PARSON'S FARM

84 Sargeant St.
Holyoke, MA

Project Narrative

What was once a site wrought with social and economic significance will be again. Parson's Farm is an **economic incubator** for Holyoke with focus in the **agricultural**, **commercial**, and **industrial** sectors. The **mission** that drives Parson's Farm is based in open collaboration of people from many different backgrounds and skills. The **goal** is to create an open forum for the sharing and cultivation of knowledge in many different fields resulting in a vibrant epicenter of social and environmental innovation.

Our **method** is to reach out to local organizations and institutions such as Nuestras Raices, Holyoke Unites, Holyoke Community College, UMass, and Holyoke Farmer's Market to develop grassroots participation and community user-base. While keeping the the emphasis on the history and socio-economic development in Holyoke, **start-up businesses** are invited to set-up shop in Parson's Farm for reasonable rent and free water, electricity, internet. In exchange for the subsidized office and lab space, the businesses must pledge to keep jobs in Holyoke, employ local people whenever possible, and attract forward thinking individuals to work and live in Holyoke. Eventually those start-ups with mature into businesses that will need larger facilities and begin developing and habitating larger spaces available in Holyoke, while creating more local jobs.

Parson's Mill will precipitate interest in countless fields of practice and disseminate the information people need to live healthy, productive, and rewarding lives. Our hope is to **revitalize** a city that has so much latent potential woven into its founding principles and existing infrastructure. Parson's Mill will create new ideas and subsequently new businesses and industries that will sustain Holyoke and allow it to prosper in the foreseeable future and beyond.

Square Footage and Job Creation

	PROGRAM	AREA	JOBS 2014	JOBS 2017	JOBS 1020
EXCHANGE	Market / Shops / Gallery	23,495 SF	37	52	55
CREATE / LEARN	Classrooms / Kitchen Lab / Studios Workshops / Greenhouse	20,949 SF	22	27.5	27
WORK	Desk-share / Offices / Live-Work Units	19,683 SF	25	32.5	36
GATHER	Event space / Eatery / Greenway Park / Plazza	32,473 SF	12	15	18
LIVE	Studio Apartments / Live-Work Units	23,970 SF	12	18	23
		127,566 SF	**108**	**145**	**159**

Community Engagement Strategies

Bike Share - A bike rental system to encourage less carbon intensive transportation.

Market - Providing affordable, local, healthy produce and agricultural products.

Community Teaching Farm and Orchard - A space for the community to learn how to grow their own healthy food.

Gallery - For local artists to display their works to a wide audience.

Fabrication labs - a shared resource that encourages development for decentralized manufacturing and digital fabrication.

Shared studio / desk spaces - A place for artists and professionals to work on engaging projects that may not require extensive space to execute.

Pedal People Delivery Service and Waste Pickup - a carbon efficient means of getting fresh grocies home and removing waste with less dependance on fossil fuels.

Open Auditorium Area - a collective gathering space for meetings or casual events.

Outdoor classrooms - small gathering spaces that are perfect for learning farming or small scale building techniques.

Passive Strategies

Mycelium Insulation - An experimental material, Mycelium Mat Insulation provides a comparable R-value to XPS. It is produced from generic farm refuse and can be grown on site for a minimal carbon footprint.

Optimal Passive Solar Orientation - The South facing windows are positioned for direct solar heat gain.

Triple glazed windows - High r-value windows allows maximum light into spaces while retaining heat in the winter.

Louvers - on the south allow direct sunlight in for passive heating in the winter, while blocking direct sunlight to avoid overheating in the summer.
- on the east and west facades vertical louvers reflect light into spaces and minimize glare

Double Skin Facade - Along the north orientation, this element improves thermal performance of envelope while providing a passive ventilation option in the summer.

Passive Ventilation - The atrium`s glazing system includes operable panels allowing fresh air to circulate through the entire building.

Green roof - Vegetated rooftops improve thermal performance of the roof, filter collected rainwater and provide shared green spaces for users. Also the green roofs will mitigate the heat island effect experienced in cities.

Active Strategies

Geo-exchange System - Geo-exchange coil runs under the vegetable gardens, regulating thermal comfort through the radiant floors.

Hydro-electric power - A horizontal Kaplan "pit" turbine with a rated output of 2,892,000 kWh annually, is located beneath the site and is powered by the canal system.

