Climate-friendly cooling for the hotel industry in Sri Lanka

Finding sustainable, cost-effective cooling solutions with a positive impact on the climate.

green cooling initiative

Keeping Sri Lankan hotels cool

Climate change, rising prices for fossil fuels and more tourists with environmental consciousness are prompting hoteliers in tropical destinations such as Sri Lanka to find ways to maintain their businesses in a sustainable manner.

Refrigeration and air conditioning (RAC) in hotels often makes up more than 50% of total energy consumption. In many cases, this corresponds to half of the hotel's carbon footprint, and it is typically the single fastest-growing cost point for hotels in warm climates.

Greenhouse gas (GHG) emissions in Sri Lanka have been increasing continuously over the last decades (*Figure 1*) as the economy has grown. Refrigeration and air conditioning is responsible for roughly 15% of national GHG emissions, and hotels contribute a major share of that. By limiting emissions from refrigeration and air conditioning, Sri Lanka can move toward its climate targets.

GHG emissions resulting from refrigeration and air conditioning come from the electricity used to operate appliances, which is still generated with fossil fuels and results in massive amounts of indirect CO_2 emissions. It also comes from the release of climate-damaging HCFC or HFC-based refrigerants during the operation and maintenance of refrigeration and cooling appliances. This adds to indirect CO_2 emissions as well.

Figure 1
BAU and mitigation scenario of GHG emissions in the RAC sector in Sri Lanka *(Source: GCI)*

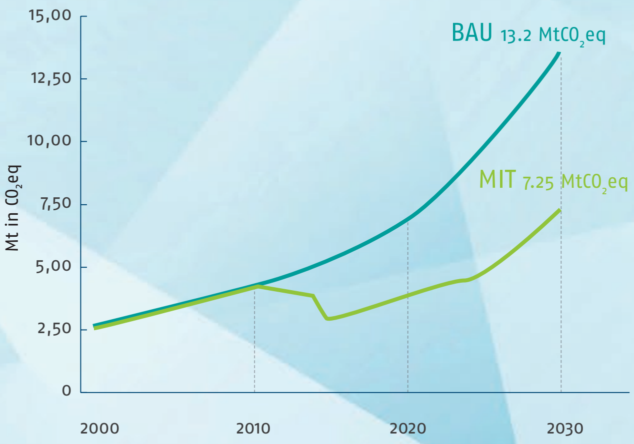
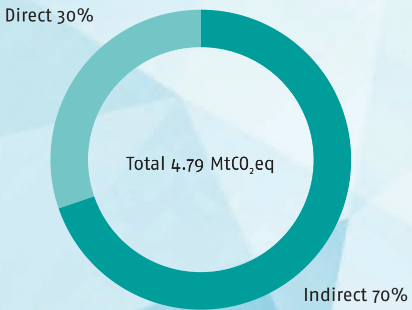


Figure 2
Direct and indirect GHG emissions arising from refrigeration and air conditioning in Sri Lanka *(Source: GCI, 2016)**



* *http://www.green-cooling-initiative.org/country-data/#!country-data-sheet/144/all-sectors* (last access 12 May 2017)

In Sri Lanka, around 70% of GHG emissions are estimated to be indirect, coming from electricity use, for example, while 30% are direct - from refrigerants released into the atmosphere, according to data from 2016 (*Figure 2*).

Almost all refrigeration and air conditioning equipment, such as chillers, unitary air conditioners, domestic refrigerators and commercial standalone equipment, can operate using natural refrigerants and with superior energy efficiency. When old equipment needs to be replaced, this technology is the best choice and could reduce GHG emissions in Sri Lanka by approximately 45% by 2030.

The Sri Lankan tourism industry has grown tremendously since 2010. In 2012, it achieved 1 million arrivals (*Sri Lanka Tourism Development Authority, 2014*). Travel and tourism in Sri Lanka contribute significantly to the overall Gross Domestic Product (GDP), representing 10.6% in 2015.

How Jetwing Hotels are staying cool

The refrigeration and air conditioning systems in Jetwing Hotels consume up to 64% of the total electricity used. Of that 64%, air conditioning chillers across the group consume around 60%.

Unitary air conditioners are the second highest energy- consuming equipment other than the chillers, which consume around 32% of the total electricity. Refrigerators, condensing units and others consume a smaller amount of electricity among the different installed RAC appliances.

