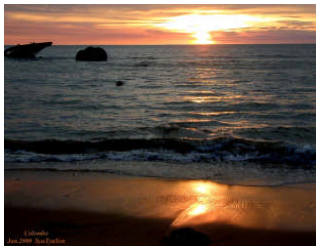
CONTAINED ENERGY

Sustainable Solutions - Renewable Energy

Alternative Energy Solutions and Systems for Villas

Alternative Energy Solutions and Systems for Villas

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Alternative Energy Systems for Villas

Intro

More and more people are more and more aware of the issues with energy. Apart from rising costs, there are shortages and environmental issues to consider. It is clear that we generally can not expect to keep using energy the way we have gotten used to – alternative solutions need to be considered.

Anyone building a villa now, needs to look at a 20-30 years horizon and will realize that energy will HAVE to be one of the more important considerations in planning and design. Even existing villas will have to consider the management of their energy requirements. Oil prices WILL keep on rising and PLN (State) power WILL get more expensive and more differential (with peak hour charges, etc.).

You don't have to be a 'tree hugger' to think carefully about your energy needs: A villa property with (some) energy self-sufficiency will be more valuable than its neighboring property that is fully dependent on 'conventional' energy.

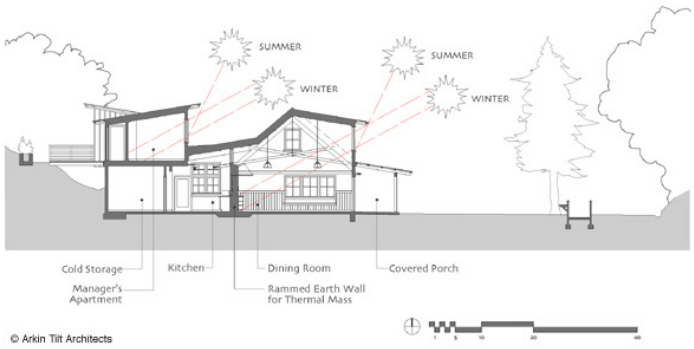
This booklet aims to provide an overview of energy solutions and considerations.

In General

Sound energy management starts with sound design and sound choices. Orientation, shading, roof-styles and -materials, insulation, material choices, equipment choices and many more factors can have a HUGE impact on your energy requirements.

Too often, architects and MEP engineers still pay very little attention to this and just 'plug in' conventional numbers, double them, add 20% to be sure, and then tell you you will need a 33 kVA connection to the grid (at huge cost to you, the owner). In 99% of cases we come across, you do NOT need that!

Talk to your architects and electrical contractors about this! If they are not taking energy requirements into account, they are not doing you the best service and 10 years from now, you'll have a villa that will cost a fortune to run (and will have much less value than your neighbor's property that HAS some self-sufficiency).



There are many variables in designing a good energy system, depending on usage, location, size, style, budgets and many other factors but fortunately there are as many solutions as there are specific situations.

The good news is that, on average, on Bali, the sun alone showers us with around 1 kW of energy per square meter per hour! If your property is, say, 1000 m2, that works out at 6,000 – 7,000 kWh per day! Even on cloudy days, you will be showered with around 4,500 kWh per day… And on top of that there is wind! We only need a tiny fraction of that available energy. There is no shortage of energy – we just need to (re)learn how to convert and manage it!

The following is an overview of the main possible applications and solutions that may be considered. And there are more….

But first:

About Energy Units

We all have gotten used to think in, and talk about, Watts (W) or KiloWatts (KW), which is a unit of 'power' whereas we should actually think and talk about units of 'energy', for which we tend to use KiloWattHours (kWh's) but for which the correct unit is KiloJoules (kJ's).

For some really informative booklets about energy, energy-usage and –education, please visit http://www.kajul.org/DownloadsEN.php and download the booklets, courtesy of Maurice Adema of PT Sundaya Indonesia, one of our main suppliers.

For this overview, we will still use WattHours and KiloWattHours, with apologies to Maurice.

Solutions Overview

Solar Hot Water

Solar water heating HAS to be one of the clearest 'no-brainer' (free) energy solutions in the Tropics. It is bordering on the ridiculous to have to expend substantial paid-for energy to make hot water when the outside temperature in the sun is often more than 40 C and a bucket of water placed in the sun will easily reach 40 – 50 C.

There are many types of solar hot water solutions:

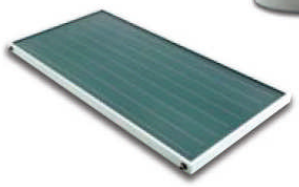
- with or without integrated storage tanks
- with or without back-up heating with electricity or gas
- flat-plate collectors or vacuum-tube collectors
- closed systems or flow-through systems

Although vacuum-tube collectors are the latest generation, they are mainly more (cost) efficient in climates where the ambient temperature can be substantially lower than the required water temperatures. Here in the Tropics, that type of efficiency is not so relevant because the ambient temperature is usually only 20-30 degrees below your desired hot water temperature and thermal losses are therefore not so great.

Current (economic) flat-plate solar thermal collectors will convert 60-70% of solar energy into usable heat, at very low cost. Consisting of glass, copper and aluminium, they will easily last 10-20 years or more.

The lowest-cost and easiest solution is a system with an integrated tank and an electrical back-up heating element, but these systems are bulky, heavy, not-so-aesthetically-attractive, and can still use a lot of electrical power (which, by the way, is the least energy-efficient form of water heating).

A more elegant, more energy-efficient and better-looking solution is to have separate solar collectors on the roof, working in combination with a gas-fired back-up heater, either in a simple flow-through system or in a closed loop circulation system (mainly depending on the 'hardness' of the water). Control systems range from very basic temperature sensors to sophisticated 'smart' control and –monitoring systems that can tell you the status and production of the system, even remotely.



