

# **HERON: Full IES Simulation**

FORCE Overview and Training April 4-6, 2023 Dylan McDowell Modeling & Simulation Engineer Idaho National Laboratory



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## **Getting Started**

#### Navigate into the IES workshop folder

- Open heron\_input.xml
  - VSCode
  - Notepad
  - Emacs

ON	
].github	<testinfo></testinfo>
doc	<name>IES</name>
	<author>dylanjm</author>
	<created>2023-03-0/</created>
_] src	<pre><gescription></gescription></pre>
templates	Simple workshop case detailing a tull its with secondary resource market and storage components.
う tests	
🖻 integration_tests	<pre> </pre> Classes ies teurerum/Classes ies teurerum
🖻 unit_tests	
🔁 workshop	<case name="IES"></case>
Pries	<mode>sweep</mode>
heron_input.xml	
🗅 tests	
🖻 simple	
🖻 wind	
 € init pv	<pre><num_arma_samples>25</num_arma_samples> <!-- Try a different value--></pre>
h dir looole el	<time_discretization></time_discretization>
	tEak /ear_variable
] .gitignore	<li><li><li><li><li><li><li><li><li><li></li></li></li></li></li></li></li></li></li></li>
.ravenconfig.xml	sent_time/zos/sent_time/
CONTRIBUTING.md	//ium_steps=zt=//ium_steps=
dependencies.xml	
ት heron	
	<pre></pre>
D NOTION .	<pre><tax>0.3</tax> <!-- Try a different value--></pre>
] NOTICE.txt	<inflation>8.86</inflation> Try a different value
] README.md	
ງ setup.cfg	



#### **Shortcut Reminder**

 Run the following commands to make running HERON & RAVEN easier:

>~/Documents/projects/HERON/tests/workshop/ies >>>> devel
λ alias heron="<PATH/TO/HERON>/heron"

>>/Documents/projects/HERON/tests/workshop/ies 
>>> devel
A alias raven="<PATH/TO/RAVEN>/raven\_framework.py"

• Now your commands will look like this:



# System Configuration & Case Information



images: Flaticon.com

# **Debug Mode**

<!-- Uncomment the <debug> node to turn on debug mode! --> <debug>

<inner\_samples>5</inner\_samples>
 <macro\_steps>1</macro\_steps>
 <dispatch\_plot>True</dispatch\_plot>
 </debug>

Permissions	Size	<u>User</u>	Date Change	ed	Name
d <b>rwx</b> r-xr-x		mcdodj	2023-03-28	10:50	⊳gold
. <b>r</b> w-r-r-	9.7k	mcdodj	2023-03-28	11:01	🕒 heron.lib
. <b>r</b> w-r-r-	7.1k	mcdodj	2023-03-28	11:00	<pre> heron_input.xml</pre>
. <b>r</b> w-r-r-	8.6k	mcdodj	2023-03-28	11:01	<pre> inner.xml</pre>
. <b>r</b> w-rr	<b>63</b> k	mcdodj	2023-03-28	11:01	🗈 network.png
. <b>r</b> w-rr	<b>5.1</b> k	mcdodj	2023-03-28	11:01	<pre> outer.xml</pre>
. <b>r</b> w-r-r-	236	mcdodj	2023-03-28	10:50	🗋 tests
.rw-r-r-	917	mcdodj	2023-03-28	11:01	<pre>write_inner.py</pre>

>/Documents/projects/HERON/tests/workshop/ies
λ heron heron\_input.xml

>>/Documents/projects/HERON/tests/workshop/ies
λ raven outer.xml



	Dispatchable?	Governed?
npp	independent	False
turbine	independent	False
wind	independent	False
HTSE	independent	False
H2_storage	independent	False
grid	independent	False
H2_market	fixed	False



