

主辦機構



贊助機構



SPARK TO SPEED

電動車大冒險

STEAM Adventures in Electric Cars



SPARK 電動車大冒險 TO SPEED

STEAM Adventures in Electric Cars

姓名:

班別:

學校:

SOLAB 解島線上學習平台
Online Learning Platform

Solab 解島



現在，請按照導師指示，一起開始製作屬於你的電動車吧！
Now, follow your instructor's guidance and start building your own EV Car!

亦可以在家中花些時間探索平台的功能，享受您在SOLAB上的時間，並充分利用SOLAB資源分享和學習。
Take some time to explore the features of the platform, enjoy your time on SOLAB, and take advantage of SOLAB resources to share and learn.



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本計劃

「Spark to Speed: 電動車的STEAM冒險」計劃旨在為小學生提供一次引人入勝且富有教育意義的體驗。我們希望透過是次教育活動讓小學生能夠：

1. 提升對可持續能源的認識：
啟發參與者對電動車及可持續能源的好奇心和興趣，並提高可持續能源對環境影響及綠色能源產業於未來發展的認識。
2. 環保意識與可持續實踐：
加深參與者對可持續能源概念、電動車技術及可再生能源的理解，並作出明智的選擇，打造綠色和永續未來。
3. 經驗實踐：
為參與者提供機會，讓他們參與實踐活動、自我導向學習、同儕學習，以發展創意、溝通技巧及解決問題的能力。

The program

The purpose of the “Spark to Speed: STEAM Adventures in Electric Cars Program” is to provide an engaging and educational experience for primary school students, aiming at:

1. **Promote Awareness of Sustainable Energy:**
Ignite curiosity and interest in electric vehicle (EV) cars and sustainable energy among participants. Raise awareness about the environmental impact of sustainable energy and the future development of the green energy industry.
2. **Environmental Awareness and Sustainable Practices:**
Help students develop a deeper understanding of sustainable energy concepts, EV technology, and renewable energy sources. Empower them to make informed choices that contribute to a greener and more sustainable future.
3. **Hands-on Experience:**
Provide opportunities for participants to engage in practical activities, self-directed learning, peer learning, problem-solving, creativity, and communication skills development.

2 | Spark to Speed



童享慈善基金會

童享慈善基金會（HKCIN，簡稱「童享」）的創立旨在為裝備香港幼稚園與小學學生，讓他們擁有基於STEAM方法的基本生活技能，為未來的成功做好準備。自2019年10月成立以來，HKCIN受惠於各捐贈者和志願者的慷慨支持和貢獻，已經積極影響了7,000多名學生、2,000名父母、600名教師及28所學校。我們了解很多學生過於注重考試成績和追求完美分數，故此童享亦致力促進更多元化和多樣化的學習體驗，鼓勵學生探索個人興趣和熱情。

HKCIN

The Hong Kong Children In Need Foundation (HKCIN) was established with the mission of equipping kindergarten and primary students in Hong Kong with essential life skills grounded in a STEAM-based approach, preparing them for success in the future.

Since its inception in October 2019, HKCIN has positively impacted over 7,000 students, 2,000 parents, 600 teachers, and 28 schools. This progress has been made possible through the generous support and contributions of our donors and volunteers.

Recognizing that many students are overly focused on exam results and the pursuit of perfect grades, our aim is to promote a more well-rounded and diverse educational experience that encourages students to explore their personal interests and passions.



童享的使命及願景



“ 使命

To develop a community-driven STEAM education ecosystem through collaborations with educators and communities, weaving holistic learning with core humanistic values, and embracing every child's success.

“ 願景

Empowering young minds through inclusive STEAM education to unlock their intellectual and creative potential, thrive in a fast-evolving future, and enhance the well-being for all.