Hot water usage obviously varies considerably by household but in general, a 4-person household can very comfortably be supplied with plenty of hot water by a 300 liter system, with one flat-plate solar collector of 2 square meter, which will typically cost around US$3,500 – US$4,000[1].

[1] All prices and costs quoted are budgetary only. They do not include 10% sales tax, nor do they include installation which will vary per location.

Solar Pool Pumping

The pool pump represents a significant electrical load for many hours during the day, and thus eats many kWh's, whether anyone is using the villa or not! It HAS to run most of the day, every day!

Our robust (German) Lorentz PS600 Badutop pool pump is powered direct from solar panels, without the need for batteries. With a DC motor, it is 50% more energy efficient compared to AC-powered pumps and thus requires relatively little solar power.

The smart Maximum Power Point Tracking (MPPT) electronic controller measures the output from the solar panels and optimizes the power supplied to the pump. The pump simply starts running when there is enough light in the morning and stops pumping when the light fades in the evening. Automatically. Every day. Without electrical bills.

One PS600 can handle pool sizes up to 200 m3[2]

A 220V/AC power pack is optionally available to operate the pump outside sunshine hours, for instance for vacuuming the pool early in the morning, or running the pump at night when desired.

Depending on the size of the pool, the pump requires a 300-720 Watt Peak (Wp) solar array. If a solar tracker is used, making the solar array follow the sun's trajectory throughout the day, the pump will start earlier in the morning and will run until later in the afternoon.

Solar Array Requirements & Budget Examples
(Bali conditions, 6 kWh/day solar irradiation)

Pool size	**50 m3**	**80 m3**	**100 m3**
Solar array, without tracker	8 x 54 Wp	12 x 54 Wp	6 x 130 Wp
Budgetary system costs	US$ 5,200	US$ 6,900	US$ 7,200

Pool size	**80 m3**	**120 m3**	**140 m3**
Solar array, with tracker	8 x 54 Wp	12 x 54 Wp	6 x 130 Wp
Budgetary system costs	US$ 7,200	US$ 8,900	US$ 9,500

[2] Based on one full circulation per day

Solar Well Pumping

Pumping water from a deep-well can take a lot of energy and can easily draw several 1000's of Watts, adding to the peak load power requirement AND using lots of kWh's. Again, even when a villa is not in use, the well pump often needs to run to water the gardens.

Using our (German) Lorentz PS-series solar-direct powered DC well pumps can shave these Watts (power) from the peak power requirement, and kWh's (energy) from your energy bill.

The highly-efficient pump-ends and DC motors of these German submersible pumps only require 50% of the energy typically used by a conventional AC-powered pump with equivalent capacity.

Our biggest versions can pump up from depths of up to 240 meters (with low volume), or up to 150 m3 per day (at low lift).

By only pumping water during the day, into a suitable storage tank, no batteries will be needed. In effect, your storage tank becomes the battery!

A 220V/AC power pack is optionally available to operate the pump outside sunshine hours, when desired.

Required solar power depends on total lift (from pump depth up to storage tank) and daily volume required.

The following are a few examples of capacities and budgets[3]. Many more variations are available and adding solar trackers will add 30-50% more daily production.

Type	Total Lift	Solar Array	Daily Production	Budget
Lorentz PS150	10 mtr	1 x 130 Wp	10 m3	US$ 2,500
Lorentz PS200	20 mtr	2 x 54 Wp	3 m3	US$ 2,700
Lorentz PS600	40 mtr	6 x 54 Wp	5 m3	US$ 5,400
Lorentz PS1200	100 mtr	4 x 130 Wp	4 m3	US$ 6,200

These systems are completely maintenance free and have been known to 'keep on pumping' for 20 years in adverse conditions! Thus, for instance, the PS150 can pump a staggering 73,000 m3 in its lifetime, at a cost of only 3 cents US per m3.

[3] Budgets are for pump, controller and solar panels only. Subject to change without notice. Installation and installation materials not included.

Solar Grid-Feed Power

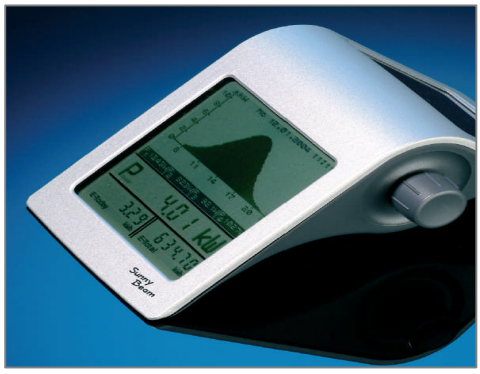
Especially interesting now that PLN, the state-owned power company, is starting to implement differential tariffs, 'penalizing' big users with up to **60% penalty** and rewarding small users with 20% discounts, solar energy can be added to your household needs direct during the day, keeping down the kWh's you need from PLN.

Solar arrays of any size, on rooftops, on trackers or even as shade structures, produce DC power that is 'inverted' by a 'grid-tie' inverter to high-quality 220V AC power that is directly used in the villas electrical systems.

Systems can be as big or small as required and multiple systems can be installed in parallel.

Our German SMA equipment is characterized by:

- Exceptional reliability, efficiency and energy capture ratio (up to **96% efficiency**)
- 5-year comprehensive warranty
- Rugged stainless steel outdoor enclosure standard
- Easy to install wall mount bracket system
- Comprehensive SMA communications and **data collection** options
- SMA's modular inverter design is expandable to virtually any size system
- The favorite among PV professionals everywhere. Over 250,000 Sunny Boy inverters have been installed throughout the world.
- Superior design, rock-solid German engineering.