#### https://ies.inl.gov

# Debug Mode Continued...





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Permissions	Size	User	Date Change	ed	Name
d <b>rwx</b> r-xr-x		mcdodj	2023-03-28	11:03	⊳debug
.rw-r-r-	7	mcdodj	2023-03-28	11:03	造 .ravenStatus
.rw-r-r-	<b>10</b> k	mcdodj	2023-03-28	11:03	Lispatch.nc
.rw-r-r-	<b>96</b> k	mcdodj	2023-03-28	11:03	🖬 dispatch_id0_y2020_c0.png
rw-r-r-	<b>69</b> k	mcdodj	2023-03-28	11:03	➡ dispatch_id0_y2020_c0_SIGNAL.png
.rw-r-r	<b>94</b> k	mcdodj	2023-03-28	11:03	🖬 dispatch_id0_y2020_c1.png
.rw-r-r-	<b>83</b> k	mcdodj	2023-03-28	11:03	➡ dispatch_id0_y2020_c1_SIGNAL.png
.rw-r-r-	100k	mcdodj	2023-03-28	11:03	🖬 dispatch_id1_y2020_c0.png
. <b>r</b> w-r-r-	<b>74</b> k	mcdodj	2023-03-28	11:03	➡ dispatch_id1_y2020_c0_SIGNAL.png
.rw-r-r-	<b>84</b> k	mcdodj	2023-03-28	11:03	🛃 dispatch_id1_y2020_c1.png
.rw-r-r-	<b>75</b> k	mcdodj	2023-03-28	11:03	dispatch_id1_y2020_c1_SIGNAL.png
.rw-r-r-	<b>16</b> k	mcdodj	2023-03-28	11:03	🖈 dispatch_print.csv
.rw-r-r-	2.2k	mcdodj	2023-03-28	11:03	<pre> dispatch_print.xml</pre>

