00,

-1.4049246330478172e+03, -1.2885268517354632e+03,

9.0476190476190482e+02, -8.9064405098882298e+02,

-2.5467953969607479e+03, 4.7570953840456968e+03,

8.1303505999172230e+03, 0.0000000000000000e+00])

capacity solar: 664.458796975983

capacity wind: 0.0

capacity battery: 0.0

cost solar: 700.838310155443

cost wind: 0.0

cost\_battery: 0.0

cost\_om: 24.58497548811137

annual cost: 68.73778902790427

total energy: 1967.3286521103232

penalty: 0.0

coe: 34.93965736440137

aep: -1.9673286521103233

pro: -36.868064966043086

opt\_val: -36.868064966043086

run time: 609.412162065506

function calls: 3255

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: pro

interconnect: 600.0

max\_capacity: 1e+16

penalty\_min\_energy: 600.0

absolute\_min\_energy: 0.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 3

shadow\_type: 1

design variables: array([ 3.1746031746031747e+02, 2.2000000000000000e+01,

1.5000000000000000e+01, 1.1000000000000000e+01,

8.1587301587301590e+02, 8.1587301587301590e+02,

-2.7426602531339461e-01, 2.1941282025071573e+00,

1.1664782772471540e+03, 1.4215900149036115e+03,

7.7777777777777783e+02, 2.6236065930809714e+03,

-2.2383808269868359e+02, 7.9713490219144105e+03,

2.6133269785448219e+03, 0.0000000000000000e+00])

capacity solar: 574.2896296926083

capacity wind: 189.0

capacity battery: 0.0

cost solar: 606.6968818874604

cost wind: 278.7925411917686

cost\_battery: 0.0

cost\_om: 28.241716298626503

annual cost: 84.02754995261795

total energy: 2323.2558665570673

penalty: 0.0

coe: 36.168013675197116

aep: -2.323255866557067

pro: -13.739871462288692

opt\_val: -13.739871462288692

run time: 4138.184227228165

function calls: 15882

**300 MW interconnect**

**No penalties**

**10% required min power**

**Chart

Description automatically generated**

FINISHED

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RUN PARAMETERS

objective: coe

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 30.0

absolute\_min\_energy: 30.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 1

shadow\_type: 1

design variables: array([ 1.1746031746031747e+03, 2.1000000000000000e+01,

1.2000000000000000e+01, 1.0000000000000000e+00,

7.6190476190476193e+02, 3.0825396825396824e+03,

-8.7266462599716466e-01, 2.4933275028490423e+00,

1.0807648469039882e+03, 3.2605978886944122e+03,

2.3809523809523810e+02, -1.1922317790033162e+02,

8.4085068633809578e+02, 1.9285521827212283e+03,

3.4844359713930958e+03, 3.0476190476190476e+02])

capacity solar: 332.1052172885901

capacity wind: 147.0

capacity battery: 304.76190476190476

cost solar: 356.53536154656115

cost wind: 219.8096904058116

cost\_battery: 218.97089252642706

cost\_om: 29.003083515868305

annual cost: 79.1079880180327

total energy: 1405.4749694758311

penalty: 0.0

coe: 56.285590093102726

aep: -1.405474969475831

pro: 8.83423954424113

opt\_val: 56.285590093102726

run time: 854.2098491191864

function calls: 3940

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: coe

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 45.0

absolute\_min\_energy: 45.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 1

shadow\_type: 1

design variables: array([ 4.4444444444444446e+02, 2.1000000000000000e+01,

1.2000000000000000e+01, 7.0000000000000000e+00,

1.6793650793650793e+03, 6.0000000000000000e+02,

-7.7293152588320302e-01, 3.3909254038746974e+00,

-1.6620649240773146e+03, -5.1420774698144169e+02,

7.3015873015873012e+02, -1.6620649240773146e+03,

5.5048102205533769e+02, 6.5570774212521765e+03,

1.7422179856965479e+03, 4.8571428571428572e+02])

capacity solar: 321.943967687741

capacity wind: 203.0

capacity battery: 485.7142857142857

cost solar: 346.1018501127418

cost wind: 298.14190027257416

cost\_battery: 343.17238964269484

cost\_om: 37.39435537587499

annual cost: 99.60157219763967

total energy: 1522.7924591926508

penalty: 0.0

coe: 65.40718769414323

aep: -1.522792459192651

pro: 23.461949238007143

opt\_val: 65.40718769414323

run time: 2339.7298221588135

function calls: 9214

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: pro

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 30.0

absolute\_min\_energy: 30.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 1

shadow\_type: 1

design variables: array([ 9.8412698412698410e+02, 2.1000000000000000e+01,

1.3000000000000000e+01, 7.0000000000000000e+00,

1.7333333333333333e+03, 3.1904761904761904e+03,

-1.3713301265669733e+00, 4.3882564050143147e+00,

3.0521737447967994e+03, 3.2605978886944122e+03,

9.8412698412698410e+02, -1.6620649240773146e+03,

-2.2383808269868359e+02, 6.9427878577964220e+03,

1.7422179856965479e+03, 3.0476190476190476e+02])