At Jetwing's 10 hotels, most emissions are indirect (94%) and produced from burning fossil fuels to operate cooling appliances, while the rest (6%) are direct emissions from leaking refrigerants (*Figure 6*).

JW Yala and JW Lagoon, which rely on absorption chillers, had the best energy consumption patterns (*Figure 5*). About 95% of the energy used in both Yala and Lagoon is produced by energy-efficient vapour absorption chillers using biomass as fuel. Only the remaining 5% comes from electricity from less-efficient vapor compression chillers that are used as backups. (*Figure 4*) The different sizes of the individual rooms and the total number of rooms in each hotel may explain the varying energy consumption patterns.

Figure 5 shows that *JW Beach* has the highest consumption of electricity for cooling (64%), while JW Yala consumes only 27%. The total electricity consumption pattern and the cooling energy analysis show that, although JW Yala consumes the largest amount of energy, the electrical energy used for cooling by JW Yala is the least. The decline in energy used for cooling, compared to the total energy, can be linked to the use of absorption chillers.

In addition, by using absorption chillers at Yala and Lagoon, the hotels can save money, since the fuel used, cinnamon wood, is relatively cheap.

The two vapour absorption chillers at JW Yala and JW Lagoon use distilled water as a refrigerant, which has a global warming potential of zero.

Figure 3
Equipment electricity consumption pattern (in KWh) in Jetwing Hotels *(Source: HEAT analysis)*

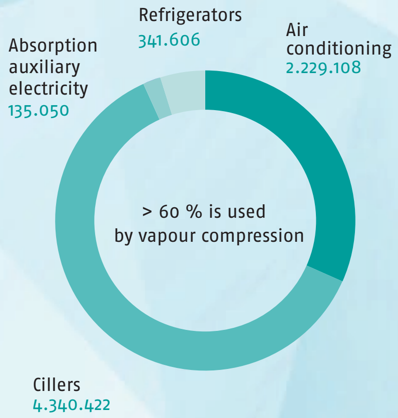


Figure 6
RAC GHG emissions (tCO_2eq)

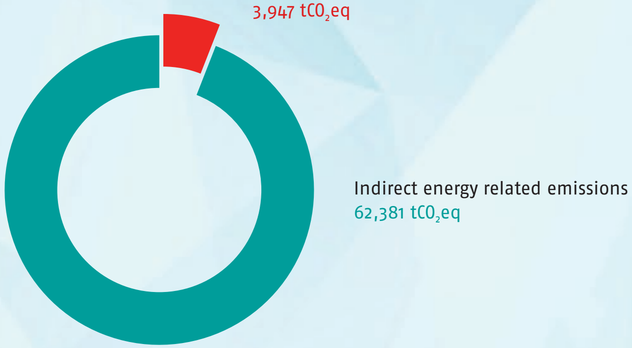


Figure 4:
Total energy from vapour absorption chillers at two different sites of the Jetwing Group

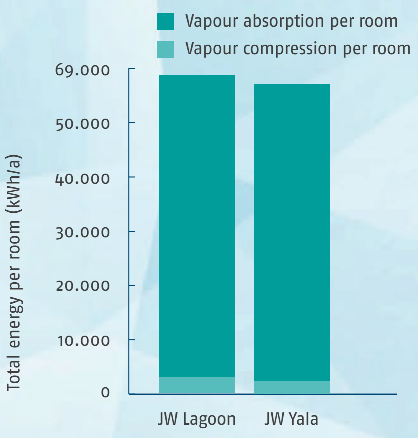
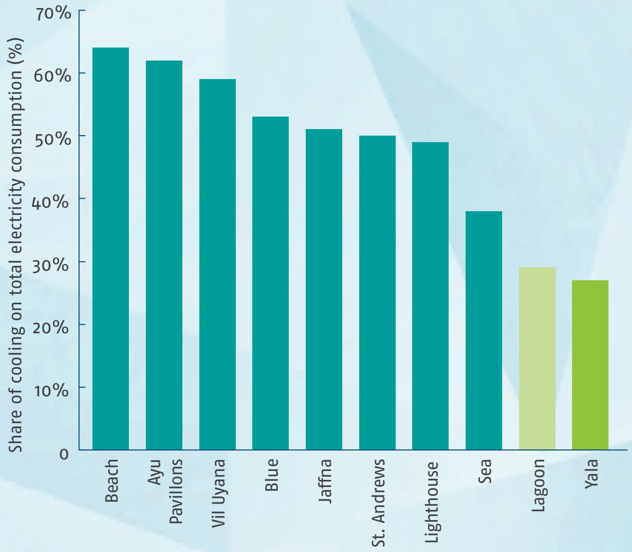