中華電力

中華電力有限公司是由中電控股有限公司全資擁有。我們是亞洲規模最大的私營電力公司之一。我們在香港經營縱向式電力供應綜合業務，服務涵蓋：

- 發電；
- 輸配電；和
- 客戶服務。

我們取得今天的成績，全賴集團貫徹始終恪守商業原則和道德操守。這些原則及操守釐訂了清晰的目標、使命、價值觀，以及中電員工應有的作業行為。我們承諾在發展及實現業務目標的過程中，遵循可持續發展的原則，並充分考慮及兼顧今天和未來社會的需要。詳情可了解我們的價值觀架構。

中電的能源願景包括與中國內地建立更緊密的能源聯繫、採用更潔淨的燃料，以及加強推廣能源效益。我們深信，為了香港的未來，逐步實踐中電的能源願景，是邁向未來能源可更持續發展的重要一步。

目標

成為亞太區最具領先地位的負責任能源供應商，代代相承。

使命

在瞬息萬變的世界中，我們的使命是提供可持續發展的能源方案及服務，為股東、客戶、僱員及廣大社群創造價值。



About CLP Power

CLP Power Hong Kong Limited is a wholly-owned subsidiary of CLP Holdings Limited, a listed company in Hong Kong. We are one of the largest investor-owned power businesses in Asia. As a vertically integrated power utility, we cover:

- Power generation;
- Power transmission and distribution; and
- Customer service.

Our success is built on strong business principles and ethics. These define our vision, mission and values. We are committed to sustainable development that meets the needs of current and future generations. Find out more about our Value Framework.

Our energy vision encompasses closer energy integration with the Mainland, moving to cleaner fuels, and encouraging greater energy efficiency. For the future of Hong Kong, we believe securing CLP's energy vision is an important step on the road to a more sustainable energy future.

Vision

To be the leading responsible energy provider in the Asia-Pacific region, from one generation to the next.

Mission

In a changing world, our mission is to produce and supply energy with minimal environmental impact to create value for shareholders, customers, employees and the wider community.



可持續與可再生能源

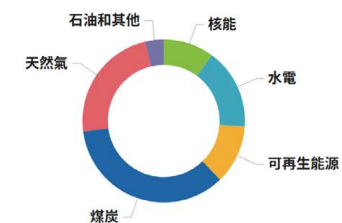
能源來自哪裡？

能源可分為兩類：初級和次級能源。初級能源（如化石燃料）可通過能源轉換過程轉變為次級能源，如化石能源能轉變為熱能、電能或其他形式的能源（如精煉燃料）。此外，初級能源亦可再分為可再生能源和非可再生能源，後者仍然是目前的主要能源來源。

化石燃料仍於能源供應需求方面佔主導地位。世界各地的發電極度依賴不可再生能源，佔總發電量71.4%，其中61.3%來自化石燃料，10%來自核能。餘下27.7%來自可再生能源，其中16%來自水電，約1%來自其他可再生能源。

2020年的世界发电量

化石燃料	61.3%
非再生燃料	71.4%
可再生能源	27.7%



圖片說明：2020年全球發電量

資料來源：英國石油公司世界能源統計回顧2021年

https://www.hknuclear.com/zh_hk/nucleaessentials/world-energy-usage.html

Sustainable and Renewable Energy

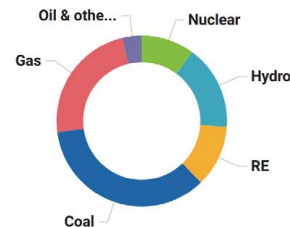
Where does energy come from?

Energy can be classified into two types: primary and secondary. Primary energy (e.g. fossil fuels) is transformed through energy conversion processes to secondary energy, such as heat energy, electrical energy, or energy in other forms (e.g. refined fuels). Primary energy sources can be renewable or non-renewable with the latter remaining the dominant source of energy today.

Fossil fuels dominate in supplying our energy needs. Electricity generation around the world is heavily dependent on non-renewable energy, which contributes 71.4% of total generation, of which 61.3% comes from fossil fuels and 10% from nuclear sources. The remaining 27.7% comes from renewable energy, comprising 16% from hydropower and some 1% from other renewable energy sources.

World Electricity Generation in 2020

Fossil fuel	61.3%
Non-renewable	71.4%
Renewable	27.7%



Source: BP statistical review of world energy 2021
<https://www.hknuclear.com/en/nuclearessentials/world-energy-usage.html>

不可再生能源

煤，石油，天然氣，甲烷和鈾皆為不可再生能源。它們被稱為不可再生能源，因為這些能源的儲量都是有限的。例如石油是古代海洋動植物的遺骸經歷數百萬年的自然分解而形成，難以短時間內被生產，因此稱為不可再生能源。於所有不可再生能源中，由於價格便宜，煤成為現今世界用於發電的首選能源。

Non-renewable Energy

Coal, petroleum, natural gas, propane, and uranium are non-renewable energy sources. These energy sources are called non-renewable because their supplies on Earth are limited. Petroleum, for example, originated from the remains of ancient sea plants and animals, taking millions of years of natural processes to produce it, making it unlikely to be produced in a short time. Amongst the non-renewable energy sources, coal is the most commonly used energy source for generating electricity in the world nowadays due to its low price.

