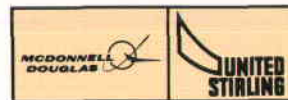


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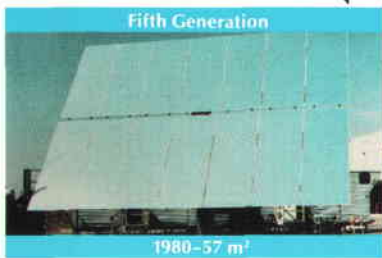
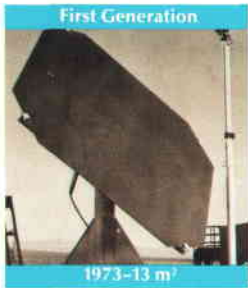
# The Dish Stirling Solar Electric Generating System





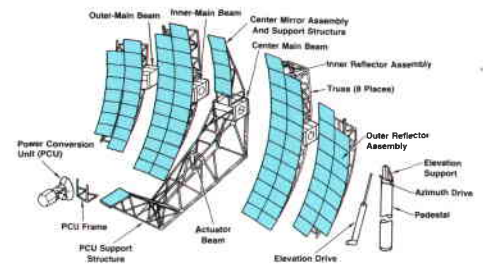
# Development History

## Concentrator Development



**The McDonnell Douglas Concentrator**  
The concentrator, designed and manufactured by McDonnell Douglas Corporation's Solar Programs Division, represents over 12 years of McDonnell Douglas experience in the design, fabrication, and testing of solar two-axis tracking devices.

### Major Subassemblies

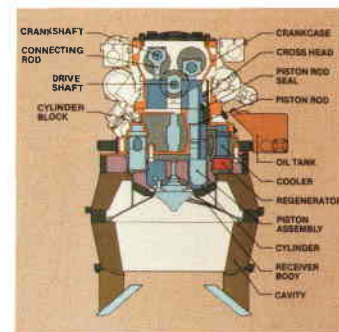


## Stirling Engine Development



### The United Stirling Power Conversion Unit

The Solar Stirling Power Conversion Unit (PCU) is designed and manufactured by United Stirling AB of Malmö, Sweden. The solar PCU is a derivative of United Stirling AB's 4-95 engine. As of March 1985 36 PCU's have been built with cumulative running time of 65,000 hours and 11,000 hours on a single unit.



### The McDonnell Douglas/Dish Stirling System

Coupling of the McDonnell Douglas concentrator with the United Stirling PCU yields a module with a nominal rating of 25 kW. The required capacity of each plant is achieved by combining these modular units.





# Applications

## Irrigation Pumping

The output of the PCU electric generator is coupled directly to one or more submersible pump motors. With nearly constant efficiency, the amount of water pumped follows the insolation available throughout the day.



## Remote Power

The Dish Stirling System can provide power for communities or operations not connected to a utility grid. A diesel-driven generator is supplied for periods without sun. The economies are based on the diesel oil saved.



## Utility Grid Supply

Dish Stirling power modules can be combined in any number to provide the desired plant output. The modularity of this system allows capacity additions as the growth of load requires.



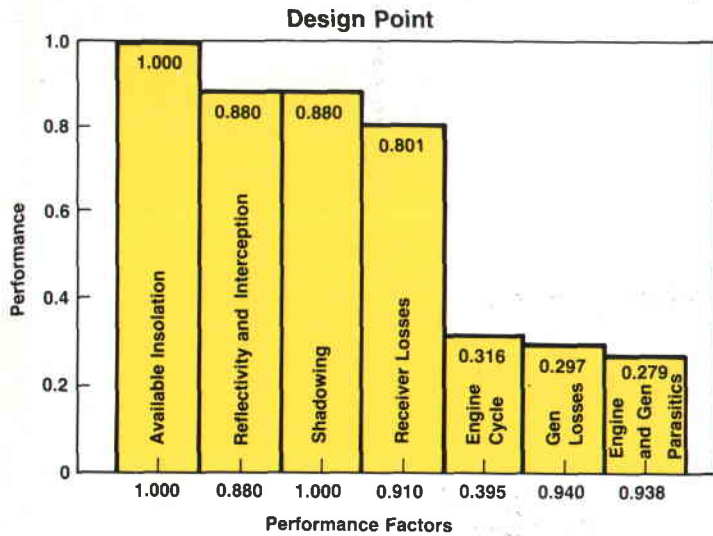
## Key Features

- Multiple applications
- Modularity and Short Lead Time for Construction
- Siting Flexibility
- Minimal Environmental Impact
- Minimal Water Requirements
- High Overall Efficiency
- Automatic, Unattended Operation
- Attractive Customer Economics



# Performance

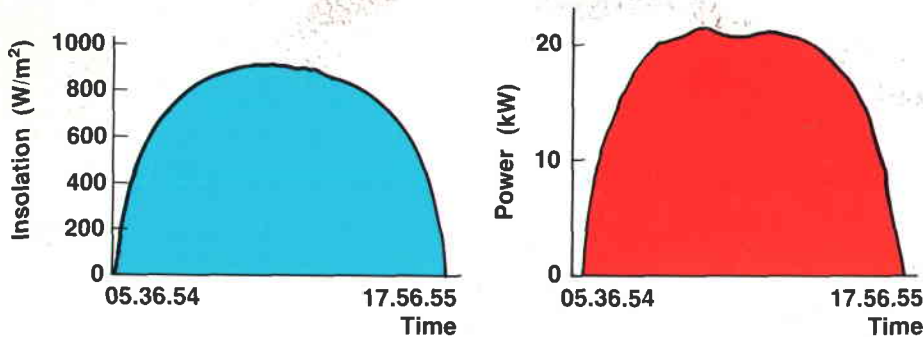
## System Performance Dish Stirling



### Design Point Performance

The conversion efficiency from sunlight to net electrical output is 28 percent, based on actual test data. Because of very high part-load efficiency, the mean daily efficiency is around 95% of the maximum.

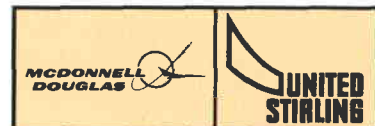
## Insolation and Power From a Full Day Test



### Daily Power Production

This diagram shows the measured power output and the insolation for a full day's run. The pressure of the engine working gas is varied in relation to the insolation. This maintains constant temperatures and nearly constant efficiency.

McDonnell Douglas and United Stirling are committed to the commercialization of Dish/Stirling systems and welcome the opportunity to participate with you in discussing your energy needs.



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