HOME AUTOMATION WITH HYBRID ENERGY GENERATION

Yogesh Diwakar[1], Ashish Patil[2], Ashwini Suryawanshi[3], Amol Dighe[4]
[1](Dept. of Electrical Engineering, SKNSITS, INDIA)

ABSTRACT

In parallel to developing technology, demand for more energy makes us seek new energy sources. The most important application field of this search is renewable energy resources. Wind and solar energy have been popular ones owing to abundances, ease of availability and convertibility to electric energy; there is also another resource called Micro-hydro generation. This work covers realization of a hybrid renewable energy system for domestic or commercial application. This paper focuses on the use of micro-hydro generation, solar generation and wind generation on the residential building to provide them with surplus amount of energy to supply the entire building load. This generated energy is also used for automation in residential building providing automation in building as well as in home.

Keywords *- Micro-hydro, Solar power, Wind power, home automation ,hybrid generation.*

I. INTRODUCTION

THIS PROJECT PAPER CONSISTS OF TWO SECTION-

- Renewable Hybrid Energy Generation.
- Home Automation.

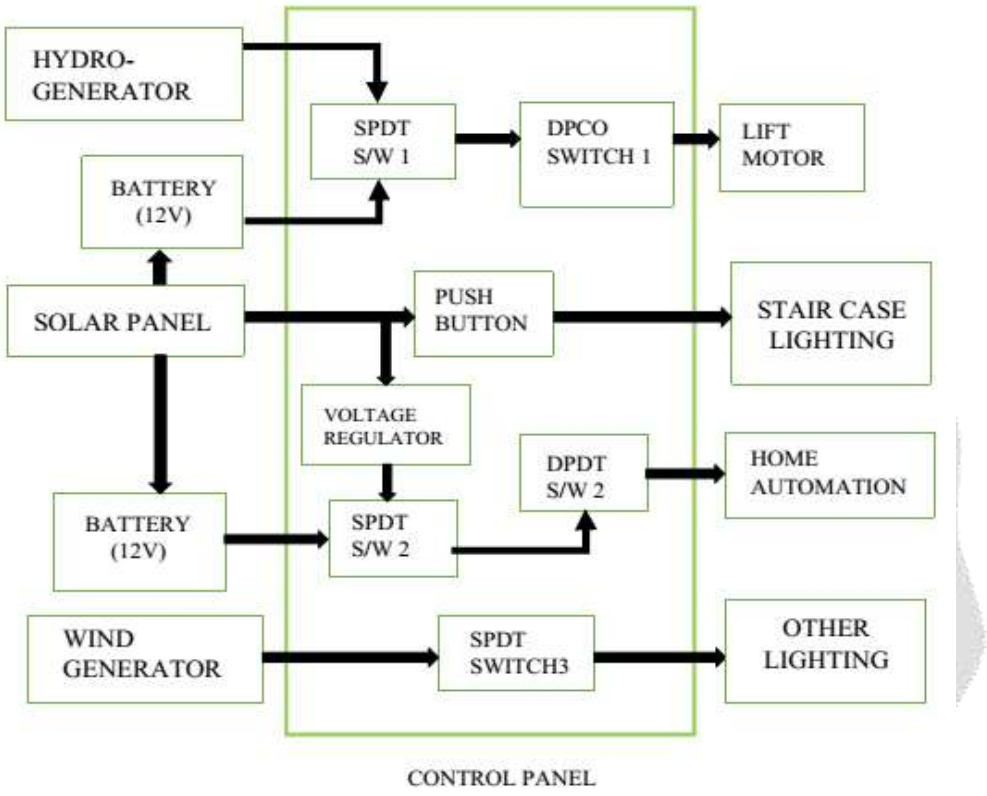
Section I: - In parallel to developing technology, demand for more energy makes us seek new energy sources. The most important application field of this search is renewable energy resources. Wind and solar energy have been popular ones owing to abundances, ease of availability and convertibility to electric energy, there is also another resource called Micro-hydro generation. This work covers realization of a hybrid renewable energy system for domestic or commercial application. This project is implemented in accordance with available line electricity. Batteries in the system are charged by either wind power via a small alternator or solar power via Micro generator. This power Generation does not produce any harmful effect on environment as CO2 Emission; Chemical substances etc. are not produced, and are free from fossil fuels as well.