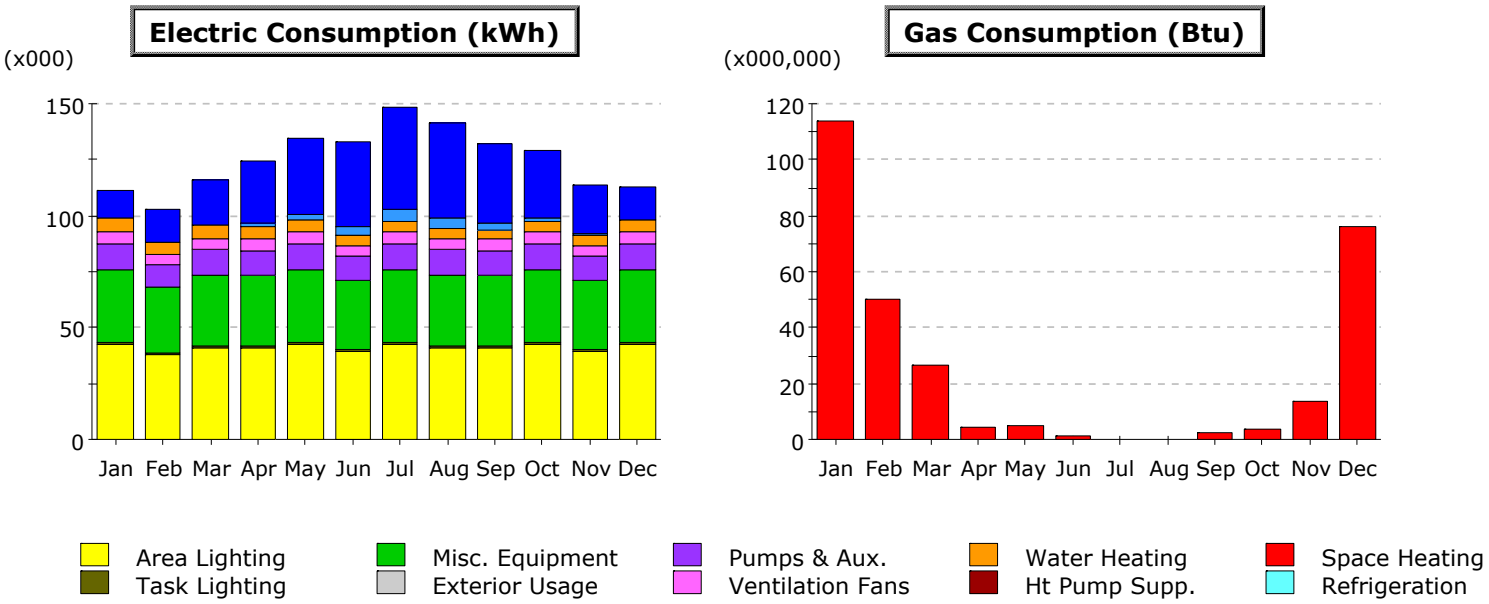
Living Machine - All wastewater is biologically remediated on-site and returned into the watershed. The system utilizes 16,000sf of constructed wetlands. The remediation process consists of 7 steps. 1) Solid Settlement Tanks 2) Equalization Tanks 3) Anoxic Tanks 4) Constructed Wetlands 5) Aerated Lagoons 6) Recirculating Sand Filter 7) Dispersal Fields. It processes up to 40,000 gallons of water per day

Radiant Flooring - Radiant heating and cooling uses passive heat from thermal masses and the geo-exchange system. This strategy saves energy by evenly distributing thermal comfort and allows zoning for maximum control.

Photovoltaic array - The south orienting building shell and its 42 degree slope are ideal for harvesting solar energy. 580 panels provide 136,126 kWh annually.

Solar Hot Water - Preheats water using the sun's heat so that the initial temperature is higher when it enters the hot water heater so that the system doesn't need to use as much energy to get it to the desired temperature.

Rain-water Collection Cistern - Rain-water catchment system harvests all water run-off from the building's roofs and stores it in an underground cistern for use throughout the building.



Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	12.9	14.3	19.6	28.1	33.7	37.7	45.6	42.3	35.2	29.8	21.7	14.4	335.1
Heat Reject.	0.0	0.1	0.3	1.3	2.3	3.8	5.3	4.8	3.1	1.6	0.7	0.1	23.5
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	5.9	5.5	5.9	5.8	5.6	4.8	4.7	4.3	4.3	4.7	4.7	5.5	61.7
Vent. Fans	5.2	4.6	5.0	5.0	5.2	4.8	5.2	5.0	5.0	5.2	4.8	5.2	60.6
Pumps & Aux.	11.5	10.2	11.1	11.1	11.5	10.7	11.5	11.1	11.1	11.5	10.7	11.5	133.6
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	32.8	29.3	32.0	31.6	32.8	30.8	32.8	32.0	31.6	32.8	30.8	32.8	382.0
Task Lights	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	11.9
Area Lights	42.3	37.7	40.8	40.8	42.3	39.3	42.3	40.8	40.8	42.3	39.3	42.3	491.1
Total	111.7	102.6	115.8	124.7	134.5	132.8	148.5	141.4	132.1	129.0	113.7	112.8	1,499.6

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	113.76	50.16	26.70	4.54	4.64	1.25	-	-	2.53	3.45	13.74	76.20	296.96
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	113.76	50.16	26.70	4.54	4.64	1.25	-	-	2.53	3.45	13.74	76.20	296.96

GOOD FOR YOUR BUILDING. GOOD FOR OUR PLANET.

Myco Foam Insulated Sheathing

Myco Foam is:
VOC Free
Rapidly Renewable
Biobased
Fire Resistant

Installation Options

Why wrap a house with petrochemical-based plastic foams like EPS, XPS or polyisocyanurate when you can go foam-free with Myco Foam Insulated Sheathing? Ecovative's product is safer for your health and better for our planet. This natural insulation board achieves a Class A fire rating without any fire retardant chemicals. Ecovative offers an R-value guarantee; unlike many plastic foams, the aged R-value of Myco Foam Insulation will not decrease over time.