Hama	Incent	Draw	Dese Lever		ulee	Data	Daviaur	Manu	Automote	0 Tell										
Home	insert	Diaw	rage Layou	n Form	ulas	Data	Review	VIEW	Automate	a ∆ ieii	me								omments	1
- th	Å c	alibri (Bod								General			<b>1</b> • 🗊	<b>~</b> •	Insert 🗸	ר∲י≦	~• Ø`	· 🔍		
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O Possil	ble Data Lo:	ss Some f	eatures migi	nt be lost if :	you sav	e this wa	rkbook in t	ne comma-i	delimited (.e	:sv) format.	To preserv	e these feat	tures, save i	t in an Excel file	format.					Sa
A1	‡ × ·	$\checkmark f_x$	RAVEN_sam	ple_ID																
A	8	c	D	E		F	G	н	1	J	к	L	м	N	0 Р	Q	R	s	т	
1 RAVEN	sam HOUR	ROM	Clust YEAR	scaling	Dis	patchn	Dispatch_tu	Dispatch_tu	Dispatch_w	Dispatch_H	Dispatch_H	Dispatch_H	f Dispatch_H	DispatchH Dis	patchH Dispatch_	gi Dispatch_H	TOTALLOAD	WIND	ProbabilityW P	Poi
2	0	0	0	2020	1	25	8.2308598	-24.941999	0.62748182	10	-0.3411805	-0.0580007	1	0	0 -8.51716	11 -10	16.8000675	0.06274818	1	
3	0	0	1 :	2020	1	24.80531	8.1666121	-24.747309	8.4498606	10	-0.3411805	-0.0580007	1	0	0 -16.2752	92 -10	16.2752922	0.84498606	1	
4	0	1	0	2020	1	25	8.2308598	-24.941999	0.20021064	10	-0.3411805	-0.0580007	1	0	0 -8.08988	99 -10	26.4012471	0.02002106	1	
5	0	1	1 :	2020	1	25	8.2308598	-24.941999	8.4277543	10	-0.3411805	-0.0580007	1	0	0 -16.3174	34 -10	18.4327663	0.84277543	1	
6	0	2	0 :	2020	1	25	8.2308598	-24.941999	0.15976695	10	-0.3411805	-0.0580007	1	0	0 -8.04944	52 -10	15.3463471	0.01597669	1	
7	0	2	1	2020	1	25	8.2308598	-24.941999	7.6317181	10	-0.3411805	-0.0580007	1	0	0 -15.5213	97 -10	16.5494457	0.76317181	1	
8	0	3	0	2020	1	25	8.2308598	-24.941999	0.63892983	10	-0.3411805	-0.0580007	1	0	0 -8.52860	91 -10	14.0778176	0.06389298	1	
9	0	3	1	2020	1	25	8.2308598	-24.941999	1.8951912	10	-0.3411805	-0.0580007	1	0	0 -9.78487	05 -10	18.904008	0.18951912	1	
10	0	4	0	2020	1 2	0.939436	6.8908736	-20.881435	6.3521496	10	-0.3411805	-0.0580007	1	0	0 -12.9018	43 -10	12.9018427	0.63521496	1	
11	0	4	1	2020	1	25	8.2327738	-24.947799	2.6442309	9	-0.3070624	-0.0522006	7.466-14	0	1 -10.5699	42 -10	17.4993895	0.26442309	1	
12	0	5	0	2020	1	7.978168	2.6136552	-7.92016/3	8.0288733	10	-0.3411805	-0.0580007	1	0	0 -10.3013	18 -10	10.3013481	0.80288733	1	
15	0	5	1 .	2020	1 4	4.906314	8.2197432	-24.908313	7.3498975	10	-0.3411805	-0.0580007	7.406-14	0	0 -15.228	10 -10	15.2284602	0.73498975	1	
14	0	6	0	2020	1 1	9.805046	0.510525	-19.747045	3./1914/	10	-0.3411805	-0.0580007	7467.14	0	0 -9.89449	15 -10	9.89449154	0.3/1914/	1	
16	0	7	0	2020	1	25	0.2300330	-24.341333	5 71/0900	10	-0.3411805	-0.0580007	7.400-14	0	0 -14.5768	50 -10	16.0509603	0.57140900	1	
17	0	7	1	2020	1	25	8 2308508	-24.941999	2 0590713	10	-0.3411805	-0.0580007	7.46E-14	0	0 -9.94875	19 -10	14 6336088	0.37149899	1	