System size and budget examples:

Nominal Size	**Solar Array**	**Daily Production**[4]	**Budget**[5]
2000 Watt	16 x 130 Wp (static mount)	12,5 kWh/day	US$ 15,000
4000 Watt	32 x 130 Wp (static mount)	25 kWh/day	US$ 30,000
6000 Watt	46 x 130 Wp (on trackers)	48 kWh/day	US$ 50,000

We also have other brands and sizes available.

[4] At 6 kWh/day solar irradiation
[5] Budgetary numbers only. Not including installation. Subject to change.

Wind Grid-Feed Power

Most of Indonesia is marginal for wind power but Bali is blessed with a pretty good wind regime for most of the year. And the further South and East one goes, the better the winds get.

If your location had good exposure to wind, wind power should be considered. A 1000 Watt turbine has the potential of producing 24 kWh per day. Even with only 12 hours per day of good winds (10 m/s or more), it produces 12 kWh. Plus, as opposed to solar power, it can be productive at night as well.

We offer several types of small to medium wind turbines especially developed for low-wind and low-noise performance.

Through grid-tie inverters, these turbines can feed power straight into your villa system, replacing kWh's supplied by the utility grid.

We offer German-made SMA grid-tie inverters, characterized by

- Special operation mode for wind turbines
- Freely configurable output characteristic curve
- For indoor and outdoor installation
- SMA grid guard 2: automatic disconnection unit
- Galvanic isolation from grid by means of transformer
- Extended temperature range –20 °C to +60 °C
- Integrated 2-line display
- Diagnostics and communication via display, network, radio and cable
- 5 years SMA warranty (10 years optional)

Wind power can be relatively economic (IF there IS wind, of course) and doesn't require large investments.

A 900 Watt marine-version Lakota, complete with grid-tie inverter, will cost approximately US$ 3,500 whereas a larger 3000 Watt turbine, with inverter, will cost approximately US$ 10,000 (excluding tower and installation).

Small and Medium Stand-Alone Systems

For small applications, small weekend homes, and the likes, but also as add-on to existing properties or 'starting packages' that can be expanded upon, we offer a complete, economic range of interesting, high-quality systems, made in Indonesia by a Dutch-managed manufacturer.

These 'mini' and 'midi' systems are very simple to install, very well designed and relatively low-cost.

The 'heart' of the smaller systems is an integrated battery/controller pack, the S4, with a deep-cycle battery and 'forced health improvement' circuitry, preventing detoriation of the battery by overuse. It is perfect for running a few lights or a DC fan, even a small DC television

The 'medium' system, the S5, available in mid-2008, has bigger capacities and is easy to expand. It works with modules of 12V/175AH deep-cycle batteries and smart controllers for each battery. It comes in a highly-designed 'wood-grain' mounting rail and housing system that completely hides the batteries and cables.

This S5 system has the capability of energizing lighting systems, fans, TV's and more and can be expanded to 48V systems with 6400 WattHour storage capacity. It has a Central System Monitor that keeps track of 'energy in' and 'energy out' and measures the life expectation of the batteries.

Both the S4 and S5 systems can also work for larger projects when multiple modules are installed.

It also includes a very well-designed, simple, fool-proof, cabling system and many types of 12V or 24V lighting options, as well as an AC charger.

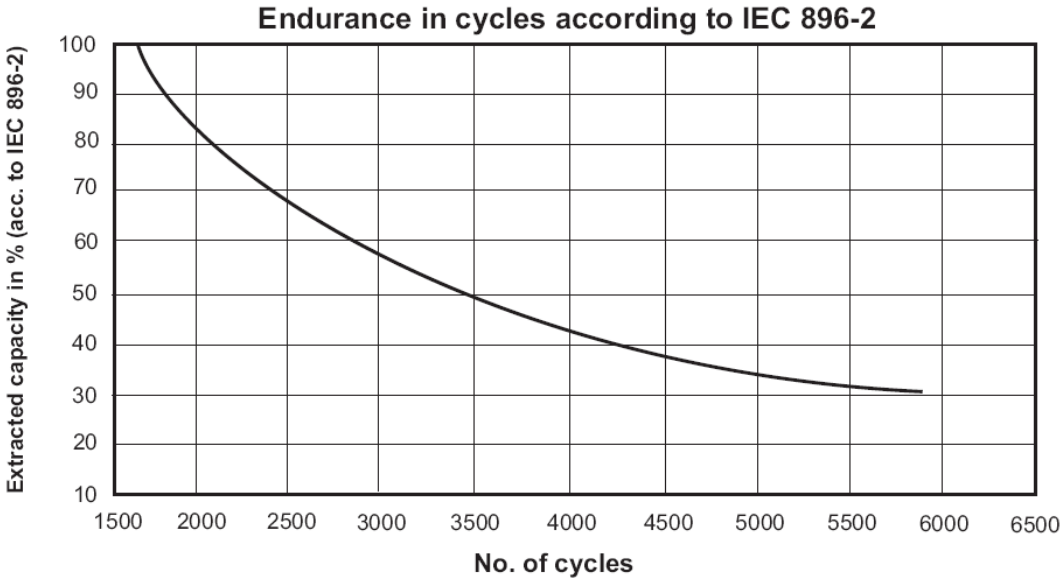
Battery Based Systems with Inverter/Chargers

For villas that want to be completely independent of the grid, or where grid is not available at all, or where back-up power is desired (replacing a generator) battery storage will be needed, usually with an inverter/charger. Batteries store and release energy in the form of DC electricity. Inverter/chargers charge the batteries and discharge them for 'making' 220V AC power.

