
The request focuses on the hazards inherent in American supply lines carrying fuel. Most of the fuel isn’t even for vehicles…

…it’s for diesel generators that provide power at U.S. bases.
Renewable Energy in Theater

Not as cost effective
Not a dependable resource
Difficult to deploy and set up
Too fragile for use in the field
Not as transportable as gensets
Renewable Energy in Theater

Solar power isn’t cost effective

Cost-per-kilowatt Comparison

Based on fuel cost of $5 per gallon-delivered
3-year payback period
Solar power generation is not dependable

Clouds happen...

Other stuff happens...
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Solar is complicated & difficult to set up
Renewable Energy in Theater

Solar is too fragile for use in theater

Fossil fueled generator

Solar
Renewable Energy in Theater

Renewable systems aren’t very transportable

Handsome old dude
Renewable Energy in Theater

Project Nobel
Solar-wind hybrid system, K Crossing, Kuwait
Renewable Energy in Theater

Weather & environmental issues
Renewable Energy in Theater

Crowded installation site
Renewable Energy in Theater

Changing personnel on the ground
Renewable Energy in Theater

Spares not available at the corner hardware store
Renewable Energy in Theater

Was it Worth It?
Renewable Energy in Theater

How do we make solar solutions more portable?
Renewable Energy in Theater

Tactical, Solar-Powered Light Trailers
Renewable Energy in Theater

Cost Comparison

<table>
<thead>
<tr>
<th></th>
<th>Diesel Light Trailer</th>
<th>Solar Light Trailer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Cost of Operation</strong></td>
<td>3-Year Amortized Annual Average</td>
<td></td>
</tr>
<tr>
<td><strong>Halide</strong></td>
<td><strong>Fluorescent</strong></td>
<td></td>
</tr>
<tr>
<td>Purchase price</td>
<td>$5,924.10</td>
<td>$17,609.00</td>
</tr>
<tr>
<td>Fuel cost, annual</td>
<td>$4,927.50</td>
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<tr>
<td>Maintenance, annual</td>
<td>$648.00</td>
<td>$648.00</td>
</tr>
<tr>
<td>Genset replace/rebuild</td>
<td>$2,190.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Battery replacement</td>
<td>$3,650.00</td>
<td>$746.67</td>
</tr>
<tr>
<td>Annual operation</td>
<td>$7,765.50</td>
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<tr>
<td><strong>Total annual cost of operation</strong></td>
<td>$29,220.60</td>
<td>$21,793.01</td>
</tr>
</tbody>
</table>

FUEL AT $2.50 A Gallon, Delivered

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## Renewable Energy in Theater

### Cost Comparison

#### Diesel Light Trailer

<table>
<thead>
<tr>
<th>Item</th>
<th>Total Cost of Operation 3-Year Amortized Annual Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halide Purchase price</td>
<td>$5,924.10</td>
</tr>
<tr>
<td>Fuel cost, annual</td>
<td>$19,710.00</td>
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<tr>
<td>Maintenance, annual</td>
<td>$648.00</td>
</tr>
<tr>
<td>Genset replace/rebuild</td>
<td>$2,190.00</td>
</tr>
<tr>
<td>Battery replacement</td>
<td>$3,650.00</td>
</tr>
<tr>
<td>Annual operation</td>
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<tr>
<td>Total annual cost of operation</td>
<td>$23,360.00</td>
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<tr>
<td>Total 3-Year Cost of Operation</td>
<td>$76,004.10</td>
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</table>

#### Solar Light Trailer

<table>
<thead>
<tr>
<th>Item</th>
<th>Total Cost of Operation 3-Year Amortized Annual Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halide Purchase price</td>
<td>$17,609.00</td>
</tr>
<tr>
<td>Fuel cost, annual</td>
<td>$0.00</td>
</tr>
<tr>
<td>Maintenance, annual</td>
<td>$648.00</td>
</tr>
<tr>
<td>Genset replace/rebuild</td>
<td>$0.00</td>
</tr>
<tr>
<td>Battery replacement</td>
<td>$746.67</td>
</tr>
<tr>
<td>Annual operation</td>
<td>$0.00</td>
</tr>
<tr>
<td>Total annual cost of operation</td>
<td>$1,394.67</td>
</tr>
<tr>
<td>Total 3-Year Cost of Operation</td>
<td>$21,793.01</td>
</tr>
</tbody>
</table>

**FUEL AT $10 A Gallon, Delivered**
## Renewable Energy in Theater

### Cost Comparison

<table>
<thead>
<tr>
<th></th>
<th>Halide</th>
<th>Fluorescent</th>
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</thead>
<tbody>
<tr>
<td><strong>Total Cost of Operation</strong></td>
<td><strong>3-Year Amortized Annual Average</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Purchase price</strong></td>
<td>$5,924.10</td>
<td>$17,609.00</td>
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<tr>
<td><strong>Fuel cost, annual</strong></td>
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<tr>
<td><strong>Maintenance, annual</strong></td>
<td>$648.00</td>
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<tr>
<td><strong>Genset replace/rebuild</strong></td>
<td>$2,190.00</td>
<td>$0.00</td>
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<tr>
<td><strong>Battery replacement</strong></td>
<td>$3,650.00</td>
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<tr>
<td><strong>Annual operation</strong></td>
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<td><strong>Total 3-Year Cost of Operation</strong></td>
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<td><strong>$21,793.01</strong></td>
</tr>
</tbody>
</table>

FUELS AT $20 A Gallon, Delivered
Renewable Energy in Theater

Tactical Hybrid Power Trailer

- Dual wind turbines
- Fold-out solar array
- On-board backup genset
- Battery pack and inverter
- Computerized energy monitor
Renewable Energy in Theater

Tactical Hybrid Power Trailer

- Solar array
- Wind turbines
- Backup genset
- Vehicle-based generator

Energy gain sensor
Renewable Energy in Theater

Tactical Hybrid Power Trailer

Solar array → Energy gain sensor → Battery Pack

Wind turbines

Backup genset

Vehicle-based generator
**Renewable Energy in Theater**

**Tactical Hybrid Power Trailer**

- Solar array
- Wind turbines
- Backup genset
- Vehicle-based generator
- Energy gain sensor
- Battery Pack
- Energy load sensor
- Inverter

- AC loads
- DC loads

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**Renewable Energy in Theater**

**Tactical Hybrid Power Trailer**

- Solar array
- Wind turbines
- Backup genset
- Vehicle-based generator
- Energy gain sensor
- Battery Pack
- Energy load sensor
- Inverter
- AC loads
- DC loads
- Energy Management Display
- Computer

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