capacity solar: 325.84307388991743

capacity wind: 133.0

capacity battery: 304.76190476190476

cost solar: 350.1055020240149

cost wind: 199.67059233332265

cost\_battery: 218.97089252642706

cost\_om: 28.253384210117417

annual cost: 76.68444438379458

total energy: 1358.306868025531

penalty: 0.0

coe: 56.45590564911523

aep: -1.358306868025531

pro: 8.769100982518047

opt\_val: 8.769100982518047

run time: 1170.322889328003

function calls: 5208

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: pro

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 30.0

absolute\_min\_energy: 30.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 2

shadow\_type: 1

design variables: array([ 1.8095238095238096e+03, 6.0000000000000000e+00,

1.4000000000000000e+01, 1.0000000000000000e+00,

3.8380952380952381e+03, 2.7587301587301586e+03,

-1.4211966766239541e+00, 4.9866550056980845e+00,

4.8077083450182818e+02, -9.9815718745270510e+02,

3.0158730158730157e+02, -2.0493660824349740e+02,

-2.1596358445837373e+03, 1.5428417461769827e+03,

7.8399809356344658e+03, 3.0476190476190476e+02])

capacity solar: 326.4028914948716

capacity wind: 42.0

capacity battery: 304.76190476190476

cost solar: 350.68032004804206

cost wind: 67.79606560553464

cost\_battery: 218.97089252642706

cost\_om: 24.907097461500722

annual cost: 65.06627598684096

total energy: 1103.8094526303391

penalty: 0.0

coe: 58.947018284532994

aep: -1.1038094526303392

pro: 7.502897342769123

opt\_val: 7.502897342769123

run time: 1858.9140973091125

function calls: 9573

Chart, scatter chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: pro

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 30.0

absolute\_min\_energy: 30.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 3

shadow\_type: 1

design variables: array([ 2.8571428571428572e+02, 2.2000000000000000e+01,

1.4000000000000000e+01, 1.4000000000000000e+01,

1.6253968253968253e+03, 1.0857142857142858e+03,

3.7399912542735647e-01, 4.6874557053561992e+00,

1.5093319986198167e+03, 2.4862787839403909e+03,

8.5714285714285711e+02, -6.3350375995932586e+02,

1.3248001268093594e+03, 1.5428417461769827e+03,

3.4844359713930958e+03, 3.1428571428571428e+02])

capacity solar: 253.67685200831903

capacity wind: 182.0

capacity battery: 314.2857142857143

cost solar: 275.9243635256619

cost wind: 269.08533413928853

cost\_battery: 225.49181893858616

cost\_om: 27.748614952879237

annual cost: 76.29021049890206

total energy: 1337.998495009839

penalty: 0.0

coe: 57.01815867763069

aep: -1.3379984950098391

pro: 18.020461836884408

opt\_val: 18.020461836884408

run time: 3629.2747399806976

function calls: 12363

**600 MW interconnect**

**No penalties**

**10% required min power**

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: aep

interconnect: 600.0

max\_capacity: 1e+16

penalty\_min\_energy: 60.0

absolute\_min\_energy: 60.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 1

shadow\_type: 1

design variables: array([ 2.8571428571428572e+02, 2.0000000000000000e+01,

3.0000000000000000e+00, 0.0000000000000000e+00,

2.1111111111111113e+03, 1.3555555555555557e+03,

-7.4799825085471117e-02, 4.7871888054701612e+00,

2.4521797323946398e+03, -1.0949470755469579e+03,

8.0952380952380952e+02, 2.2807528717083082e+03,

6.6531581584074047e+01, 7.9713490219144105e+03,

4.9362842928068858e+03, 8.3809523809523807e+02])

capacity solar: 1102.7062524932958

capacity wind: 70.0

capacity battery: 838.0952380952381

cost solar: 1166.2285057634542

cost wind: 111.45958906509158

cost\_battery: 589.1188192956715

cost\_om: 74.39965515177575

annual cost: 192.00849074160146

total energy: 2589.7611838428143

penalty: 0.0

coe: 74.14138876569687

aep: -2.589761183842814

pro: 62.52043154946077

opt\_val: -2589761.183842814

run time: 1396.559945821762

function calls: 6655

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: coe

interconnect: 600.0

max\_capacity: 1e+16

penalty\_min\_energy: 60.0

absolute\_min\_energy: 60.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

solar\_type: 1

ppa\_type: 1

shadow\_type: 1

design variables: array([ 1.5873015873015873e+02, 2.2000000000000000e+01,

1.4000000000000000e+01, 4.0000000000000000e+00,

2.0031746031746031e+03, 8.1587301587301590e+02,

-4.2386567548433707e-01, 2.4933275028490423e+00,

1.0807648469039882e+03, 5.5048102205533769e+02,

8.2539682539682542e+02, -5.4779032961616031e+02,

2.3894888958461388e+03, 4.4999550930161995e+03,

6.0977629499379173e+03, 6.0952380952380952e+02])