Batteries are heavy, cumbersome, not 100% efficient, expensive (the good ones), do not live forever and are usually made with heavy metals, so they are not ideal but they are currently the only way to store electrical energy.

There are several types of batteries but only a few are suitable for renewable energy applications. Automotive batteries, which are designed to release a short burst of energy to start an engine, are useless for renewable energy application where a slow release of energy is required. Battery life is limited by the number of discharge/recharge cycles they are capable of, at a given percentage of discharge.

CE usually recommends the ETG-brand (UK), highest-quality, longest-life, deepest-cycle, gel batteries in cells of 2V. These are the batteries used in telecommunications applications and they have a design life of 10-15 years. They are maintenance free and, though expensive, the best value for money over their lifetime. They are the ONLY batteries that can deal with a 50% discharge for 3500 cycles (10 years, when charged/discharged to 50% every day).



From these 2V cells, banks of 12, 24, 48 or even 120V are made by connecting 6, 12, 24 or 60 cells. The most widely used size is 1000Ah and a 48V bank of these will store approximately 48 x 1000 = 48,000 Whr (48 kWh). With 50% 'daily-rate-of-

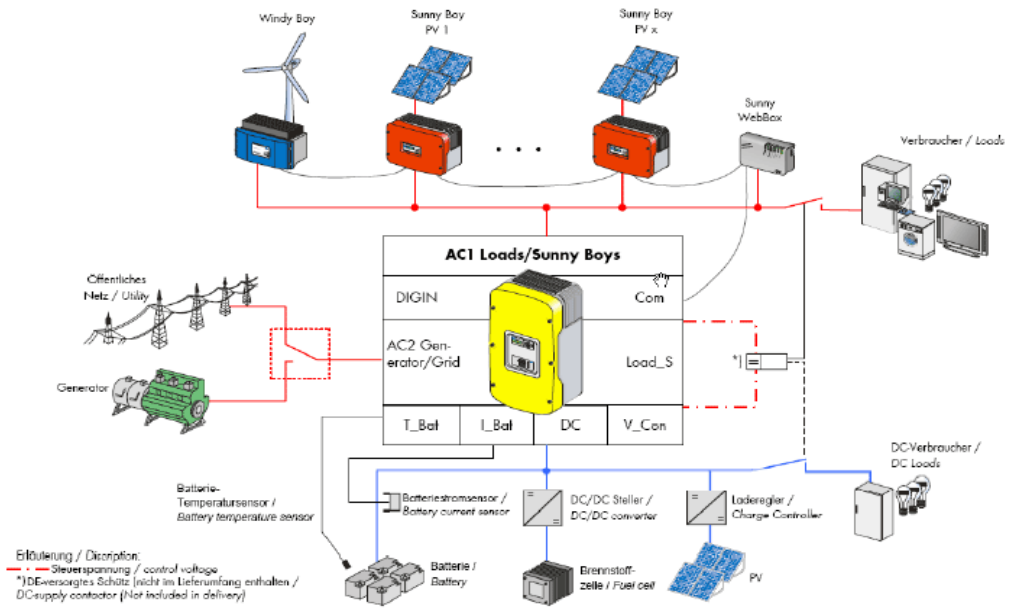
discharge, such a bank makes available 24 kWh of energy, and on occasion, during a black-out, for instance, they can be discharged to 70%, providing around 35 kWh. This is a LOT of energy.

Battery banks are charged by battery chargers, solar charge controllers, wind charge controller or inverter/chargers, and can discharge electricity in DC form or, via an inverter, as 220V AC power. There is a limit to what they can take in as charge and to what they can discharge, per hour. The bigger the bank, the higher that limit.

We highly recommend to NOT save on batteries! Get the biggest, strongest banks you can afford.

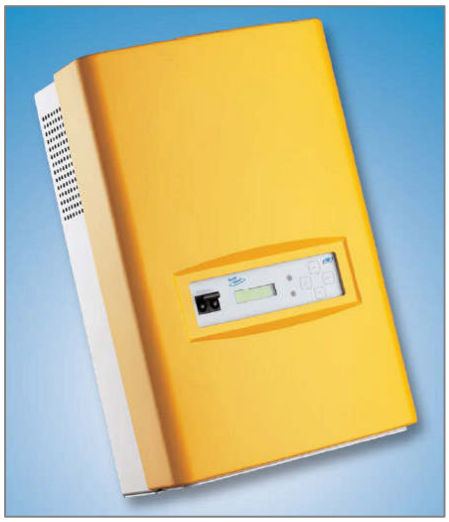
When utility- or generator-power is available, we typically install 'inverter/chargers', also called 'bi-directional inverters', that can both charge the batteries (from utility of genset) and 'invert' energy from the batteries as AC power. The inverter/chargers typically can work together with solar arrays, wind power and other sources and have smart circuitry to know what to do when.

Inverter/chargers can also 'top up' power available from utility or genset during peak usage! For instance, if you only have a 10 kVa connection to the utility, usually use only 50% of that but occasionally require 15 kVa, the inverter/charger can take the surplus power from the utility or genset, store it in the battery banks, and release it during peak requirements.