Continuous Insulating Performance

Myco Foam Insulated Sheathing can be used on new construction or retrofits to meet building code requirements for continuous insulation, or to meet deep energy retrofit goals. Continuous insulation increases thermal performance without any thermal bridging, and this product also delivers a continuous air barrier for greater energy efficiency. A weatherproof facing material is bonded to Mushroom Insulation providing strength and insulation.

Ecovative has licensed Myco Foam Insulated Sheathing to Fortifiber Building Systems Group® to finalize product development, testing, and availability.

Performance Specifications

Metric	Standard		Ecovative
Thermal Resistance	ASTM C518		R 3.6 per inch
Compressive Strength	ASTM D695	10%	0.3 - 6.7 psi
		50%	72 - 260 psi
Water Vapor Transmission	ASTM E96		0.02 0.03 US Perm
Fire Resistance	ASTM E84		Class A
Flame Spread			20
Smoke Developed			50
Aldehyde & VOC Emissions	ASTM E1333		< 0.01 - 0.03 ppm

Ecovative's Mushroom® Materials are protected by issued and pending patents. To date, Myco Foam is Cradle to Cradle Certified^{CM} Gold. Cradle to Cradle Certified^{CM} is a certification mark licensed by the Cradle to Cradle Products Innovation Institute.

Performance Testing & Certification

Today, Ecovative is continuing to test mechanical and environmental performance of Myco Foam Insulated Sheathing with third-party and in-house laboratories. Builders who are interested in interior and controlled pre-fab or experimental projects can purchase Myco Foam Insulated Sheathing today.

CM CERTIFIED cradletocradle GOLD

Cradle to Cradle's Gold Certification and Product Innovation Award qualify Myco Foam for LEED points.

Ecovative uses fungi to grow revolutionary materials and products. These environmentally responsible biomaterials are high performance and cost effective. At the intersection of ecology and innovation, we're producing materials for a sustainable future.