19	0		0	2020	1	25	9 2209509	-24 941999	4 7590712	10	-0.2411905	0.0580007	1.402 14	0	0 -12 6497	1 .10	19 2742141	0.47590712	1	
19	0	8	1	2020	1 1	8 548714	6 1019355	-18 490714	8.0878182	10	-0.3411805	-0.0580007	7.46E-14	0	0 -13 8485	73 -10	13 8485732	0.80878182	1	
20	0	9	0	2020	1	25	8 2308598	-74 941999	4.0256687	10	-0 3411805	-0.0580007	11100 11	0	0 -11 9153	18 -10	20 3085317	0.40256687	1	
21	0	9	1	2020	1 1	8 046409	5 9361748	-17 988408	8 2555231	10	-0.3411805	-0.0580007	7.46E-14	0	0 -13.8505	17 -10	13,8505175	0.82555231	1	
22	0	10	0	2020	1	25	8 2308598	-24 941999	4.0686165	10	-0.3411805	-0.0580007	1	0	0 -11 9582	36 -10	21 3335447	0.40686165	1	
23	0	10	1	2020	1	25	8.2308598	-24.941999	5.1275471	10	-0.3411805	-0.0580007	7.46E-14	0	0 -13.0172	26 -10	14.1627664	0.51275471	1	
24	0	11	0	2020	1	25	8.2308598	-24.941999	5.8797052	10	-0.3411805	-0.0580007	1	0	0 -13.7693	34 -10	20.8113558	0.58797052	1	
25	0	11	1	2020	1 2	3.500903	7.7361579	-23.442903	6.7733167	10	-0.3411805	-0.0580007	7.46E-14	0	0 -14.1682	94 -10	14.1682942	0.67733167	1	
26	0	12	0	2020	1	25	8.2308598	-24.941999	0.50671134	10	-0.3411805	-0.0580007	1	0	0 -8.39639	-10	26.1250188	0.05067113	1	
27	0	12	1 :	2020	1	25	8.2308598	-24.941999	3.0073004	10	-0.3411805	-0.0580007	7.46E-14	0	0 -10.896	98 -10	16.6424249	0.30073004	1	
28	0	13	0	2020	1	25	8.2308598	-24.941999	0.45157588	10	-0.3411805	-0.0580007	1	0	0 -8.34125	52 -10	34.8447878	0.04515759	1	
29	0	13	1	2020	1	25	8.2308598	-24.941999	1.8832789	10	-0.3411805	-0.0580007	7.46E-14	0	0 -9.77295	82 -10	16.2872568	0.18832789	1	
30	0	14	0	2020	1	25	8.2308598	-24.941999	0.0015914	10	-0.3411805	-0.0580007	1	0	0 -7.89127	-10	22.605075	0.00015914	1	
31	0	14	1	2020	1	25	8.2308598	-24.941999	1.1784234	10	-0.3411805	-0.0580007	7.46E-14	0	0 -9.06810	27 -10	18.299618	0.11784234	1	
32	0	15	0	2020	1	25	8.2308598	-24.941999	3.3462761	10	-0.3411805	-0.0580007	1	0	0 -11.2359	55 -10	23.9519474	0.33462761	1	
33	0	15	1 :	2020	1	25	8.2308598	-24.941999	2.8626582	10	-0.3411805	-0.0580007	0	0	0 -10.7523	37 -10	17.4949082	0.28626582	1	
34	0	16	0	2020	1	25	8.2308598	-24.941999	3.7579191	10	-0.3411805	-0.0580007	1	0	0 -11.6475	98 -10	13.4141191	0.37579191	1	
35	0	16	1	2020	1	25	8.2308598	-24.941999	8.0079683	10	-0.3411805	-0.0580007	0	0	0 -15.8976	48 -10	17.9370959	0.80079683	1	
36	0	17	0	2020	1	25	8.2308598	-24.941999	7.6564834	10	-0.3411805	-0.0580007	1	0	0 -15.5461	53 -10	21.7241941	0.76564834	1	
37	0	17	1 :	2020	1	25	8.2308598	-24.941999	7.9846993	10	-0.3411805	-0.0580007	0	0	0 -15.8743	79 -10	19.1997774	0.79846993	1	
	0	18	0	2020	1 1	6 508945	5.4288115	-16.450944	7 8014939	10	-0 3411805	-0.0580007	1 1	0	0 -12 8891	16 .10	12 8891249	0 78014939	1	