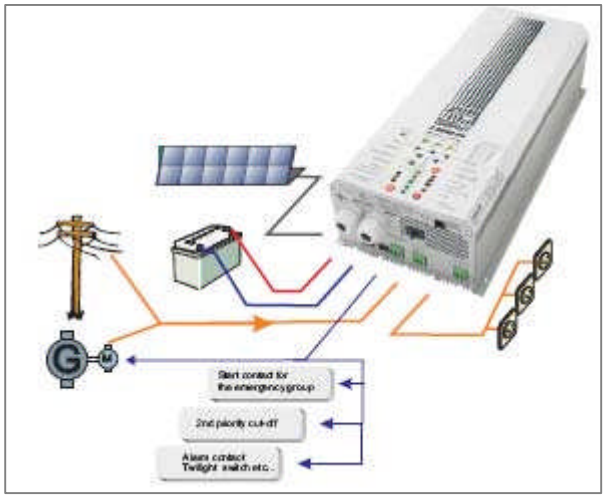
Schematic design of a possible system configuration

Again, we like to use German SMA inverter/chargers, because of their flexibility and high quality. They work together seamlessly with wind power, solar power and other energy sources and are characterized by:



- High efficiency
- Ergonomic aluminum enclosure
- Active ventilation system OptiCool
- For applications from 3 kW to 100 kW
- AC/DC coupling of all energy sources and consumers
- Parallel connection in case of single- and three-phase operation
- Modularly expandable
- Excellent overload characteristics
- Intelligent battery management for maximum battery durability
- Storage of system data on MMC/SC card
- Easy and intuitive handling

We also carry Swiss-made Studer inverter/chargers, slightly less feature-rich, but also of exceptionally robust quality and with very good charging capacities, which are especially important if you use a genset for recharging batteries (translating into less genset running time and thus less fuel use).



Studer models can also have a solar charger pre-integrated.

There is a huge variety of models and sizes available from SMA, Studer and others, but here are a few sample configurations and illustrative budgets:

Capacity at 50% discharge	Capacity at 70% discharge	Battery Bank	Inverter/ Charger	Continuous Power Capability	Charger Capability	Budget[6]
6 kWh	8 kWh	6 x 2V/1000AH	Studer XP1400-12	1400 Watt	45A	US$ 7,000
12 kWh	16 kWh	12 x 2V/1000AH	Studer XP2300-24	2300 Watt	55A	US$ 12,600
24 kWH	32 kWh	24 x 2V/1000AH	Studer XP8000-48	7000 Watt	90A	US$ 26,700
24 kWh	32 kWh	24 x 2V/1000AH	SMA SB4248	4200 Watt	80A	US$ 25,200
24 kWh	32 kWh	24 x 2V/1000AH	SMA SB5048	5000 Watt	80A	US$ 27,000

[6] Budgetary prices for batteries and inverter/charger only. Installation and sales tax not included. Various other (small) equipment, such as temperature sensors, disconnects, etc. may be required.

Lighting

Whole books can be, and have been, written about lighting and it is an issue that involves a lot of personal taste, which can not be 'argued'. For this overview, we will just deal with the energy aspects of lighting.

Villas properties often have many, MANY lights and they DO add up in terms of energy consumption, so it IS worth looking at energy-efficient lighting, and fortunately there are good options.

Lighting efficiency is all about 'Lumens per Energy'[7]

Incandescent	
Light Output Luminous Flux (in Lumen)	900Lm
Lamp Efficiency Electric Energy to Light Energy Conversion Efficiency (in % of theoretical maximum)	1.3%
Energy Consumption Per Hour	360 kJ/Hour
Per Year (@ 8hrs/day)	1050 MJ/Year
Light Output Lifetime 75% Lumen Maintenance	700 Hours
50% Lumen Maintenance	1,000 Hours
Switching Cycle Lifetime	2,000 On-Off Cycles
Electrical Requirements Nominal Oerating Voltage range	180-230Vac/dc
Nominal Oerating Current range	455mA

Fluorescent	
Light Output Luminous Flux (in Lumen)	900Lm
Lamp Efficiency Electric Energy to Light Energy Conversion Efficiency (in % of theoretical maximum)	7.9%
Energy Consumption Per Hour	60 kJ/Hour
Per Year (@ 8hrs/day)	174 MJ/Year
Light Output Lifetime 75% Lumen Maintenance	10,000 Hours
50% Lumen Maintenance	15,000 Hours
Switching Cycle Lifetime	20,000 On-Off Cycles
Electrical Requirements Nominal Oerating Voltage range	180-230Vac/dc
Nominal Oerating Current range	75mA

Silicon Lamp	
Light Output Luminous Flux (in Lumen)	900Lm
Lamp Efficiency Electric Energy to Light Energy Conversion Efficiency (in % of theoretical maximum)	30%
Energy Consumption Per Hour	16 kJ/Hour
Per Year (@ 8hrs/day)	46 MJ/Year
Light Output Lifetime 75% Lumen Maintenance	40,000 Hours
50% Lumen Maintenance	70,000 Hours
Switching Cycle Lifetime	Unlimited
Electrical Requirements Nominal Oerating Voltage range	180-230Vac/dc
Nominal Oerating Current range	20mA

The efficiency of a lamp can be expressed in %; which is extremely easy to explain to a customer. The higher the number the more efficiently the lamp converts electric energy into light energy.

Interior Lighting

For interior lighting, consider LED lights. They are now available in 'warm white' and have overcome their previous problems with 'fading' over time. They are available as with 'MR16' (halogen spot) fittings, screw fittings, etc. LED lights are expensive but easily save their investment back in energy-savings and longevity. There are now LED lights that will last 100,000 (that's over 20 years when 'on' for 12 hours per day!)

'Warm White' CFL lights are also a good option.