Figure 5
Share of cooling on total electricity consumption *(Source: Data Jetwing, 2016)*



Comparison of energy-efficient alternatives with current system

	Current System	Option 1	Option 2
	Vapour Compression	High efficiency vapour compression	Vapour absorption
Refrigerant	R-22/R-407C	R-290 or R-717	Distilled Water
Lifespan (Years)	20	20	20
COP	4.47	5.14	1.40
Running hours (hours/a)	7,950	7,950	7,950
Electricity consumed (kWh/a)	700,395	595,335	125,280
Elec. cost per year (US$)	77,043	65,487	13,781
Biomass consumed (kg/year)	NA	NA	1,387,000
Biomass cost (US$)	NA	NA	41,610
GHG Emissions (tCO_2/year)	667	575	379

Source: HEAT Analysis

Absorption chillers

Vapor absorbtion chillers (VAC) have numerous advantages compared to electric cooling systems. They operate by making use of waste heat, which greatly increases cost effectiveness. Absorption chillers also reduce operating costs by helping avoid peak electricity charges and by eliminating the high incremental costs of electric cooling with their greater absorption efficiency.

The major benefits of VACs are:

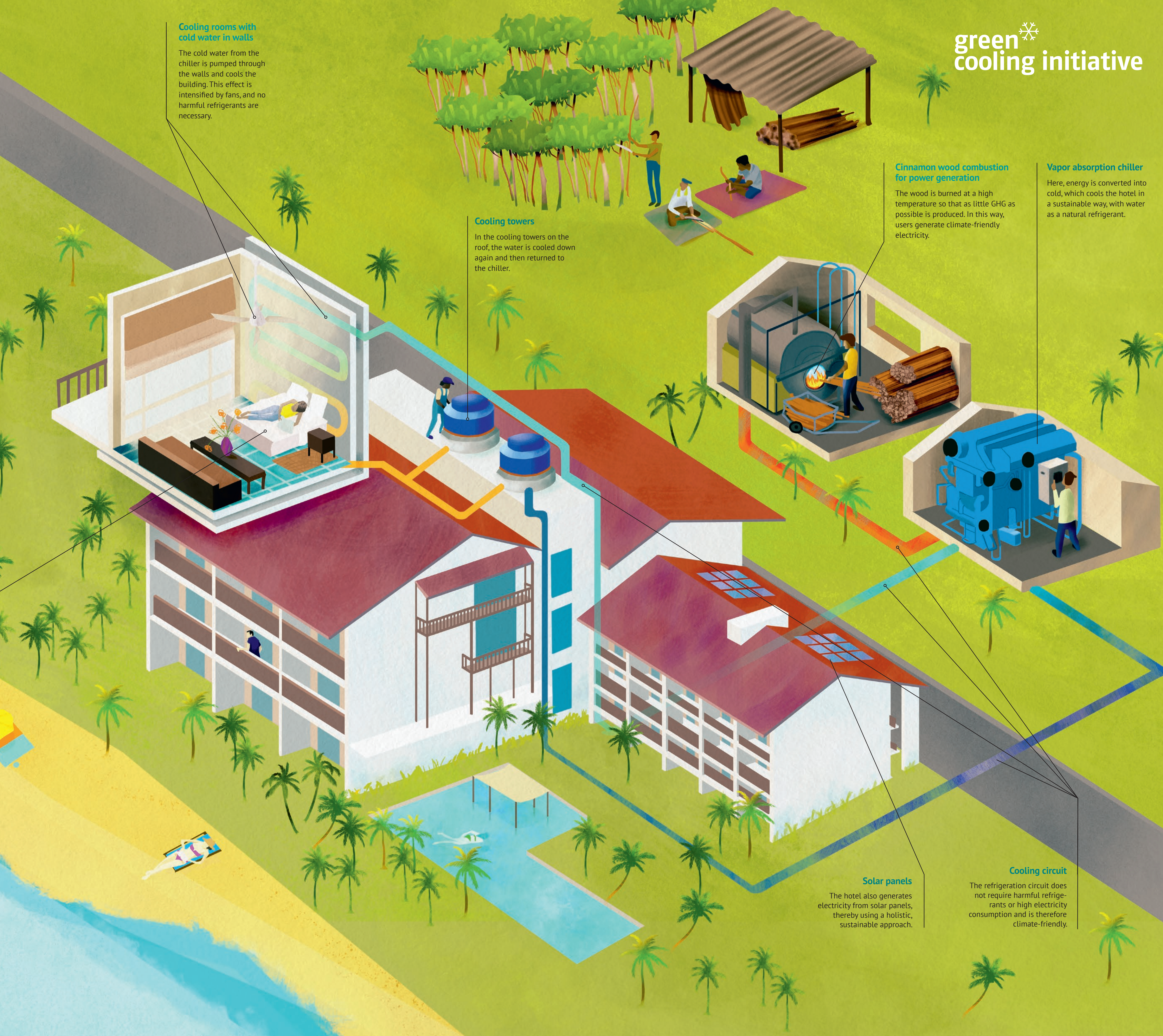
- Quiet and vibration-free operation
- Low pressure systems with no large rotating components
- Low maintenance and high reliability
- Environmentally friendly water and salt water solutions as a refrigerant
- Ability to operate with residual wood, i.e. from cinnamon production.