Section II: - This hybrid electric energy we are going to use in Home Automation by implementing a Sensors at Specific locations. In building we use pump motors to pump the water in the tank placed at the terrace of the building. So, here we are going to use float sensor which will measure the level of water in the tanks and when the tank level reaches the higher level it will switch OFF the motor and vice versa. Similarly, in home we can Switch ON the tube light based on the intensity of light coming in the rooms using LDR sensor and also control the Fans using Temperature Sensor. We have also added security measures which will alarm the users in case of fault occurring. Micro Controller (PIC-18F4520) is used for above mentioned operation controls. The micro controller is programmed in C language using MPLAB IDE software.

Keywords: - Hybrid power generation, Solar, Wind, Micro turbine, LDR, temperature sensor, security, float sensor.

II. METHODOLOGY

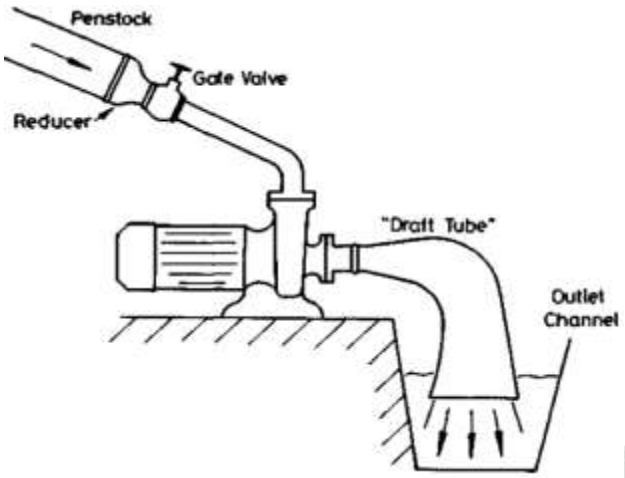
1 Block Diagram of Overall Project



Description of component

Working principle of micro-hydro: - Hydro-electricity is fundamentally the combination of water flow and horizontal drop (commonly called "head"). Horizontal drop creates pressure, and the continuous flow of water in a hydro system gives us an ongoing source of pressurized liquid energy. Pressurized, flowing water is a very dense resource, and hydro-electric systems convert a very large percentage of the available energy into electricity because the resource is captive in a pipe or flume.

A simple formula can give you a rough idea of how much capacity your stream might have. Take the head in feet, multiply it by the flow in gallons per minute (gpm), and divide by a factor of about 12. This will give you the potential wattage of a reasonably efficient, small system. For example, if you have 30 gpm available and 40 feet of head, you will be able to generate something in the range of 100 watts: [(30 x 40)/12 = 100): . Over the course of an entire day, the generation would be 2,400 watt-hours or 2.4 kWh (24 hours/day x 100 W).



Working of solar pv system: - Solar Power Systems, or Stand-alone PV Systems and Off-grid Power Systems operate independently of the electric utility grid (off-grid) and are most often used in remote rural areas where the electric grid does not reach or where the connection fees for access to the grid are higher than the cost of an alternative energy system. The DC power generated by these systems is stored in batteries and converted to AC power for household or commercial use. Stand-alone Solar Power System are best suited for remote village and rural electrification projects, and provide a more affordable and reliable source of electricity, particularly in more remote rural areas utilizing only diesel generators.

Working of wind system: - Wind power captures the natural wind in our atmosphere and converts it into mechanical energy then electricity. People started using wind power centuries ago with windmills, which pumped water, ground grain, and did other work. Today's wind turbine is a highly evolved version of a windmill. Modern wind turbines harness wind's kinetic energy and convert it into electricity. Most wind turbines have three blades and sit atop a steel tubular tower, and they range in size from 80-foot-tall turbines that can power a single home to utility-scale turbines that are over
260 feet tall and power hundreds of homes.
When wind blows pass a turbine, the blades capture the energy and rotate. This rotation triggers an internal shaft to spin, which is connected to a gearbox increasing the speed of rotation, which is connect to a generator that ultimately produces electricity. Most commonly, wind turbines consist of a steel tubular tower, up to 325 feet, which supports both a "hub" securing wind turbine blades and the "nacelle" which houses the turbine's shaft, gearbox, generator and controls. A wind turbine is equipped with wind assessment equipment and will automatically rotate into the face of the wind, and angle or "pitch" its blades to optimize energy capture.