[7] See chapter on Energy

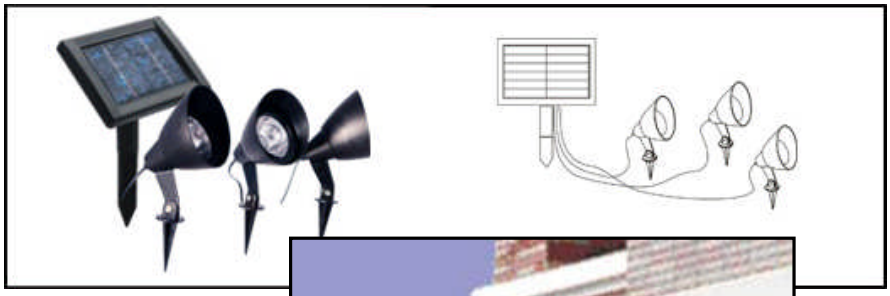
Security Lighting

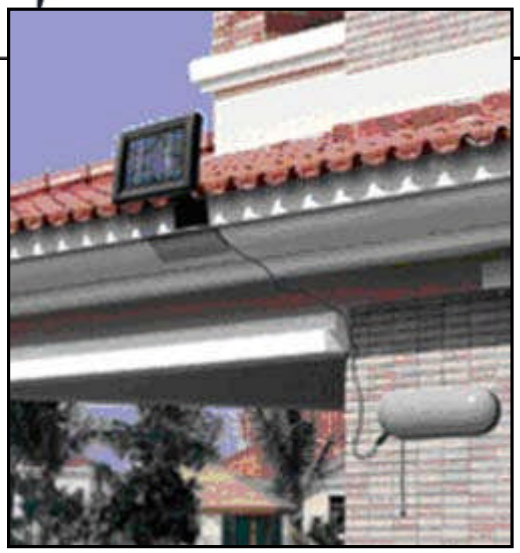
For security lighting, consider solar-powered stand-alone units with CFL lights. They stay on during black-outs!

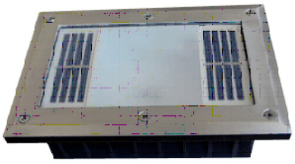
They provide grid-independent security light without energy costs. See also ‘Rental Villa Strategies’ below.

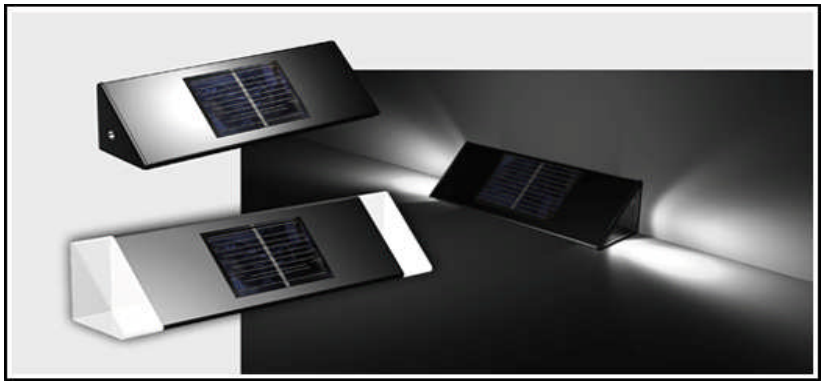
Outdoor Lighting

For garden- and other outdoor lighting, we now have well-designed, small stand-alone and cluster models. They will not ‘bath’ your garden in light but can provide good accent lighting. These are all LED lights and have their own solar panel and battery.



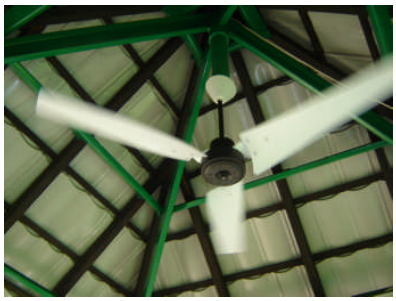






Ceiling Fans

Most ceiling fans are notoriously energy-inefficient. When was the last time you saw an airplane propeller made from a flat piece of steel with a bend edge?! Consequently, they use way too much energy to move the amount of air they do.



We now have ceiling fans with a properly designed 'fan-blade' that move 40% more air (they actually have the same profile as the propellors of the 'Gossamer' solar-powered aircraft – designed by NASA) AND with a highly-efficient DC motor.

These 'Gossamer' ceiling fans run on 15-20 Watt, compared to 70–100 Watt for convetional, AC-powered ceiling fans. If you had 8 fans spinning for 12 hours per day, the difference in energy-usage could be 9 kWh per day!

They are made from ABS plastic and will last forever.

These fans can also be powered 'solar-direct'. 3-4 fans can be run direct from 2 units 54Wp solar panels. They'd start spinning in the morning and stop when it gets dark. The more sun, the faster they spin.

One fan, with speed-controller, costs approximately US$350. A set of 3 fans and two solar panels will cost approximately US$1,850 (ex sales tax and installation).

Well-placed ceiling fans will save a lot of air-conditioning energy!

Refrigeration

Although not a HUGE power load (in Watts), refrigerators and freezers DO use a large quantity of energy (in kWh's) because they pretty much run for 20-24 hours per day.

There are 150-liter, 2-door Sanyo fridges on the market that run on 29 Watt, as opposed to run-of-the-mill fridges of the same size that can use as much as 150-200 Watt. Over 24 hours, that makes a HUGE difference and if your energy comes from solar or batteries, using these low-energy fridges will save you a lot of investment in solar panels and batteries. These fridges only cost around US$200, not much more than a normal fridge.

Similarly, there are General (top-lid, 100 liter) freezers on the market that run on only 70 Watt and cost only US$200.

