

Solar Collection Systems

Selection Criteria	Weight	Concepts		
		A	B	C
Lightweight	25%	1	2	3
System Simplicity	5%	1	2	3
Environmental Tolerance	20%	1	3	2
Ease of Integration	15%	1	2	3
Efficiency	15%	1	3	2
Cost	5%	1	3	2
Reliability	15%	1	2	3
Weighted Sum		1.00	2.40	2.60

Concepts	
A	Thermal Collector
B	Rigid Cells
C	Flexible Cells

Value Scale	
3	Highest/Best Rank
2	Middle Rank
1	Lowest/Worst Rank

Criteria Descriptions	
Lightweight	Weight of solar collector and any adjoining systems
System Simplicity	Any depending subsystems present or other needed support
Environmental Tolerance	Ability to function while being exposed to harsh conditions
Ease of Implementation	Mechanically and electrically
Efficiency	Energy output vs. energy input
Cost	Cost of solar collector device(s)
Reliability	Probability of providing proper system function throughout mis
Multiple Applications	Easily adaptable to alternate configurations

Battery Technology

Selection Criteria	Weight	Concepts		
		A	B	C
Specific Energy (W-h/kg)	25%	3	1	2
Energy Density (W-h/L)	10%	3	1	2
Specific Power (W/kg)	20%	3	1	2
Charge/Discharge Efficiency (%)	10%	3	1	2
Cycle durability	20%	3	1	2
Ease of charging	15%	2	3	1
Weighted Sum		2.85	1.3	1.85

Battery Technology

A	Lithium-Ion Polymer
B	Lead Acid
C	Nickel-Metal Hydride(NiMH)

Value Scale

3	Highest/Best Rank
2	Middle Rank
1	Lowest/Worst Rank

Selection Criteria	LiPo	Lead Acid	NiMH
Specific Energy (W-h/kg)	130-200	30-40	60-120
Energy Density (W-h/L)	300	60-75	140-300
Specific Power (W/kg)	7100	180	250-1000
Charge/Discharge Efficiency (%)	99.8	50-92	66
Cycle durability (cycles)	1000	500-800	500-1000
Ease of charging	Cell balancing	Self regulated	End charge

Mechanical Structure

Selection Criteria	Concepts						
	Weight	A	B	C	D	E	F
Lightweight	10%	5	2	6	4	1	3
Maximum Temperature	20%	3	5	2	6	4	1
Minimum Temperature	20%	3	5	2	6	4	1
Modularity*	5%	6	3	1	3	3	1
Thermal Conductivity	5%	2	5	6	4	3	1
UV Resistance*	5%	3	6	1	6	6	1
Material Cost	10%	6	5	1	4	3	2
Construction Cost	10%	6	2	4	5	3	1
Material Strength	15%	1	5	3	6	4	2
Weighted Sum	100%	3.6	4.35	2.75	5.25	3.5	1.45

A	Polycarbonate
B	Coated Steel
C	Carbon Fiber
D	Aluminium
E	Stainless Steel
F	Fiberglass

6	Highest/Best Rank
3	Middle/Fair Rank
1	Lowest/Poor Rank

Criteria Descriptions	
Lightweight	Maintain sufficient impact strength, while minimizing weight of enclosure
Maximum Temperature	The maximum service temperature that the material can withstand without sacrificing strength
Minimum Temperature	The minimum temperature a material can withstand before becoming brittle
Modularity*	Possibility for customization of enclosure for brackets, framing, venting, etc.
Thermal Efficiency	Ability to maintain consistent temperature within enclosure
UV Resistance*	The materials ability to retain strength under exposure to UV light and Solar Radiation
Material Cost	Cost of raw materials
Construction Cost	Cost to fabricate and/or customize enclosure
Material Strength	Overall strength of the material, impact resistance, brittleness

*Modularity and UV Resistance Criteria are both rated on a scale of 6 (good), 3 (fair), or 1 (poor)

Microcontroller Technology

Selection Criteria	Weight	Concepts		
		A	B	C
Memory	15%	2	2	3
Power Consumption	20%	3	2	1
Environmental Tolerance	15%	2	2	2
Ease of Integration	10%	3	3	1
Speed	10%	2	2	3
Cost	10%	2	2	1
IO Capabilities	20%	2	2	3
Weighted Sum	100%	2.30	2.10	2.05

Concepts	
A	TI MSP430
B	ARM
C	Atmel AVR

Value Scale	
3	Highest/Best Rank
2	Middle Rank
1	Lowest/Worst Rank

Criteria Descriptions	
Memory	Memory Size Capabilities
System Simplicity	Power consumed while operating
Environmental Tolerance	Ability to function while being exposed to harsh conditions
Ease of Implementation	Ease of adding controller to system
Cost	Cost of solar collector device(s)
Speed	Speed Capabilities

Communication Standard

Selection Criteria	Weight	Concepts						
		A	B	C	D	E	F	G
Expandability	15%	5	4	6	1	1	3	7
System Simplicity	10%	7	3	4	2	1	5	6
Ease of Implementation	15%	7	4	4	2	1	3	6
Speed	10%	1	5	6	3	3	2	7
Number of Conductors	35%	7	3	4	2	1	5	6
Transmission Distance	15%	5	4	4	2	2	6	7
Weighted Sum	100%	5.80	3.65	4.50	1.95	1.35	4.25	6.40

Concepts	
A	1-Wire
B	SPI
C	I2C
D	8-bit Parallel
E	16-bit Parallel
F	RS-232
G	RS-485

Criteria Descriptions	
Expandability	Ability to add more devices.
System Simplicity	Additional components required.
Ease of Implementation	Ease of implementing communication standard into system.
Speed	Maximum speed achievable.
Number of Conductors	Number of conductors required to match standard.
Transmission Distance	Maximum distance that can be reliably achieved.

Value Scale	
7	Highest/Best Rank
6	
5	
4	Middle Rank
3	
2	
1	Lowest/Worst Rank

Concept Overview

Solar Collection
Flexible Cell
Thermal
Rigid Cell

Battery Technology
Lithium-Ion
Lead Acid
Nickel Cadmium(NiCd)
Nickel-Metal Hydride(NiMH)

Mechanical Structure
Polycarbonate
Coated Steel
Carbon Fiber
Aluminium
Stainless Steel
Fiberglass

Microcontroller
TI MSP430
ARM
Atmel AVR

Communication
1-Wire
SPI
I2C
8-bit Parallel
16-bit Parallel
RS-232
RS-485