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#### **Sweep Run**

• Now let's go ahead and run an entire sweep case:

►~/Documents/projects/HERON/tests/workshop/ies 등≱ devel λ heron heron\_input.xml

(	418.97 sec)	CODE MODEL	: Message	->	Execution	n command submitted:	python	/Users/mcdodj/Documents/projects/raven/raven_framework.py inner.xml
(	437.16 sec)	STEP MULTIRUN	: Message	->	***	Run finished	***	
(	437.16 sec)	STEP MULTIRUN	: Message	->	*** C	Closing the step	***	
(	437.16 sec)	STEP MULTIRUN	: Message	->	***	Step closed	***	
(	437.16 sec)	SIMULATION	: Message	->	End st	ep sweep of type: Mu	ıltiRun	
(	437.16 sec)	SIMULATION	: Message	->	Run compl	lete!		



#### Sweep Run Continued...

#### • There should now be a sweep.csv inside of IES o/

	А	В	С	D	E	F	G	н	I	J	к	L	М	N	0
1	npp_capacity t	turbine_capa	wind_capaci <sup>.</sup>	HTSE_capaci	H2_storage_	H2_market_	mean_NPV	std_NPV	med_NPV	max_NPV	min_NPV	perc_5_NPV	perc_95_NP\	samp_NPV	var_NPV
2	25	40	5	10	0	-10	-226753980	23771.1369	-226750342	-226707954	-226812328	-226799543	-226719118	25	565066949
3	25	40	10	10	0	-10	-228165877	136243.553	-228129119	-227935358	-228461839	-228378687	-227969718	25	1.8562E+10
4	50	40	5	10	0	-10	-441760262	174335.638	-441734759	-441384270	-442064106	-442023151	-441517080	25	3.0393E+10
5	50	40	10	10	0	-10	-445854823	250466.567	-445848414	-445324539	-446302829	-446157219	-445444834	25	6.2734E+10
6	25	40	5	15	0	-10	-234560936	28521.7183	-234557659	-234490299	-234601148	-234596946	-234512985	25	813488415
7	25	40	10	15	0	-10	-235974460	139603.922	-235980976	-235720473	-236205044	-236173875	-235743096	25	1.9489E+10
8	50	40	5	15	0	-10	-449559219	185407.814	-449566199	-449102024	-449889406	-449780788	-449238432	25	3.4376E+10
9	50	40	10	15	0	-10	-453609275	208060.405	-453632154	-453088670	-453942393	-453840080	-453278836	25	4.3289E+10
10	25	40	5	10	5	-10	-230950829	37635.1698	-230946061	-230893771	-231020401	-231005324	-230898953	25	1416406003
11	25	40	10	10	5	-10	-232295969	153181.027	-232297841	-232002873	-232547987	-232540171	-232082372	25	2.3464E+10
12	50	40	5	10	5	-10	-445909521	146063.452	-445936691	-445600863	-446212919	-446073767	-445652560	25	2.1335E+10
13	50	40	10	10	5	-10	-450050998	213229.225	-450011928	-449603219	-450421865	-450373215	-449662950	25	4.5467E+10
14	25	40	5	15	5	-10	-238758812	35403.7066	-238751173	-238711083	-238849908	-238839055	-238713284	25	1253422443
15	25	40	10	15	5	-10	-240134056	159636.786	-240123042	-239823456	-240432720	-240358948	-239904714	25	2.5484E+10
16	50	40	5	15	5	-10	-453690449	161989.786	-453702792	-453240865	-453927520	-453926009	-453447213	25	2.6241E+10
17	50	40	10	15	5	-10	-457816857	187853.568	-457797180	-457514948	-458260619	-458105657	-457607771	25	3.5289E+10
18	25	40	5	10	8	-10	-233458535	31380.5822	-233454462	-233365695	-233503467	-233498541	-233415112	25	984740937
19	25	40	10	10	8	-10	-234834948	174517.746	-234820680	-234500053	-235148788	-235087981	-234553304	25	3.0456E+10
20	50	40	5	10	8	-10	-448419017	130541.793	-448437549	-448125122	-448583810	-448573805	-448171570	25	1.7041E+10
21	50	40	10	10	8	-10	-452523123	179531.328	-452541241	-452184488	-452903717	-452800553	-452198226	25	3.2231E+10
22	25	40	5	15	8	-10	-241276084	29182.3407	-241280142	-241217669	-241336544	-241313285	-241235011	25	851609006
23	25	40	10	15	8	-10	-242603271	187649.634	-242582595	-242282578	-242963469	-242873052	-242318005	25	3.5212E+10
24	50	40	5	15	8	-10	-456209524	153709.611	-456209827	-455858394	-456497833	-456444429	-456000052	25	2.3627E+10
25	50	40	10	15	8	-10	-460297232	190648.693	-460260425	-459944034	-460715292	-460665668	-460054293	25	3.6347E+10

What system configuration provides the highest mean NPV?



# Now it's time to play!

- What would it take to make the system profitable in only three years?
- What about a 20-year investment timeline?
  - Try replacing the 3 year synthetic history with a 20-year one:
    - The file-path: "#HERON%/tests/integration\_tests/ARMA/NYISO\_20yr/nyiso\_arma\_20yr.pk
    - Remember to change ProjectTime
- Try adding a Lithium-Ion Battery for electricity storage
- How does std\_NPV change as you increase the number of samples?
- What would it take to run an optimizing case?
- What happens if you fix the dispatch of the H2 Market and the grid?



#### Hints... 20 Year Investment Horizon

#### <ProjectTime>20</ProjectTime>

#### <lifetime>5</lifetime>

You may also want to change the lifetime nodes to last longer than 5 years:

<DataGenerators>
 <ARMA name='synth' variable="TOTALLOAD,WIND">%HERON%/tests/integration\_tests/ARMA/NYISO\_20yr/nyiso\_arma\_20yr.pk</ARMA>
 </DataGenerators>



## Hints... Adding Lithium-Ion Battery

#### Start by copying the H2 Storage Node and then modifying as necessary

```
<Component name="LI_ION_Battery">
 <stores resource="electricity" dispatch="independent">
    <capacity resource="electricity">
      <sweep_values debug_value="5">0, 5, 8</sweep_values> <!-- MW -->
    </capacity>
    <initial_stored>
     <fixed_value>0.0</fixed_value> <!-- Try a different value -->
    </initial_stored>
    <RTE>0.9</RTE>
  </stores>
  <economics>
    <lifetime>5</lifetime>
    <CashFlow name="capex" type="one-time" taxable="True" inflation="none" mult_target="False">
      <driver>
        <variable>LI_ION_Battery_capacity</variable>
      </driver>
      <reference_price>
       <fixed_value>-900_000.00</fixed_value> <!-- Try a different value -->
      </reference_price>
    </CashFlow>
  </economics>
</Component>
```



# Hints... Optimization Runs

#### <mode>opt</mode>

#### <sweep\_values debug\_value="25">25, 50</sweep\_values> <!-- MW -->



Change all sweep\_values to opt\_bounds

#### <opt\_bounds debug\_value="25">25, 50</opt\_bounds> <!-- MW -->

Note: This may take a long time to run!