70 Cohoes Avenue
Green Island, NY, 12180
USA, Earth
ecovativedesign.com
518-273-3753

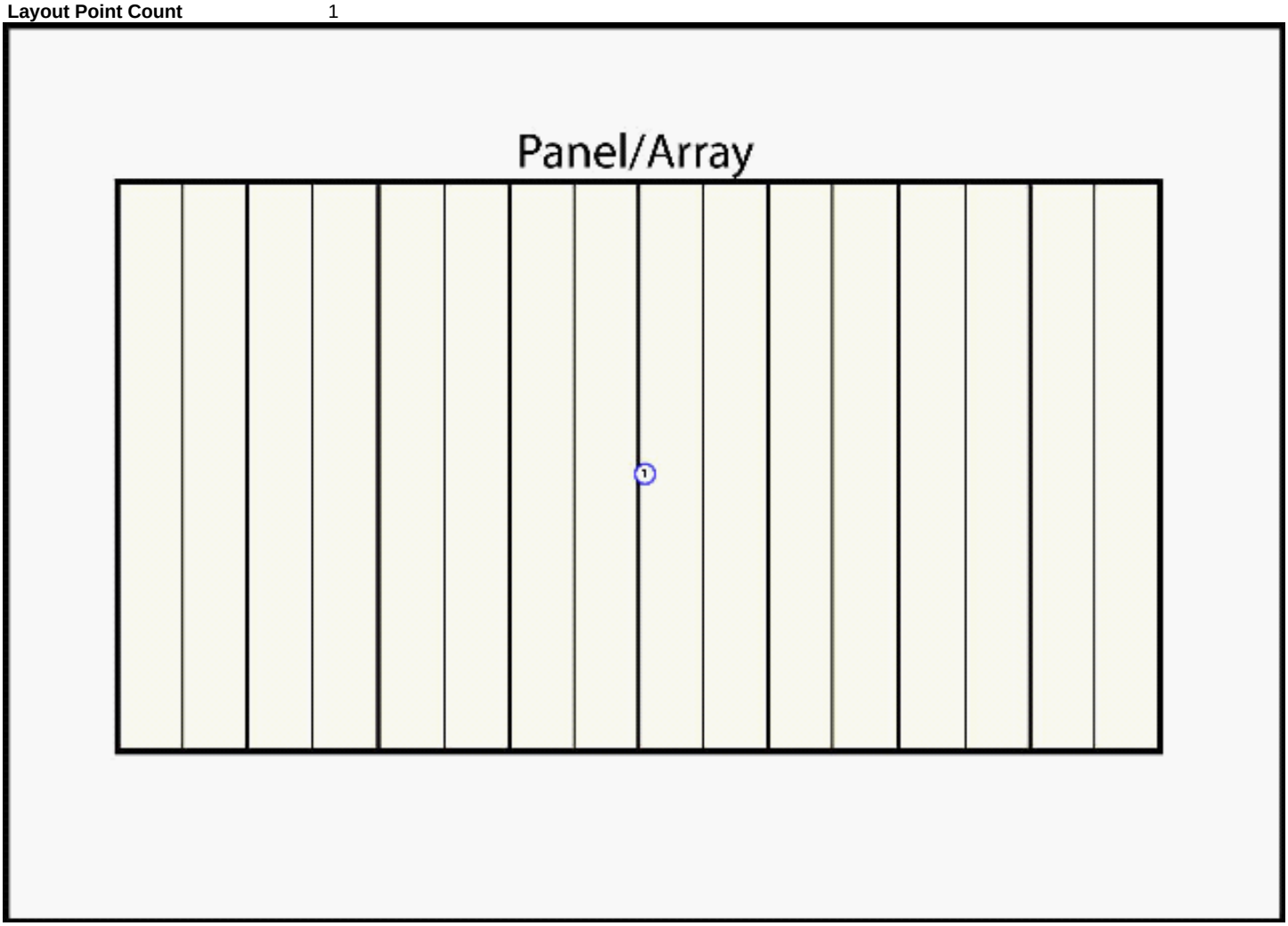
4-MatDesign Studio
Site Report

Report Name	82 SARGEANT ST
Report Date	1/30/2014 5:33:49 PM
Declination	-14d 07m
Location	Holyoke, MA 01040
Lat/Long	42.204 / -72.63
Weather Station	Chicopee Falls-Westover AFB, MA, Elevation: 246 Feet, (42.200/-72.533)
Site Distance	5 Miles
Report Type	PV
Array Type	Fixed Angle
Tilt Angle	42.20 deg
Ideal Tilt Angle	42.20 deg
Azimuth	180.00 deg
Ideal Azimuth	180.00 deg
Electric Cost	0.118 ($/KWH)
Panel Make	Sanyo Electric of Panasonic Group
Panel Model	HIT-N225A01
Panel Count	580
DC Rate (per panel)	225.0 Watts
Total System Size	130,500.0 Watts
Inverter Make	SMA America
Inverter Model	STP24000TL-US-10 (480V)
Inverter Count	6
Derate Method	Inverter Derate Only
Derate Factor	0.980
Layout Configuration	Single Picture
Layout Point Count	1

Notes: [None]

4-MatDesign Studio
System Picture Layout

Layout Type	Single Picture
Layout Point Count	1



Solar Obstruction Data (Part 1 of 2)

Month	Actual Unshaded Solar Radiation Azimuth=180.0 Tilt=42.2 KWhr/m^2	Actual Shaded Solar Radiation Azimuth=180.0 Tilt=42.2 KWhr/m^2	Actual Shaded AC Energy (KWH) Azimuth=180.00 Tilt=42.20	Actual Unshaded AC Energy (KWH) Azimuth=180.0 Tilt=42.20	Ideal Unshaded AC Energy (KWH) Azimuth=180.0 Tilt=42.20	PV Solar Cost Savings 0.118 ($/KWH)
January	2.21	2.21	8,526.00	8,526.00	8,526.00	$1,006.07
February	3.71	3.71	13,536.00	13,536.00	13,536.00	$1,597.25
March	4.95	4.95	19,258.00	19,258.00	19,258.00	$2,272.44
April	4.59	4.59	16,424.00	16,424.00	16,424.00	$1,938.03
May	5.13	5.13	18,694.00	18,694.00	18,694.00	$2,205.89
June	4.47	4.47	15,382.00	15,382.00	15,382.00	$1,815.08
July	4.75	4.75	16,345.00	16,345.00	16,345.00	$1,928.71
August	4.57	4.57	15,968.00	15,968.00	15,968.00	$1,884.22
September	4.85	4.85	17,013.00	17,013.00	17,013.00	$2,007.53
October	4.59	4.56	17,221.00	17,234.00	17,234.00	$2,032.08
November	3.09	3.09	11,532.00	11,532.00	11,532.00	$1,360.78
December	1.30	1.30	4,441.00	4,441.00	4,441.00	$524.04
Totals	**48.20**	**48.17**	**174,340.00**	**174,353.00**	**174,353.00**	**$20,572.12**
	Effect: 100.00%	**Effect: 99.94%**				
	Sun Hrs: 4.02	**Sun Hrs: 4.02**				

Notes: [None]

Solar Obstruction Data (Part 2 of 2)