capacity solar: 656.6019424599856

capacity wind: 119.0

capacity battery: 609.5238095238095

cost solar: 692.6133512333937

cost wind: 179.55189823489337

cost\_battery: 428.9449485962425

cost\_om: 51.24965282340042

annual cost: 133.21959530146577

total energy: 2308.6888699472547

penalty: 0.0

coe: 57.70357237634596

aep: -2.3086888699472548

pro: 17.785151804103062

opt\_val: 57.70357237634596

run time: 1191.6674699783325

function calls: 5579

**300 MW interconnect**

**No penalties**

**10% required min power**

**1 day down**

Chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: coe

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 30.0

absolute\_min\_energy: 30.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

resource\_type: 2

ppa\_type: 1

shadow\_type: 1

design variables: array([ 1.7460317460317460e+03, 2.2000000000000000e+01,

0.0000000000000000e+00, 9.0000000000000000e+00,

1.8412698412698412e+03, 3.0285714285714284e+03,

-1.2217304763960306e+00, 6.2831853071795862e+00,

2.4521797323946398e+03, 3.2605978886944122e+03,

2.2222222222222223e+02, 6.5219769518815974e+02,

6.4727091014959024e+02, 1.9285521827212283e+03,

3.4844359713930958e+03, 3.0476190476190476e+02])

capacity solar: 332.10521728859004

capacity wind: 154.0

capacity battery: 304.76190476190476

cost solar: 356.53536154656103

cost wind: 229.79765853818964

cost\_battery: 218.97089252642706

cost\_om: 29.262083515868305

annual cost: 79.99623001037249

total energy: 1420.3791519345502

penalty: 0.0

coe: 56.320335243880464

aep: -1.42037915193455

pro: 8.977272413644998

opt\_val: 56.320335243880464

run time: 946.2356731891632

function calls: 4253

**2 days down**

Chart, radar chart

Description automatically generated

FINISHED

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RUN PARAMETERS

objective: coe

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 30.0

absolute\_min\_energy: 30.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

resource\_type: 2

ppa\_type: 1

shadow\_type: 1

design variables: array([ 6.6666666666666674e+02, 2.1000000000000000e+01,

1.1000000000000000e+01, 1.0000000000000000e+01,

1.0857142857142858e+03, 7.0793650793650795e+02,

-7.7293152588320302e-01, 4.0890571046724293e+00,

-2.9065003858666319e+02, 1.6332146967832705e+02,

7.7777777777777783e+02, -1.1922317790033162e+02,

5.5048102205533769e+02, 2.6999730558097199e+03,

2.3229573142620638e+03, 3.4285714285714283e+02])

capacity solar: 309.9648694693508

capacity wind: 217.0

capacity battery: 342.85714285714283

cost solar: 333.8002825368513

cost wind: 317.45052313378324

cost\_battery: 245.05023601829961

cost\_om: 32.183414456080264

annual cost: 88.65038008248311

total energy: 1533.7466419102977

penalty: 0.0

coe: 57.79988536572645

aep: -1.5337466419102979

pro: 11.963047986968235

opt\_val: 57.79988536572645

run time: 4206.3237137794495

function calls: 13340

RUN PARAMETERS

objective: coe

interconnect: 300.0

max\_capacity: 1e+16

penalty\_min\_energy: 30.0

absolute\_min\_energy: 30.0

penalty\_multiplier: 0.0

turbine\_type: 1

solar\_cost\_multiplier: 0.75

battery\_cost\_multiplier: 0.5

bound\_type: 1

resource\_type: 2

ppa\_type: 1

shadow\_type: 1

design variables: array([ 1.8095238095238096e+03, 2.2000000000000000e+01,

8.0000000000000000e+00, 1.4000000000000000e+01,

1.0317460317460318e+03, 1.0317460317460318e+03,

-2.4933275028490298e-02, 5.9839860068377015e-01,

-2.0049186454499772e+03, 2.6011135777257959e+02,

6.8253968253968253e+02, 7.3791112553132552e+02,

6.4727091014959024e+02, 3.8571043654424566e+03,

1.7422179856965479e+03, 3.0476190476190476e+02])

capacity solar: 332.10521728859004

capacity wind: 203.0

capacity battery: 304.76190476190476

cost solar: 356.53536154656103

cost wind: 298.14190027257416

cost\_battery: 218.97089252642706

cost\_om: 31.075083515868307

annual cost: 86.11491723963871

total energy: 1532.517808249545

penalty: 0.0

coe: 56.191788947627245

aep: -1.532517808249545

pro: 9.489026827161446

opt\_val: 56.191788947627245

run time: 5485.4302110672

function calls: 16772