Control panel: - The control panel of the model consists of toggle switches and push buttons. Total toggle switches are 5 and out of which three are SPDT (single pole double throw) switches and one DPCO (double pole center off) switches and one DPDT (double pole double throw) switch.
One SPDT1 and DPCO1 switches are connected such that Micro-Hydro and batteries either of two at different time of day will give supply to the lift motor and the DPCO2 switch is used to control the direction of lift either upward or downward with stop mode. Similar connection is made for the Home Automation circuit, in which either solar or battery will give supply to the Home Automation. Also, SPDT (single pole double throw) switch is used for the LED lighting powered via Wind source. Solar is also used to charge the two batteries in our system and also supply power to the staircase lighting.

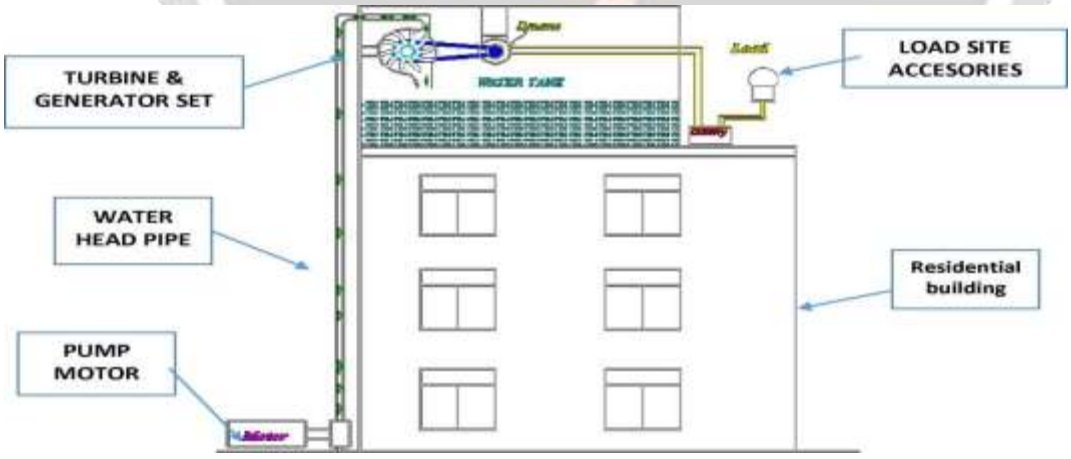
Batteries: - It stores electrical energy produced by RE resource in a reversible chemical reaction. Most batteries employed in RE systems use the lead-acid batteries typically encased in plastic and wired together in series and parallel strings by the installer. However, batteries do not belong inside

the living space due to the dangerous chemicals in them and hydrogen and oxygen gas put out while being charged. Battery capacity is rated in ampere-hours; which means 1 ampere-hour is the equivalent of drawing 1A steadily for one hour. A typical 12volt system may have 800 ampere-hours of battery capacity. This is the equivalent of 1,200 watts for eight hours if fully discharged and starting from a fully charged state. There are many brands and types of batteries available for RE systems and the two most common batteries are the L-16 and golf cart sizes.

Meters & Instrumentation: - It can help owners to keep track of important things like the battery voltage, the amount of power they are currently consuming, the state of charge in their batteries and also how much electricity traffics between their own supply systems to the utility grid for grid connection situations. Some meters have more than one channel to monitor two battery banks or a battery bank and a generating source for the hybrid systems.

Home Automation :- Home automation in our project is just to proved that with the generated energy we not only provide electricity to home and building as well as providing smartness in home and building by automatic control of building and Home appliance. Home automation block consist of Pic18f4520, LDR, LM35, Float, Relay, Seal Breaker, Relay circuit, Buzzer, and Lcd to display the value of sensors.