To see pre-run optimization results, look in: gold/IES\_o/opt\_soln\_0.csv



# Hints... Fixing Grid Dispatch

<component name="gri&lt;br&gt;&lt;demands resource=&lt;br&gt;&lt;capacity&gt;&lt;br&gt;&lt;ARMA variable&lt;br&gt;&lt;multiplier&gt;-1&lt;br&gt;&lt;/capacity&gt;&lt;br&gt;&lt;/demands&gt;&lt;/th&gt;&lt;th&gt;d"> <u>"electricity"</u> ="TOTALLOAD"&gt; </component>	dispatch="fixed"> synth		
( 0.08 sec) CODE MODEL	: Message	-> job "1" submitted!	
( 0.08 sec) STEP MULTIRUN	: Message	-> *** Initialization done ***	
( 0.08 sec) SIEP MULIIRUN	: Message	-> *** Beginning run ***	
( ) UIILS	: message	-> importing module /Users/mcdodj/Documents/projects/HERUN/tests/worksn JEDON/tests/workshop/ics/TES_c/evecp/1/TES_i	op/ies/write_inner.py
already exists this might imply d	alation of present	filos	
	• Messane	-> Execution command submitted: nython /llsers/mcdodi/Documents/nrojects	/raven/raven framework ny inner yml
( 8.57 sec) CODE MODEL	: Message	-> ************************************	
( 8.57 sec) CODE MODEL	: Message	-> Process Failed python /Users/mcdodi/Documents/projects/raven/raven_	framework.pv inner.xml returnCode 1
( 8.57 sec) CODE MODEL	: Message	-> Ouput is in "/Users/mcdodj/Documents/projects/HERON/tests/workshop/i	es/IES_o/sweep/1/out~inner"
( 8.57 sec) CODE MODEL	: Message	_> ************************************	
<pre>Traceback (most recent call last): File "/Users/mcdodi/Documents/p evaluation = modelToExecute[' File "/Users/mcdodi/Documents/p result.instSelf = selfexter File "/Users/mcdodi/Documents/p self.sim.run(externalSelf, In File "/Users/mcdodi/Documents/p dispatch, metrics = runner.ru File "/Users/mcdodi/Documents/p all_dispatch, metrics = self. File "/Users/mcdodi/Documents/p dispatch = selfdispatcher.d File "/Users/mcdodi/Documents/p dispatch = self.dispatch_windo File "/Users/mcdodi/Documents/p subdisp = self.dispatch_windo File "/Users/mcdodi/Documents/p raise RuntimeError(f"Solve wa RuntimeError: Solve was unsuccess</pre>	rojects/raven/ravenfram Instance'l.evaluateSamp rojects/raven/ravenframe nalRun(inRun,) rojects/raven/ravenframe putDict) rojects/HERON/src/Dispai n(raven_vars) rojects/HERON/src/Dispai _do_dispatch(meta, all_s rojects/HERON/src/Dispai ispatch(self_case, sel rojects/HERON/src/dispai w(specific_time, start_ rojects/HERON/src/dispai s unsuccessful! Status: ful! Status: warning Ter	<pre>work/Models/EnsembleModel.py", line 744, inadvanceModel le.original_function(modelToExecute['Instance'], origInputList, samplerType, inputKwargs) ework/Models/ExternalModel.py", line 324, in evaluateSample ework/Models/ExternalModel.py", line 266, in _externalRun tchManager.py", line 756, in run tchManager.py", line 209, in run structure, project_life, interp years, segs, seg type) cchManager.py", line 285, in _do_dispatch fcomponents, selfsources, meta) tch/pyomo_dispatch.py", line 199, in dispatch index, tch/pyomo_dispatch.py", line 324, in dispatch_window {soln.solver.status} Termination: {soln.solver.termination_condition}")</pre>	<b>Open:</b> IES_o/sweep/1/out~inner

## What We Didn't Cover

- Custom Dispatching Strategies
  - Price-Taker vs. Price-Maker
- Custom User-Defined Functions
- Control Strategy for Storage
- Different HERON Workflows:
  - DISPATCHES
  - MOPED
- We are Open-Source!
  - Open an issue on repository
  - Contribute meaningful code changes