The upfront cost of a VAC is considerably more than a similarly sized vapour compression chiller, but it takes less time to earn back the investment via reduced operating costs. For an absorption chiller, the investment can be recovered in roughly 3.5 years, compared to 4.8 years for a vapour compression chiller, assuming price and supply stability of the biomass.

However, an absorption system usually cannot meet the whole cooling load requirements of a large building. This means a conventional system needs to run in parallel or as a substitute, which increases system complexity.

All in all, absorption chillers are an important alternative technology because they reduce overall energy consumption, can be run on low-cost fuels and reduce GHG emissions.

The Jetwing Hotel Group is a model in Sri Lanka with its VACs and will install a third one in cooperation with the Green Cooling Initiative.



Sustainable cooling in hot Sri Lanka

For those vacationing in hotels in tropical Sri Lanka, cooling is indispensable. The vapor absorption chiller is a sustainable technology that helps reduce harmful emissions.

The Jetwing Hotel Group

The *Jetwing Hotel Group* is a leading hotel chain in Sri Lanka, with properties spread around the country from Negombo, Yala and Galle to Nuwara.

Jetwing is taking a holistic approach to reducing its carbon footprint by using photovoltaic, solar thermal energy generation, bioenergy generation for cooling purposes, composting and many other measures. As a result, it has become a model for the Sri Lankan hotel industry and beyond.

As part of the Green Cooling Initiative (GCI), Jetwing was selected in an ideas competition to be a technology partner in one of three projects. The technology partnership will focus on the installation at a Jetwing hotel of an absorption chiller which uses steam generated in a biomass-fired boiler. Jetwing will also continue developing its roadmap for the group on how to continuously reduce its carbon footprint and become a trendsetter in Sri Lanka for sustainable and climate friendly-refrigeration and air conditioning solutions.

The GCI and Jetwing have analyzed Jetwing's *refrigeration and air-conditioning* (RAC) equipment and processes at 10 companies in the Jetwing Hotel Group, and GCI has recommended strategies for Jetwing to mitigate its greenhouse gasses.

These include:

- reducing the cooling load in both existing and new buildings
- transitioning to natural refrigerants when investing in new RAC appliances
- continuously installing highly energy-efficient appliances
- and using renewable energy sources.

Find the whole study here:

The Green Cooling Initiative and GIZ Proklima

GIZ Proklima is a program of the *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ) *GmbH*, which provides technical support to developing countries to implement the provisions of the *Montreal Protocol* and the *Kigali Amendment* on substances that deplete the ozone layer and affect the global climate.

As part of *GIZ Proklima*, the *Green Cooling Initiative* (GCI) is working on behalf of the German *Federal Ministry for the Environment, Nature Conservation and Nuclear Safety* (BMU) under its *International Climate Initiative* (IKI) to promote ozone- and climate-friendly technologies.

The overall objective of GCI is to minimize the environmental and climate impact of cooling systems used in the private and public sectors.

Three key objectives include:

- Promoting natural refrigerants and energy-efficiency
- Establishing advanced training institutions and certification schemes
- Encouraging public and private financing of projects

One way of minimizing the impact of the cooling industry on the environment is by helping it move to green cooling technologies by leapfrogging from ozone depleting refrigerants to natural refrigerants and maximized energy-efficiency.

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