可再生能源

可再生能源包括生物質能，地熱能，水力能（包括潮汐能），太陽能 and 風能等。這些能源被稱為可再生能源，因為它們能隨時補充，並對自然資源的影響較小。目前，這類可再生能源主要用於發電。

Renewable Energy

Renewable energy sources include biomass, geothermal, hydropower (including tidal), solar, and wind. Such energy sources are called renewable energy sources because they can be replenished from time to time and the impact to the natural resources is minimal. Currently, these renewable energy sources are primarily used in electricity generation.

Reference:
<https://www.emsd.gov.hk/energyland/tc/energy/principle/source.html>
<https://www.emsd.gov.hk/energyland/en/energy/principle/source.html>

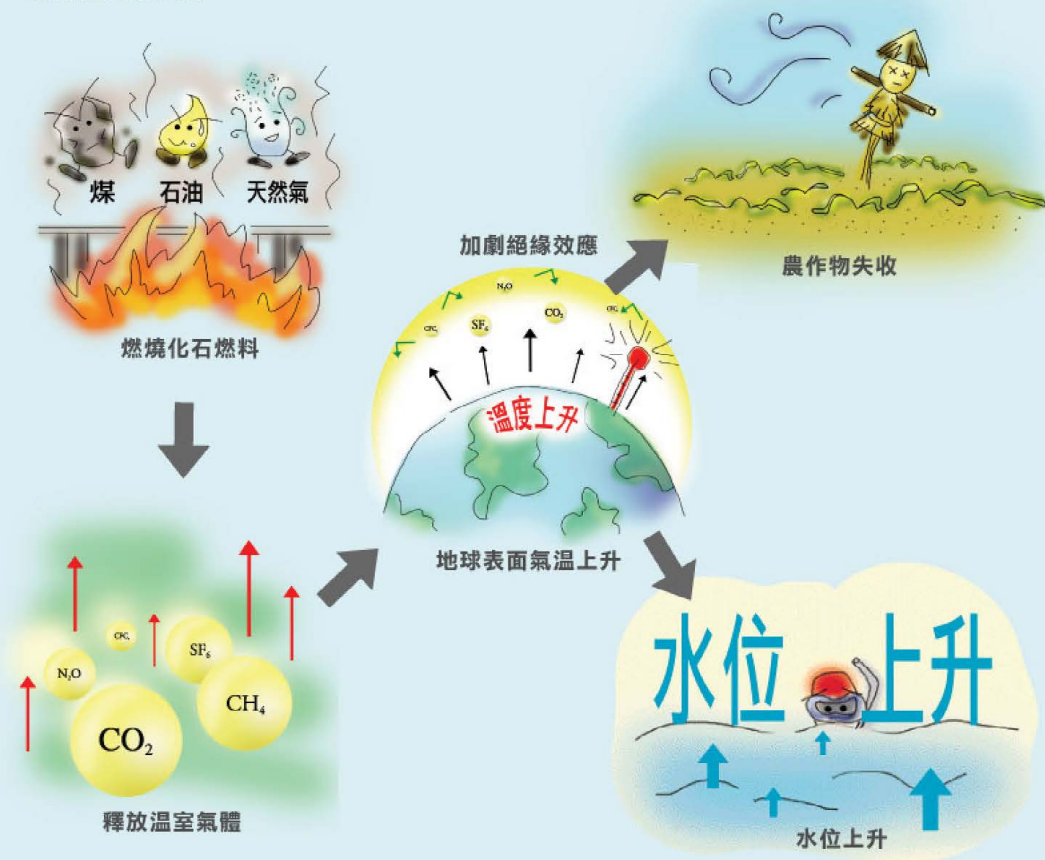


我們現時使用能源的方法， 對環境有甚麼**不良影響**？

我們現時以燃燒化石燃料（例如煤、石油和天然氣）來發電。燃燒化石燃料會釋放出溫室氣體及其他污染物，對地球及人類造成以下影響：

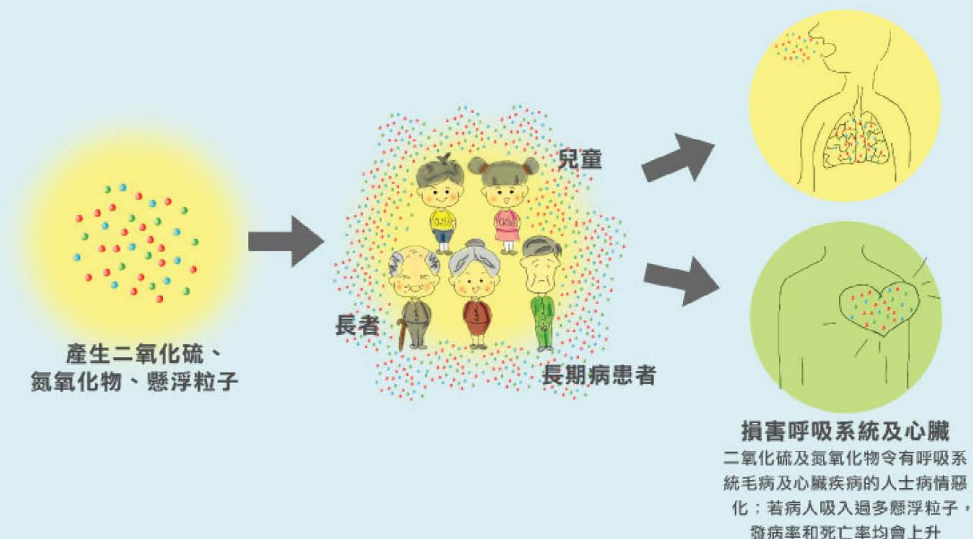
全球暖化

溫室氣體會加劇絕緣效應，令熱力不能以正常速度散去，導致地球的氣溫上升。這最終會影響農作物的收成，又會令海水水位上升，對我們的生態系統影響深遠。



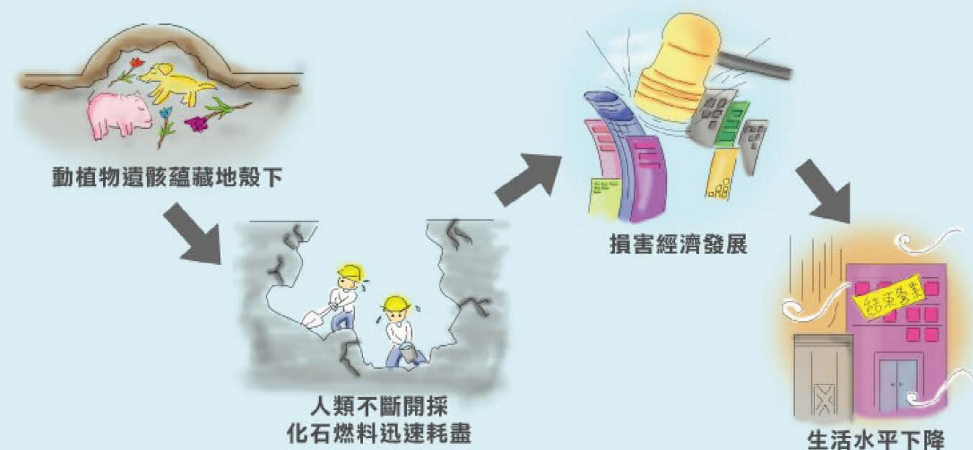
產生空氣污染物

燃燒化石燃料會產生空氣污染物，例如二氧化硫、氮氧化物、懸浮粒子等，影響人體健康，特別是兒童、長者及長期病患者。



損害經濟發展

化石燃料並非用之不竭。人類在過去數十年不斷開採，迅速耗用這有限的天然資源，各行各業很快會受到化石燃料短缺帶來的影響，經濟發展亦會大受損害，最終令人民的生活水平下降。