2 Project Strategy on Micro-Hydro Concept: - In this project we plan to generate energy from water stored in tanks of high rise buildings. Water power is the combination of HEAD and FLOW. Consider a typical hydro system. Water from pump motor is pumped into a tank through vertical pipeline, where at the end of the pipeline the pressurized water came out of pipe and allowed to fall on the turbine which will drive the generator. The water through the pipeline is called "FLOW "and Horizontal drop at the end of pipeline is called "HEAD "More FLOW, or more HEAD, produces more power. Hydro power converts the energy of flowing water into electricity. The quantity of electricity generated is determined by the volume of water flow and the amount of "head"(the height from turbines inside the tank to the water surface) created by the pump motor. The greater the flow and head, the more electricity produced.
See the simple working construction on residential terrace:



2.1 Implementation process of M-H in domestic: - Now as per this concept, we need to done some technical research to implement this technology practically. Regarding Micro-hydro generators availability in market, its size, cost, capacity, etc. so all these parameters we need to gathered.
Main component in this concept is Micro-hydro generator, so we started research from this topic only. Before discussing further, we need to understand first, that what is Micro-hydro power basically So this technology is nothing but the amount of power we can generate from hydel concept is somewhat less, and this is categorized in following manner.

- Micro Hydropower: up to 100kW

- Mini Hydropower: 100 kW-2000 kW
- Small Hydropower: 2000 kW-25000 Kw

Small scale hydro power was already used in early *20thcentury*. -(For e.g., in 1924 in Switzerland, nearly 7000 small scale hydro power were in use and SHP technology was introduced in India -90kW, in Darjeeling, 1897) Few other powerhouses of that period are still functioning properly. Specific equipment's are needed simplicity, high energy output, reliability and easy maintenance by non-specialists.

A simple formula can give you a rough idea of how much capacity your stream might have. Take the head in feet, multiply it by the flow in gallons per minute (gpm), and divide by a factor of about 12. This will give you the potential wattage of a reasonably efficient, small system. For example, if you have 30 gpm available and 40 feet of head, you will be able to generate something in the range of 100 watts (30X40)^12 = 100). Over the course of an entire day, the generation would be 2,400 watt-hours or 2.4 kWh *(24hours/day x* 100W).

Before implementing such concept practically, we need to have some parameters that is very much important for particular systems, so for Micro-hydro concept there are some parameters which can decide the actual power rating of the system and can help us to determine if our project is feasible. As with any turbine design, we'll need to know some basic facts about the project:

Available Head Pressure: What is the water pressure at the turbine inlet when water is flowing.

The available pressure for power production will be the difference between the turbine inlet and outlet.

Flow Duration: Flow is rarely constant on a public water system, so we'll need to know how much flow to expect at various points in the day. A flow duration curve showing hourly flow over the course of a full day, week, or month provides very valuable information for sizing the hydro equipment. Remember that higher flows reduce head pressure, so a chart showing both is best.

Pipeline Length and Diameter:The length and diameter will help us compute friction losses within the pipeline at varying flows. Any other details you can provide about the pipeline will be helpful.

Electrical Requirements:Let us know what output voltage and frequency you will need from the generator. Line frequency is directly related to generator RPM, which also affects the selection of turbine design.

2.2 Benefits of M-H system:- The considerable benefits of micro hydro power include the following:

- 'Fuel-free 'source of power.
- Different to large hydro since environmental impacts of installation are negligible.
- Renewable energy source therefore helping to reduce greenhouse gas emissions and having a net positive impact on the environment.
- Constant generation over long periods unlike wind and solar power.
- Good correlation with demand (more hydro energy is available in winter when heating loads are high).
- Long lifetime of systems, typically 25 years or more Low maintenance requirements and running costs.
- Reasonable payback for grid -connected systems, often 10 years or less.

3 Block diagram of Home Automation: -

Description of component: -

Pic microcontroller: PIC is a family of modified Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1650 originally developed by General Instruments Microelectronics Division. The name PIC initially referred to Peripheral Interface Controller. The first parts of the family were available in 1976; by 2013 the company had shipped more than twelve billion individual parts, used in a wide variety of embedded systems. In this project we have used

PIC18F4520 microcontroller and its features are given below.