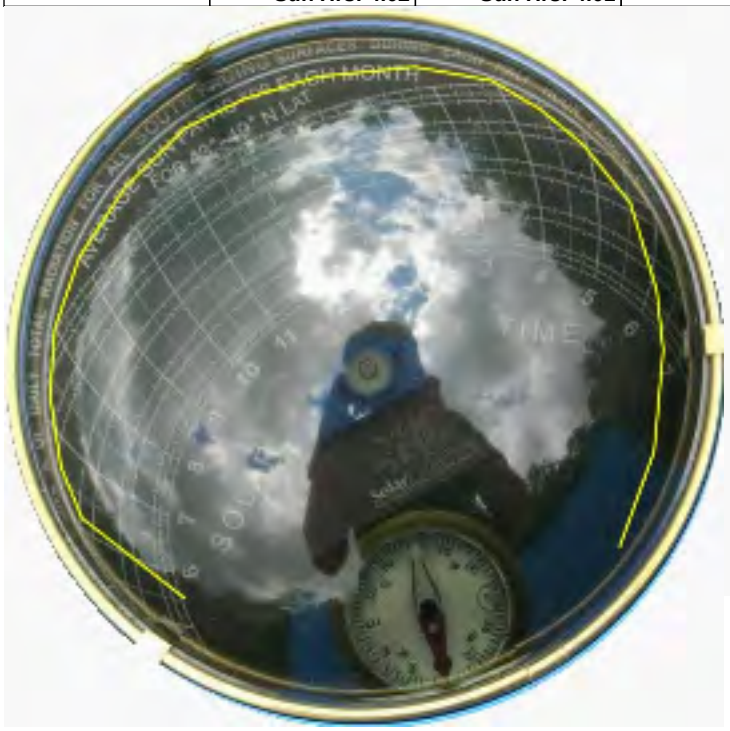
Month	PVWatts Unshaded % Actual Site Azimuth=180.0 Tilt=42.20	Actual Site Efficiency % Azimuth=180.0 Tilt=42.20	Ideal Site Efficiency % Azimuth=180.0 Tilt=42.20
January	100.00 %	100.00 %	100.00 %
February	100.00 %	100.00 %	100.00 %
March	100.00 %	100.00 %	100.00 %
April	99.96 %	99.96 %	99.96 %
May	99.95 %	99.95 %	99.95 %
June	99.91 %	99.91 %	99.91 %
July	99.90 %	99.90 %	99.90 %
August	99.96 %	99.96 %	99.96 %
September	99.95 %	99.95 %	99.95 %
October	99.45 %	99.45 %	99.45 %
November	99.97 %	99.97 %	99.97 %
December	99.76 %	99.76 %	99.76 %
Totals	**99.90 %**	**99.90 %**	**99.90 %**
	Unweighted	**Unweighted**	**Unweighted**
	Yearly Avg	**Yearly Avg**	**Yearly Avg**

4-MatDesign Studio
Solar Site Analysis Report

Image File: "DSCN3295.JPG"
Layout Point: 1

Solar Obstruction Data (Part 1 of 2)

Month	Actual Unshaded Solar Radiation Azimuth=180.0 Tilt=42.2 KWhr/m^2	Actual Shaded Solar Radiation Azimuth=180.0 Tilt=42.2 KWhr/m^2	Actual Shaded AC Energy (KWH) Azimuth=180.00 Tilt=42.20	Actual Unshaded AC Energy (KWH) Azimuth=180.0 Tilt=42.20	Ideal Unshaded AC Energy (KWH) Azimuth=180.0 Tilt=42.20	PV Solar Cost Savings 0.118 ($/KWH)
January	2.21	2.21	8,526.00	8,526.00	8,526.00	$1,006.07
February	3.71	3.71	13,536.00	13,536.00	13,536.00	$1,597.25
March	4.95	4.95	19,258.00	19,258.00	19,258.00	$2,272.44
April	4.59	4.59	16,424.00	16,424.00	16,424.00	$1,938.03
May	5.13	5.13	18,694.00	18,694.00	18,694.00	$2,205.89
June	4.47	4.47	15,382.00	15,382.00	15,382.00	$1,815.08
July	4.75	4.75	16,345.00	16,345.00	16,345.00	$1,928.71
August	4.57	4.57	15,968.00	15,968.00	15,968.00	$1,884.22
September	4.85	4.85	17,013.00	17,013.00	17,013.00	$2,007.53
October	4.59	4.56	17,221.00	17,234.00	17,234.00	$2,032.08
November	3.09	3.09	11,532.00	11,532.00	11,532.00	$1,360.78
December	1.30	1.30	4,441.00	4,441.00	4,441.00	$524.04
Totals	**48.20**	**48.17**	**174,340.00**	**174,353.00**	**174,353.00**	**$20,572.12**
	Effect: 100.00%	**Effect: 99.94%**				
	Sun Hrs: 4.02	**Sun Hrs: 4.01**				



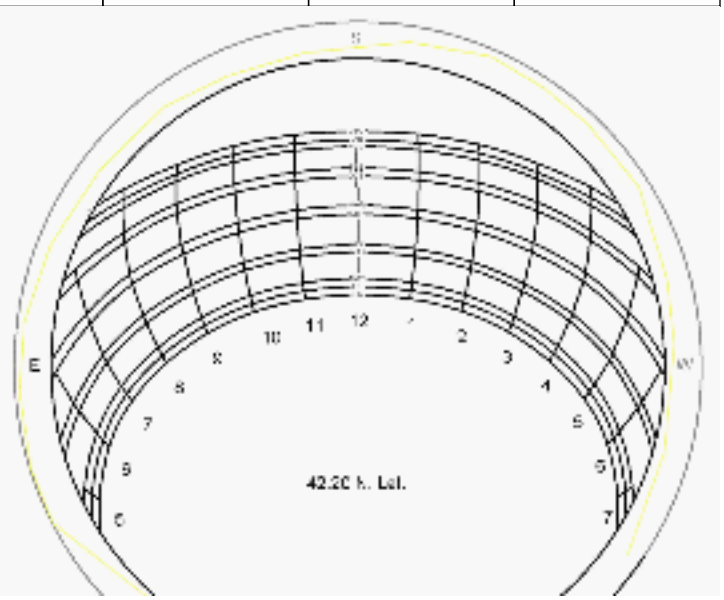


Image File: "DSCN3295.JPG"
Layout Point: 1

Solar Obstruction Data (Part 2 of 2)

