超级镜子完整文字稿：

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**发布配文：**

Simple science leads to mega structures. This "super mirror" in Dunhuang generates enough electricity for a city, cuts down on greenhouse gas emissions drastically and is powered by simple physical laws. Follow #ChinaInWords and check out the science behind this mega project.

简单的科学原理，也可以成为构筑“超级工程”的基石。在敦煌的“超级镜子”电站，在生产足够一座城市使用的电能的同时，大幅削减了温室气体排放，而它背后，只是简单的物理原理。一起关注本期“词解中国”，了解这项超级工程背后的科学原理吧！

**视频文字稿：**

When I was young,

小时候的我

I had one wish:

一直有一个愿望

that the sun could shine at night

如果太阳在晚上

as well as day.

也能亮起该多好

I'm Liz.

我是栗子

Today I'll try to realize

今天来动手实现

my childhood dream.

这个童年愿望

In Dunhuang, Gansu,

在甘肃敦煌

a super mirror has turned

一座超级镜子已经让

my dream into reality.

“复制”太阳成为现实

Today, let's replicate this mega project.

今天我们一起来复刻一下这个超级工程

Duplicating a sun for the nighttime

把太阳“复制”到晚上

means capturing the sun's energy

那就是收集太阳的能量

and releasing it at night.

到晚上再释放

To do that, we need

那么我们需要

a tool to collect the energy,

一个收集的工具

a container to store the energy,

一个储存的容器

and a means to release the energy.

还有一个释放的工具

When it comes to collecting solar energy,

说到收集 没有什么

mirrors are key.

比镜子更适合的了

They create a "second" sun.

一面镜子就等于复制了一个太阳

The mirror reflects the sunlight and

通过镜子的反射

concentrates it on a milk powder can

阳光汇聚到这个

filled with water,

装入水的奶粉罐上

thus creating enough energy to boil the water.

集中热量把水烧开

In theory,

理论上来说

as long as these mirrors bring water

只要镜子

to a full rolling boil

烧水

and generate enough steam,

产生足够多的水蒸气

the steam will continuously spin a small fan,

我们就可以推动小风扇

turning a small motor,

连接小马达

and completing the transition

最终完成从

from solar energy, to mechanical energy,

太阳能再到机械能

to electrical energy.

再到电能的转化

Now we can successfully "duplicate" the sun.

我们就复制成功了

Let's first paint the milk powder can

我们把奶粉罐刷上

with black, heat absorbing paint

黑色的吸热涂料

to help it gather heat.

帮助更好地吸热

Now we add water to it

现在我们给它加水

and seal it up,

然后把它密封起来

leaving only a small exit.

留一个小孔

Then we fix the can

把奶粉罐固定到

at the center of the platform.

平台的最中心

The steam will escape from the exit,

水蒸气从小孔冒出

and blow through the fan blades.

吹动风扇叶片

If the light bulb is lit,

只要灯泡亮起

our experiment will be a success!

我们的实验就成功了

To make the most of the sunlight,

为了充分利用太阳光

we need every mirror to

我们需要每一面镜子反射的

concentrate the reflected light on the can.

光斑汇聚到奶粉罐的表面

In reality, the sun keeps moving.

实际上太阳光是会移动的

So we need to adjust the platform,

我们需要调整平台的角度

and mirrors can keep reflecting the moving light

来保证镜子能够自然地

onto the surface of the can.

把太阳光捕获到罐子上

Now we leave everything

剩下的就交给

to the sun and time.

太阳和时间了

The blades have moved a bit

它（风扇）因为水蒸气变得多

with more steam coming out!

而开始进行缓慢的转动

Now the fan is spinning faster and faster.

现在它转得越来越快了

Let's check out the bulb.

我们看下灯泡的情况

Oh, the bulb is lit!

灯泡已经亮了

This means our experiment

说明我们290面的小镜子

to light up a bulb with 290 mirrors is successful!

发电的实验已经成功了

We can light a small light bulb

这290面镜子

with 290 mirrors.

可以点亮一个小灯泡

What if we had 12,000 mirrors?

如果我们有1.2万面镜子呢

This super mirror power plant

这个位于甘肃戈壁滩上的

in the Gobi Desert of Gansu province

超级镜子才真正做到了

can truly duplicate a sun for night.