Another option is to use kerosene or LPG fueled fridges. These are somewhat more expensive but take away the electrical load for fridges and freezers completely, which can make a LARGE difference in required investment for solar power and batteries. These fridges were quite common for boats, summer houses, etc. but somehow we forgot about them. They use very little fuel and cool VERY quickly. PLUS, they'll keep running during black-outs!

Air-Conditioning

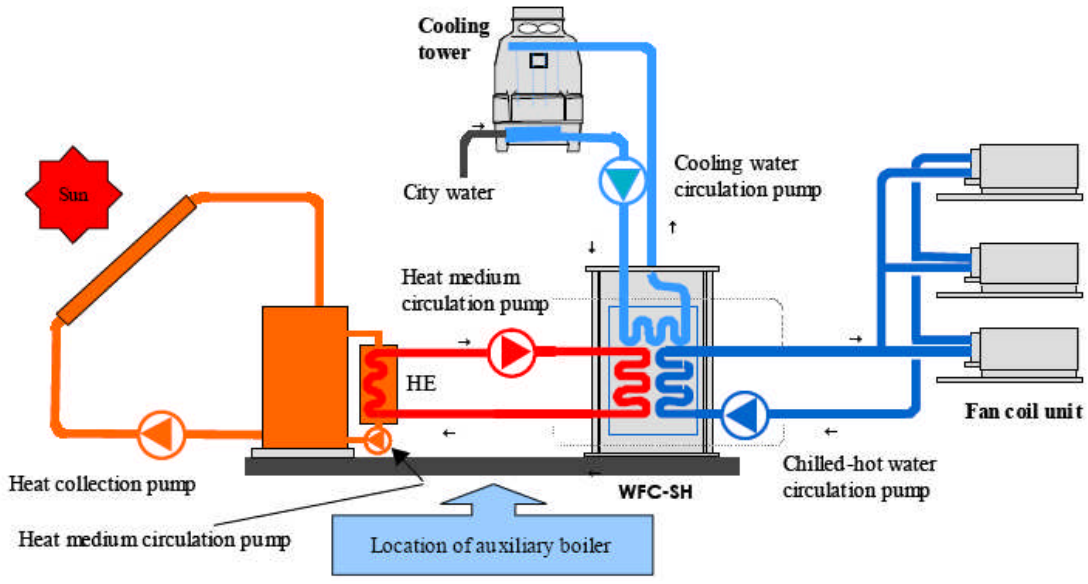
This is the big one! By FAR the biggest energy-user in almost any household and villa in the Tropics! AND mostly used during the night, when solar power is not available!

Unfortunately, we have gotten used to plugging in split-unit AC's that are cheap and common. At CE, we call them 'garden-heaters', because they do as much to heat the garden as to cool the inside of the villa. Overall, they are HUGELY energy-inefficient, if you take into account that someone, somewhere, has to stoke a huge fire to make steam to make electricity that gets send via hot wires and hot transformers to a 'garden-heater' to provide a little bit of cooling inside a room. LOTS of heat to make a tiny bit of cool!

The irony is that we can actually create cooling from heat much more direct, as we did in the late 1800's and early 1900's before we had abundant electricity distribution.

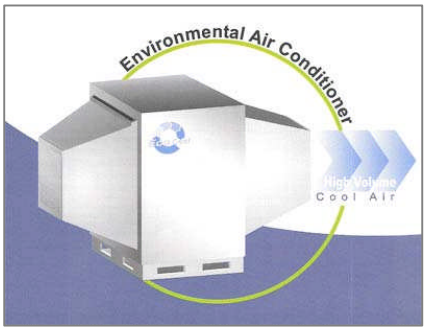
Remember the 1000 Watt per square meter per hour that falls on your house for free? 50-60% of that COULD be used to generate cooling direct, via "adsorption chilling"(heat evaporates ammonia from a water solution, condenses in a separate vessel and when that ammonia evaporates again, it creates cooling down to -23 C. This is the same principle as used in LPG/Kerosene fridges). This process uses only heat and some pumping to create lots of cooling. Heat, we have in abundance in the Tropics and heat is relatively easy to 'harvest' with high efficiency at low cost!

Fortunately, cooling solutions powered by (solar) heat are coming on the market again, especially in Europe. They are becoming cheaper and some can 'store' cooling created during the (sunshine) day, for usage at night. Others can use gas-heaters as back-up.



These systems are usually configured as ‘central’ chillers that distribute chilled water to wall-, ceiling- or floor-mounted fan-coil units (similar to the indoor part of a split-unit AC), so they DO require a bit of planning and engineering. They can also be configured to distribute fresh, cool air via air-ducting.

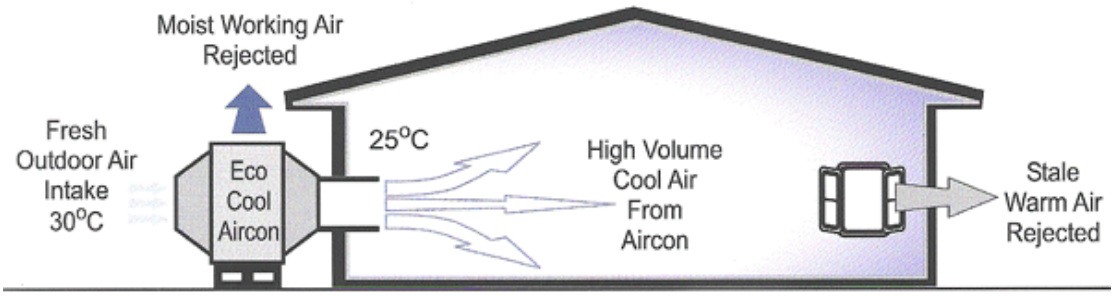
But, imagine, the more sun, the more cooling, (almost) free!