Month	PVWatts Unshaded % Actual Site Azimuth=180.0 Tilt=42.20	Actual Site Efficiency % Azimuth=180.0 Tilt=42.20	Ideal Site Efficiency % Azimuth=180.0 Tilt=42.20
January	100.00 %	100.00 %	100.00 %
February	100.00 %	100.00 %	100.00 %
March	100.00 %	100.00 %	100.00 %
April	99.96 %	99.96 %	99.96 %
May	99.95 %	99.95 %	99.95 %
June	99.91 %	99.91 %	99.91 %
July	99.90 %	99.90 %	99.90 %
August	99.96 %	99.96 %	99.96 %
September	99.95 %	99.95 %	99.95 %
October	99.45 %	99.45 %	99.45 %
November	99.97 %	99.97 %	99.97 %
December	99.76 %	99.76 %	99.76 %
Totals	**99.90 %**	**99.90 %**	**99.90 %**
	Unweighted	**Unweighted**	**Unweighted**
	Yearly Avg	**Yearly Avg**	**Yearly Avg**

Devine Tarbell & Associates, Inc.
Consulting Engineers, Scientists, & Regulatory Specialists
970 Baxter Boulevard, Portland, ME 04103

June 8, 2008

MEMORANDUM

TO: Mr. Paul Ducheney

FROM: Guy Senechal

SUBJECT: **Parson's Paper Feasibility Study**

On May 22, 2008, the City of Holyoke Gas and Electric Department (HG&E) commissioned Devine Tarbell and Associates, Inc. (DTA) to perform a pre-feasibility level study to install a new hydro-electric generator in the Parson's Paper facility. Our task was to evaluate the existing facility for suitability to re-use any existing components or civil structure, size a new unit based on the water balance analysis of the canal system, perform and energy analysis based on historic project flows, and provide a budgetary estimate for the installation of the new unit. Our summary of findings is listed below.

Section 1 - Analysis of the existing facility:

On May 22, 2008, a site visit of Parson's Paper was conducted by Guy Senechal of DTA and Rich Murray of HG&E. The existing building is abandoned and has been condemned by the City of Holyoke. The last known date of business operations conducted in this facility is 2004. The Parson's Paper facility is approximately 600 feet wide. The facility is equipped with five vertical hydro-turbines. Two hydro-turbines, Units A&B, are situated adjacent to each other on the east end of the facility and the remaining three hydro-turbines, Units C, D, and E, are situated adjacent to each other approximately 300 feet west of these units. Units A, B, D, and E are each connected to a horizontal drive shaft through a wooden bevel gear. The drive shaft is connected to an AC electric generator through a flat belt drive. Unit C is directly coupled to a separate AC electric generator. Visual inspection of the existing equipment shows that what remains is in very poor condition and is not suitable for re-use. Some of the existing steel penstocks are leaking badly and are shored-up with temporary patches. Much of the electrical gear, switches, and busses has been stripped of copper and has been rendered useless. The building itself appears to be in poor condition and the suitability floor structures for use as equipment foundations is questionable. The tailrace tunnels are open enough to pass the water leaking from the leaks in the penstocks, but the condition of the inside of the tailrace is unknown.

The unit intake structure consists of a timber ice fender, a timber trash rack frame, and horizontal timber slide gates housed in a stone foundation into which the penstock inlets are led. Each unit has one headgate that is opened or closed using a manual operator. The trash racks themselves

are not installed. The condition of the wooden ice fender and trash rack frame is poor and would require complete dismantling and re-fabrication. It was possible to inspect the condition of the gates themselves, but we anticipate that they are in poor condition given that they have not been maintained since 2004. We would anticipate that at a minimum a new trash rack structure, new trash racks, and new headgates with operators would need to be installed. We have assumed that the granite foundation would be suitable for re-use. Discontinued penstock openings will require concrete plugs.

Section 2 - Unit Sizing

In the draft Strategic Plan of the HG&E system prepared by DTA in 2007, we made recommendation for long term planning to discontinue operation of the smaller canal units that do not represent much generation for HG&E. This means discontinuing Beebe-Holebrook, Skinner, City 1, and City 4 on the first level canal, and Crocker, Nonotuck, Albion, Gill, and Mt. Tom on the second level canal. The remaining canal configuration would be as follows:

1st level canal	
Boatlock station	2300 cfs
City 2	600 cfs
Aubin (non-HG&E)	450 cfs
Unregulated Leak-by	250 cfs
1st level total flow	**3600 cfs**
2nd level canal	
City 3	400 cfs
Valley A	400 cfs
Riverside 4	400 cfs
Riverside 5	500 cfs
Riverside 7	800 cfs
Riverside 8	2000 cfs
2nd level total flow	**4500 cfs**
3rd level canal	
Chemical B	500 cfs
3rd level total flow	**500 cfs**

The water flow through the canal system is such that water from the first level canal feeds the second level canal. The third level canal is supplied from the outflow of water from the City 3 hydroelectric generator. A deficit of 900 cfs remains between the first and second level canal in this analysis. The Strategic Plan recommends discontinuing operation of Riverside 4 and 5 in order to balance flow. With the possibility of a new unit at Parsons, the flow can be balanced by installing a 900 cfs unit. We have sized the conceptual unit accordingly. The theoretical power output from this unit would be 1325 kW based on a unit net head of 20 feet.