把太阳“复制”到晚上

This real super mirror

现实中的超级镜子

also has tools to collect energy,

同样有收集的工具

containers to store energy

储存的容器

and means to release energy.

和释放的工具

Every mirror here spans 115 square meters.

这里的一面镜子有115平方米

A total of around 12,000 mirrors make up

1.2万面镜子一共形成了

a mirror field of more than

1.4 million square meters.

140多万平方米的镜场

A unique program is written for each mirror,

通过给每面镜子单独设定的程序

so that they can automatically chase the sun

它们可以自动追逐太阳

and reflect the sun's rays to the

把太阳光反射到

heat absorbing section at the top of the tower.

塔尖的吸热器上

This energy storing and power generating section,

接下来 这个位于圆心的

located in the center of the power plant,

储能发电装置 让超级镜子

allows the super mirrors to

store and release energy.

完成了能量的储存和释放

Instead of directly boiling the water

与我们在实验当中

with solar energy as we did in the experiment,

直接烧水不同

super mirrors have the gathered energy

超级镜子聚焦的能量

to first heat up a type of salt.

先是加热一种盐

The hot salt then exchanges heat with water.

再用烧热的盐与水完成换热

This special salt is called molten salt.

这种特殊的盐被称为熔盐

Molten salt keeps flowing

熔盐靠不停流动

to complete the task of storing energy.

来完成储存能量的任务

When flowing to the top of the tower,

流动到塔尖

it absorbs energy and heats up.

吸收能量升温

When flowing down to the bottom,

流动到塔底

it releases energy and cools back down.

释放能量降温

The salt keeps circulating

循环往复

and the cycle continues forever.

永不下班

Because the molten salt

正是因为熔盐

can stay liquid

在一定温度区间之内

within a certain temperature range,

都能够保持流动状态

a temperature difference of nearly 300 degrees

接近300度的温度差

allows the super mirror to store large amounts of energy.

让超级镜子实现了储能自由

It is exactly the super mirror's capability

也是储能

to store energy that sets it apart

让超级镜子与其他

from other clean forms of power generation.

清洁能源发电方式区分开

When the sun is shining,

太阳光充足时

super mirrors can store solar energy.

超级镜子将太阳能储存起来

When cloudy days persist,

碰上连日无光

the power plant can release energy at any time.

它又可以随时完成能量的释放

The energy is released in the same way

能量释放的过程跟我们

that we saw in the experiment:

在实验当中看到的步骤相同

heat from molten salt boils water,

熔盐释放的热量将水烧开

which drives a steam turbine

水蒸汽推动汽轮机

and generates electricity.

最终完成发电

In this way, the super mirror is like

这么看来 超级镜子就像是一块

a power bank gifted by nature.

大自然馈赠的充电宝

This power bank with 1,100,000 kWh power

这块充电宝有110万度电

can support a city of 180,000 people

可以供一个18万人口的城市

for two days

使用两天

and can be recharged for unlimited times.

还可以做到无限次的充电

Asia's largest

这个亚洲最大的

molten-salt concentrated solar power plant

熔盐塔式光热电站

could annually yield

每年可以稳定输出

clean and adjustable electricity.

清洁 可调节的电力

That equals to cutting down

相当于可以减少

350,000 tons of carbon dioxide emissions.

35万吨二氧化碳排放量

From Yumen in Gansu, Delingha in Qinghai

而在甘肃玉门 青海德令哈

to Hami in Xinjiang,

新疆哈密

in the vast Gobi Desert of northwestern China,

中国西北的茫茫戈壁中

tens of thousands of pieces of giant mirrors

还有几万面镜子完成着

are also completing the work of "duplicating" the sun.

“复制太阳”的工作

Using scientific laws that we are all familiar with,

运用我们都熟悉的原理

the super mirror power plant fulfills

超级镜子完成着我们

our childhood aspiration to "plant a sun".

“种太阳”的童年愿望

It also helps China achieve its goal of

也帮助中国实现

peaking carbon emissions and reaching carbon neutrality.

碳达峰、碳中和的目标

It is a mega project,

它是超级工程

and it is from our everyday life.

它也来自于我们的生活