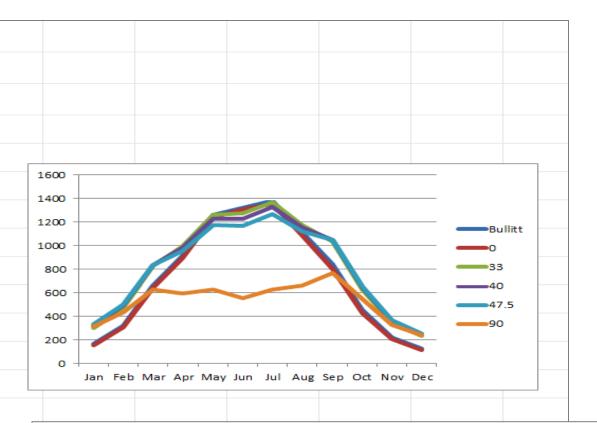
## Bullitt Center PV Orientation Analysis (for Seattle, Washington, USA)

Rob Pena, University of Washington

Fixed Tilt		Bullitt	Alt = 5 AZ=238				
10 kW syst	tem						
Sunpower	230 = 17.2	W/ft <sup>2</sup> (1	3.395 ft <sup>2</sup>	)			
	Bullitt	0	33	40	47.5	90	
Jan	168	156	303	320	333	313	
Feb	324	307	476	493	503	433	
Mar	664	643	827	838	837	629	
Apr	913	<mark>897</mark>	994	982	957	597	
May	1259	1239	1265	1230	1177	631	
Jun	1320	1307	1278	1230	1166	554	
Jul	1383	1358	1371	1330	1271	628	
Aug	1112	1087	1174	1155	1120	664	
Sep	841	801	1037	1049	1048	765	
Oct	456	426	628	646	657	550	
Nov	219	206	345	360	370	328	
Dec	125	113	232	246	256	239	
Year	8784	8539	9930	9879	9697	6331	
kWhr/ft <sup>2</sup>	15.1	14.6	17.0	16.9	16.6	10.9	
kBTU/ft <sup>2</sup>	51.4	50.0	58.1	57.8	56.8	37.1	
% of "optimum" condition (47.5°)	90.6%	88.1%	102.4%	101.9%	100.0%	65.3%	
% of actual optimum (33°)	88.5%	86.0%	100.0%	99.5%	97.7%	63.8%	



The Bullitt Center is a "Living Building" in Seattle, Washington, USA. Its PV array is oriented west-southwest, west-of-south by about 58 degrees, at a tilt of about 5 degrees to conform to the zoning envelope for the building. Architects Miller Hull used a Rhino + Grasshopper digital analysis to explore hundreds of alternatives for PV placement. The solution was to use the plane that defines the volumetric top of the zoning envelope for the site, then seek an extension of this area past the property line extending to the curb-line on two sides of the building. This project helped expand the zoning provisions in Seattle to include PV panels. As with virtually every design decision in this building, the PV array involved several competing criteria involving performance, efficiency, cost, zoning, aesthetics, and shading. Ultimately the zoning requirements were satisfied and the building conforms to land use provisions regarding shading its neighbors.