Section 3 - Energy Analysis

DTA has developed a spreadsheet energy model of the HG&E hydroelectric generating system. This model separates the HG&E hydroelectric system into 4 discrete elements: the Hadley power house, the first level canal, the second level canal, and the third level canal. Average generation

efficiencies for each element, or hydroelectric generating unit, was obtained from operating data received from HG&E. For the purpose of this analysis, the baseline energy model is set-up with the Hadley power house operating under normal operating limits and the canal units as shown in Section 2 with the exception that Riverside Units 4 and 5 are off. The Upgrade energy analysis uses this same configuration with the addition of the 1325 kW Parson's unit and the Riverside Unit 4 and 5 on. The flow data we used is for the 1985 to 1999 period of record. As is shown in Table 1 below, the incremental energy gain from the Parson's unit alone is 2893 MWh. The total energy gain is 5982 MWh.

TABLE 1
ENERGY ANALYSIS

WITHOUT PARSONS UNIT:

Preliminary Energy Analysis			Units Running:
	1985-1999 MWh		
System	**Actual Annual**	**Calc'd**	Boatlock 1,2,3
L1	12,574	15,165	City 2,3
L2	18,995	28,184	Valley A
L3	1,892	5,511	Riverside 7,8
			Chemical A,B
			Hadley
Hadley	182,674	162,618	1,2
TOTAL	216,135	211,478	

WITH PARSONS UNIT:

Preliminary Energy Analysis			Units Running:
	1985-1999 MWh		
System	**Actual Annual**	**Calc'd**	Boatlock 1,2,3
			(Parsons Paper Co.)
L1	12,574	18,058	City 2,3
L2	18,995	31,273	Valley A
L3	1,892	5,511	Riverside 4,5,7,8
Hadley	182,674	162,618	Chemical A,B
			Hadley
TOTAL	216,135	217,460	1,2

Difference: 5,982 MWh

Budgetary Costs

At the client's request, DTA has prepared a pre-feasibility estimate of the project cost in order to provide order-of-magnitude pricing for the installation of the new unit. Further refinement of

costs is required if interest in pursuing this project is considered. DTA has solicited budgetary pricing from vendors for a unit of this size, in either horizontal or vertical configuration. Unfortunately, we are not able to get a response from vendors in time for this evaluation. As an alternative, we have updated pricing of the conceptual Riverside Unit 6 from the Strategic Plan. In that study we conceptualized a horizontal Kaplan "pit" turbine rated for 1000 cfs at 29.6 feet net head with a rated output of 2200 kW. Electrically, this is significantly larger than the 1325 kW unit that is sized for Parson's, but the physical size of the turbine, based on water flow, is very similar. For this reason, we have used the pricing of the Riverside 6 turbine as the basis of this study. DTA's budgetary estimate for the new unit is $9.1 million dollars. Our breakdown of costs is outlined in Table 2 below:

TABLE 2
PROJECT ESTIMATED COSTS

Discipline	Item	Description	Cost
Civil	Cofferdam	Canal 1	
	Cofferdam	Canal 2	
	New Intake	Trash Racks, Gates, Operators	
	New Penstock	70 feet, steel, 10 feet diameter	
	Powerhouse substructure	Turbine generator foundation and draft tube support	
	Tailrace repairs	Repair to existing 15 foot diameter tailrace tunnel	
	Concrete Plugs	4 plugs in discontinued penstocks	
		Subtotal Civil Costs	**1,500,000**
Mechanical	Turbine-Generator	1325 kW horizontal Kaplan turbine-generator with hydraulic power unit and controls	
	Ancillary Systems	Miscellaneous ancillary systems: cooling water, compressed air, HVAC	
		Subtotal Mechanical	**4,310,000**
Electrical	MCC	Local distribution panel, motor starters, and circuit breakers	
	Switchgear and Protective relaying	13.8 kV electrical switchgear and protective relaying	
	Local Control Panel	Local unit control panel	
	Station Service Transformer	13.8 kV to 480/220 volt transformer for station auxiliaries.	
	Remote Operations	PLC controls and programming	
		Subtotal Electrical	**921,000**
		Subtotal Project	**6,731,000**
Engineering		10% of project cost	**673,100**
Contingency		25% of project cost	**1,679,988**
		Total Cost (rounded to nearest 100k)	**9,100,000**

Assumptions:

- Budgetary costs outlined assume that demolition of existing equipment and site preparation performed by others.
- Costs for the unit foundation and substructure are included in the estimate, cost for a power house are not included as we assume the building will be by others.
- Connection costs to local transmission lines not included in pricing.