Another interesting low-energy solution for cooling is the EcoCool system which provides HUGE quantities of fresh, dry, somewhat cooled, air at VERY low energy costs.

The ‘Breeze Machines’, as we like to call them, will only cool the air to 25-26 C but with very little humidity and it is well known that 25-26 C is very comfortable as long as the air is dry.

A machine with a capacity of 17kW cooling and blasting 24 m3 of fresh, cool, clean, filtered air into a Villa, will only use 750 Watt of electrical energy, similar to a small split-unit AC (that does not refresh the air at all!)



These machines distribute their cool air through a ducting system.

If these solutions are not for you, please select AC’s that have high energy efficiency rating!

Generators

Many villas have a stand-by generator, usually diesel-fired, to step in when the utility power goes out, which is happening more frequently in some parts of Indonesia and Bali, and will only get worse before it gets better.

Earlier in the overview, we discussed the use of battery banks to replace or complement a generator.

Generators can especially be useful for properties that are not connected to utility grid at all. If ALL energy, ALL the time, needs to come from solar or wind power, systems need to be sized for the 'worst weather' months, meaning that there is over-capacity for the other months.

IF a generator is deemed desirable, it may be worth considering LPG fired units: they are cleaner and quieter than their diesel counterparts.

We carry a range of 12-60 kVa German-made Kohler LPG generators that are extremely reliable and quiet.

Some More Notes

Energy Strategies for Rental Villas

Rental villas are not continuously occupied and warrant a specific approach to energy usage.

For instance, with a solar pool pump, a solar well-pump, and some solar security lighting, the utility power will not need to be used at all during times that the villa is not occupied.

When the villa is rented, and AC's, fridges, fans, entertainment systems, etc. will be used, there is revenue and the utility bill will thus not be so painful….

Strategies for Villa Complexes

For properties with multiple villa units, there are also specific strategies that may be applied. Central systems for hot water, cooling, back-up power and other applications may be considered. Please contact us for further information.

Solar Panels

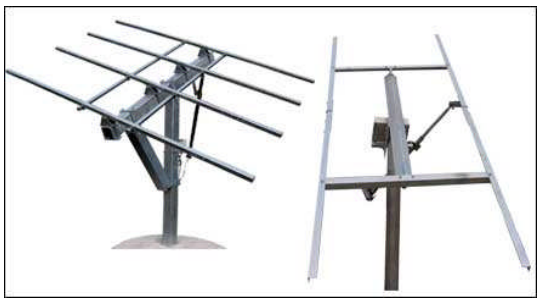
Solar PV panels are more or less a commodity: they are all good, all have more or less the same efficiency (between 16 and 18%), and cost more or less the same. Price is usally expressed per WattPeak (Wp). Most come with a 20 or 25 year performance warranty.

We like to use Kyocera panels that are especially made for hot tropical conditions, but can also supply Sharp, Kaneka (thin film) and other brands.

There ARE special types of panels for special purposes, such as:

- Shingle/tile Panels
- Transparent Panels
- Flexible Panels
- Black Panels
- Thin-film Panels

Solar Trackers



Solar trackers will keep a solar array aimed at the sun during its trajectory from East to West. They can increase production from the solar array by up to 50% and are available up to 15 m2 in size (for 15 units 130Wp solar panels, or close to 2000 Wp.).

Our (German) Lorentz EtaTrack trackers are single-axis trackers and are controlled by an intelligent timing mechanism driving a linear motor designed for 20 years usage.

Other trackers that use light-cells or thermal system to track the sun, often get 'confused' and do not track the sun's trajectory accurately.

Hydro Power

If your property is blessed with a nearby stream or river, hydro-power may be a good energy source: it runs for 24 hours so even a 500 Watt hydro-turbine can produce 12 kWh per day!

Potential capacity depends on volume (l/s) and 'head' (height) available.

There is an interesting new technology available in Bali that is very highly efficient in turning running water into power: the 'Vortex' hydro installations can produce a LOT of power from low volumes and low 'head'.

Contact us to discuss the possibilities.

Reverse Osmosis Water Making

Fresh water is not always available on all locations and in these cases owners may have to resort to desalination of sea water through Reverse Osmosis (RO). These machines make perfect water but require a lot of energy.

We offer a special range of DC-powered RO-machines with 'Energy Recuperation' systems that use only 40-50% of the energy that conventional machines use. These units were originally designed for use on racing yachts and came make water for as little as 18 Whr per gallon.

Please contact us for more details.

In Conclusion and About Us

We hope that this overview has been able to provide you some insight into the potential possibilities of applications of Alternative Energy Solutions for your Villa(s).

We have been in this industry in Indonesia since 2004 and have since undertaken a variety of projects, including:

- Solar home systems for Aceh houses
- Solar street lights for schools in Aceh
- Solar water pumping for CARE, IOM, THW, GTZ, World Vision and other NGO's in Aceh and other locations.
- Solar water heating for small hotel in Aceh.
- Solar systems for Bali villas.
- Solar/wind power system for clinics in Aceh and Meulaboh.
- Solar/wind/diesel hybrid system for villa on Fiji
- Solar water pumping in Sulawesi
- Solar security lighting for mines and factories
- Solar-powered RO watermaking facilities on Nusa Penida
- Large hotel hot water installations
- Large PV installation and training in Micronesia (2008)
- And many more…

We have a team of engineers and specialists, in Jakarta, Aceh and Bali, that can help you further – please feel free to contact us with questions or requests for further information.

Our objective is:

'to provide world-class alternative energy solutions, supported with world-class service'

We would consider it an honor to be of service to you, as well.

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