Features:

CPU

- Up to 10 MIPS Performance at 3V
- C compiler optimized RISC architecture
- 8x8 Single Cycle Hardware Multiply

System

- Internal oscillator support-31 kHz to 8MHz with 4xPLL
- Fail-Safe Clock Monitor- allows safe shutdown if clock fails
- Watchdog Timer with separate RC oscillator
- Wide operating Voltage range; 2.0V to 5.5V

Analog Features

- 10-bit ADC, 13 channels, 100K samples per second
- Programmable Low Voltage Detection Module
- Programmable Brown-out-Reset Module
- Two Analog Comparators multiplexing

Peripherals

- Master Synchronous Serial Port supports SPI and I2C master and slave mode
- EUSART module including LIN bus support
- Four Timer modules
- Up to 5 PWM outputs & 2 Capture/Compare

Temperature sensor: Temperature sensor is a device which senses variations in temperature across it. LM35 is a basic temperature sensor that can be used for experimental purpose. It gives the readings in centigrade (degree Celsius) since its output voltage is linearly proportional to temperature. It uses the fact that as temperature increases, the voltage across diode increases at known rate (actually the drop across base-emitter junction of transistor).

LDR sensor: A light dependant resistor also know as a LDR, photo resistor, photo-conductor or photocell, is a resistor whose resistance increases or decreases depending on the amount of light intensity. LDRs(Light Dependant Resistors) are a very useful tool in a light/dark circuits.A LDRs can have a variety of resistance and functions. For example it can be used to turn on a light when the LDR is in darkness or to turn off a light when the LDR is in light. It can also work the other way around so when the LDR is in light it turns on the circuit and when it's in darkness the resistance increase and disrupts the circuit.

Float sensor: A float switch is a device used to detect the level of liquid within a tank. The switch may be used in a pump, an indicator, an alarm, or other devices. Float switches range from small to large and may be as simple as a mercury switch inside a hinged float or as complex as a series of optical or conductance sensors producing discrete outputs as the liquid reaches many different levels within the tank. Perhaps the most common type of float switch is simply a float raising a rod that actuates a micro switch. A very common application is in sump pumps and condensate pumps where the switch detects the rising level of liquid in the sump or tank and energizes an electrical pump which then pumps liquid out until the level of the liquid has been substantially reduced, at which point the pump is switched off again. Float switches are often adjustable and can include substantial hysteresis. That is, the switch's "turn on" point may be much higher than the "shut off" point. This minimizes the on-off cycling of the associated pump.

Relay: It is on/off switch which uses 12V supply. It is use to make the switch on or off. Here we use 12v single change over relay. Relay is an electromagnetic switch; consist of a coil, 1 common terminal, 1 normally closed terminal, and one normally open terminal.

The relay's switch connections are usually labeled COM, NC and NO:

COM:Common, always connect to this, it is the moving part of the switch

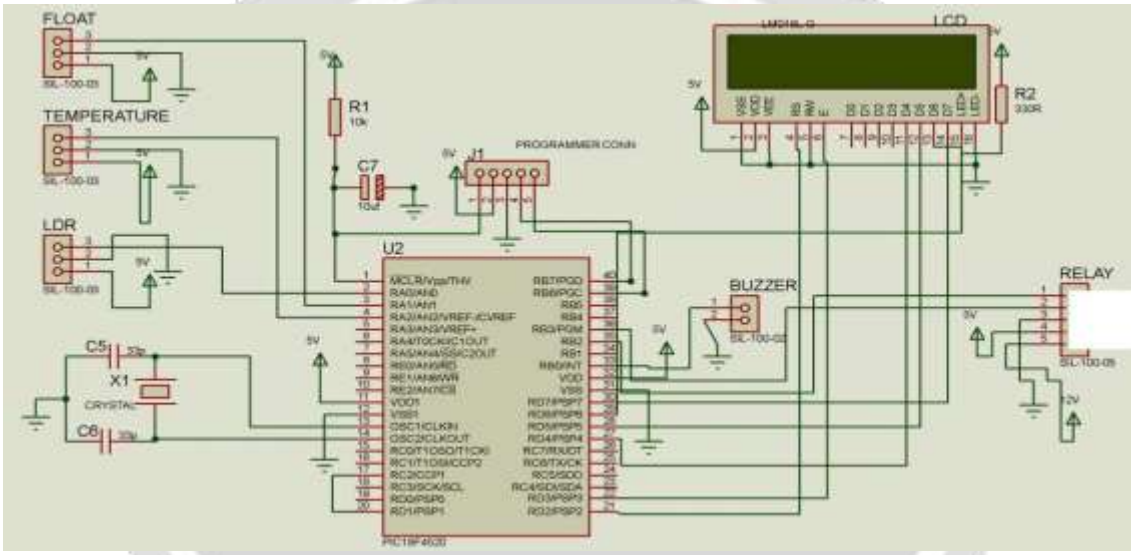
NC:Normally Closed, COM is connected to this when the relay coil is off.