- Costs include a cofferdam on the 1st level canal in order isolate the Parsons facility without impacting production from other facilities.
- Costs include an earthen cofferdam for the tailrace isolation at the second level canal. This earthen cofferdam would act as a temporary plug while installation of the new unit is underway.

GMS

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File

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Cost Analysis
Projected Build-Costs

Parson's Farm Building
Holyoke, MA 01040

Material:	Cost:		Amount:		Totals:
Shell:					
Clear argon filled triple pane low e glazing	$40	square ft	3960	SF	$158,400
double pane low e glazing	$12	square ft	24636	SF	$295,632
Polygal for Greenhouse	$3.25	square ft	8060	SF	$26,195
Wood Eastern White Cedar 1" X 6"	$0.72	square ft	7000	SF	$5,040.00
Structure:					
Glulam Timber	$20.00	linear ft	7294	linear f	$145,880.00
Interior Framing 2" X 4" Standard 24" on center	$24.01	square ft	46880	SF	$1,125,588.80
Exterior Framing 2" X 10" Standard 24" on center	$26.08	square ft	68500	SF	$1,786,480.00
Exterior Walls:					
Black Locust Wood Siding	$5.72	square ft	68500	SF	$391,820.00
Mycelium Insulation	$0.66	square ft	68500	SF	$45,210.00
XPS Extruded Polystyrene	$1.02	square ft	68500	SF	$69,870.00
Gypsum Board	$1.82	square ft	68500	SF	$124,670.00
Paint	$7.50	square ft	68500	SF	$513,750.00
Interior Walls:					
Mycelium Insulation	$0.66	square ft	46880		$30,940.80
Gypsum Board	$1.82	square ft	46880		$85,321.60
Paint	$7.50	square ft	93760		$703,200.00
Floors:					
Bamboo Flooring	$7.30	square ft	45464		$331,887.20
Applying Decorative Stain to Concrete	$3.00	square ft	82102		$246,306.00
Concrete Slab Reinforced First floor	$23,004	total	1		$23,004
Concrete Slab Reinforced Second Floor	$13,911	total	1		$13,911
Concrete Slab Reinforced Third Floor	$9,087	total	1		$9,087
Concrete Slab Reinforced Forth Floor	$7,447	total	1		$7,447
Concrete Slab Reinforced Fifth Floor	$3,908	total	1		$3,908
Roof:					
Metal Standing seem					
Mycelium Insulation	$0.66	square ft	18440	SF	$12,170.40
XPS Extruded Polystyrene	$1.02	square ft	18440	SF	$18,808.80
Gypsum	$1.82	square ft	18440	SF	$33,560.80
Green Roof:					
3rd Floor	$25.00	square ft	9720	SF	$243,000
4th Floor	$25.00	square ft	5554	SF	$138,850
Slopes	$25.00	square ft		SF	
Upkeep	$1.50	square ft	15274	SF	$381,850
Windows					
Clear argon filled triple pane low e glazing	$40	square ft	21043	SF	$841,720
Acid Etched Glass Slats	$10	square ft	4050		$40,500
Lighting:					
Ceiling Light Fixture	$276	each	241		$66,516
Doors:					
Energy Efficient Exterior	$1,833	each	30		$54,990
Energy Efficient Interior	$1,410	each	134		$188,940

Kitchens:				
Energy Efficient Refrigerators	$700	each	31	$21,700
Commercial Oven	$866	each	10	$8,660
Oven	$1,363	each	21	$28,623
Cooktop	$800	each	31	$24,800
Dishwasher	$961	each	31	$29,791
Bathrooms:				
Sinks	$420	each	29	$12,180
Low Flow Shower Head	$86	each	21	$1,806
Glass Shower enclosure	$1,411	each	21	$29,631
High Efficiency Toilet	$408	each	28	$11,424
Apartment Appliances:				
Washing Machine	$637	each	21	$13,377
Dryer	$900	each	21	$18,900
Stairs:				
Market Stairs	$4,000	each	1	$4,000
East Stairs	$9,000	each	1	$9,000
Apartment Stairs	$4,000	each	8	$32,000
Elevator:				
Elevator:	$30,000	each	1	$30,000
Living Machine:				
40,000 gpd with Greenhouse	1,077,777		1	$1,077,777
Geothermal Heat Pump:				
Geothermal Heat Pump	$2,500	per ton	126 tons	$315,000
Radiant System:				
Radiant Floors	$9.97	square ft	127566 SF	$1,271,833.02
Solar Hot Water:				
Solar Hot Water Panels 4' X 8'	$2,500	for 2	20	$25,000
Photovoltaics:				
Sanyo Electric of Panasonic Group Panel Model HIT-N225A01	$422.00	each	580	$244,760
Water Storage:				
Water Cistern	10000	each	2	$20,000
Total Materials:				**$11,394,716**
Total Labor Costs:				**$120 /SF**
Total SF:				**127,566** *
			Total Cost:	**$209.32 /SF**
With Experimental Wind Turbines:	$10,000	each	9	$90,000
			Total Cost:	**$210.03 /SF**

* - 1st Floor area = 51,163 SF, 2nd Floor area = 30,939 SF, Third Floor area = 20,210 SF, 4th Floor area = 16,562 SF, 5th Floor area = 8,692 SF