NO:Normally Open,COM is connected to this when the relay coil is on.

Relays allow one circuit to switch a second circuit, which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.
In our project two SPDT Relays (Single Pole Double Throw Relay) are used. Relay is driven by the micro controller as per system requirements. One of them is used to cut 0ff the power supply when balance goes to zero and other relay is for off hook or on hook notification to MSEB.
Advantages of relay:

- Relays can switch AC and DC; transistors can only switch DC.
- Relays can switch high voltages, transistors cannot.
- Relays are a better choice for switching large currents (> 5A).
- Relays can switch many contacts at once.

Circuit diagram of Home Automation:



4 Working process of model: -

step 1
First water start fill-up inside the Pelton wheel contain box through pump motor at some pressure, turbine will start rotating which coupled to dynamo that further generate electric power. (It is similar to concept of residential building where water start supplies to overhead water tank)
step 2
Generated power that can stored in battery, & further it's given to load (lift motor & stair case lighting), switch control is provided in panel box.
step 3
Simultaneously turn ON the bulb that is works as a solar radiation part in our model That directly strikes to solar panel, since solar panel load terminal is directly connected to LED's which is working as a stair case lighting and also to HOME AUTOMATION circuit.
step 4
At the time of all the above three steps are done, model will be on working state, Lift can operate through switch, stair case lighting will start glow, compound lighting start glow, and home automation also work.
step 5
Home automation circuit consist of PIC microcontroller, LDR sensor, Temperature sensor,
Float sensor, LED's, Buzzer, which requires supply of 5V is feed through solar via voltage regulator circuit(7812 IC) and if in case solar is unable to supply a power to home automation circuit , the supply

requirement is fulfill by main 230V AC source which then step- down to 15v and then using rectifier and voltage regulator circuit(7805) we can feed the microcontroller with constant 5v dc supply.

step 6

The LDR sensor in home automation will switch ON the LED's when it senses the low light intensity in room and Switch off when the light intensity is high. Temperature sensor(LM35) is connected to relay circuit, the temperature sensor senses the room temperature and if the temperature exceeds 40°C microcontroller will give signal to the relay and relay switch ON the fan and when the temperature is lower than 40°C, relay will remain inoperative and ultimately the fan. Float sensor is also connected to relay circuit and it will sense the level of water in the overhead tank. When the level of water is lower than the predetermined value microcontroller will give the signal to operate the relay and pump motor is connected to the main supply and water start filling in the tank. Now when the water reaches the high level, relay will disconnect the supply of Motor. Seal Breaker is use for security purpose in our model, when the seal is break , the microcontroller will give signal to buzzer and buzzer will alarm the user in case of fault occurring.

4 Test result: Output voltage may change according to flow(head) of water, wind & Sun intensity availability.

No	Source	OUTPUT VOLTAGE (in volt)
1.	Micro-Hydro	5.10V
2.	Solar Power	19.19V(min)-20.20V(max)
3.	wind	3V
4.	Total	27.29V(min)to 28.3V(max)

Table 4.3 Generation of Model

No	Load	Voltage Requirement
1.	Staircase Lighting	15V
2.	lift motor	4v-12V
3.	Home automation	5V
4.	LED.s	3V

Table 4.4 Types of load and voltage requirement

III. CONCLUSION

IV. This project gives an overview of hybrid renewable energy system. The use of optimization and simulation is done to generate a system which meets the rising energy demand. The attempt is made to increase the efficiency of the individual non-conventional energy sources to an extent so that their high infrastructural cost may not prove to be a matter of concern. Combining Hydro Power with solar and wind provided a system that ensured continuity of supply. With the continuity of supply, we have also shown the generated energy can also use to drive for Home Automation that includes automation for pump motor, some home appliance, security etc. The future scope of the system is needed to be given greater importance thus minimizing every possible limit and preparing a system which can give equal efficiency competence to thermal power systems.

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