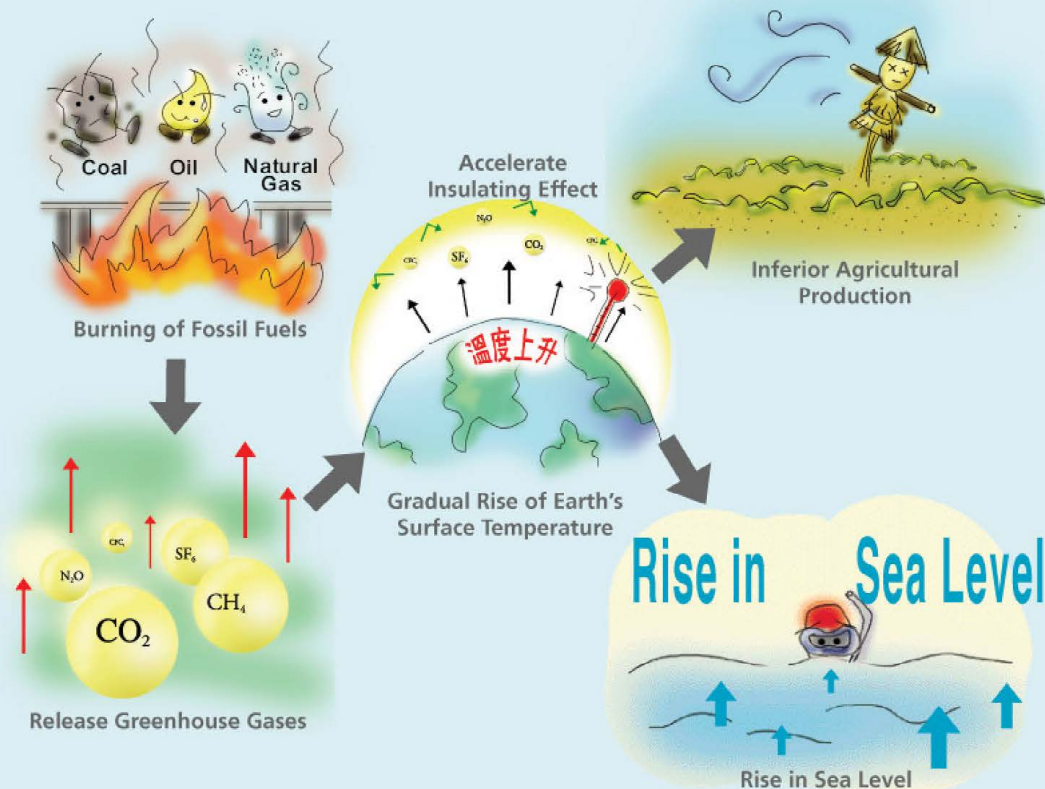


How is Our Present Energy Use Making **Unfriendly Impacts** on the Environment?

The burning of fossil fuels, such as coal, oil and natural gas, for generating electricity will release greenhouse gases and other pollutants into the atmosphere and will impose the following impacts to the Earth and Mankind:

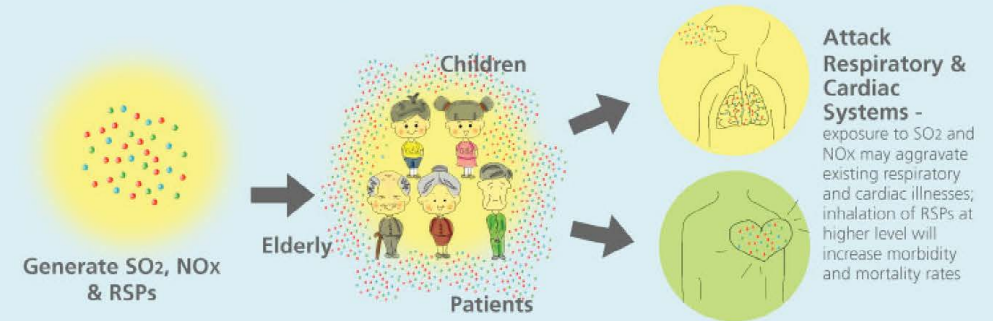
Global Warming

The greenhouse gases will accelerate the insulating effect in upper atmosphere, prevent heat dissipation at the usual rate and will result in global warming. The consequence of global warming has far-reaching impacts on our ecosystems, affecting the agricultural production, and causing rise in sea level.



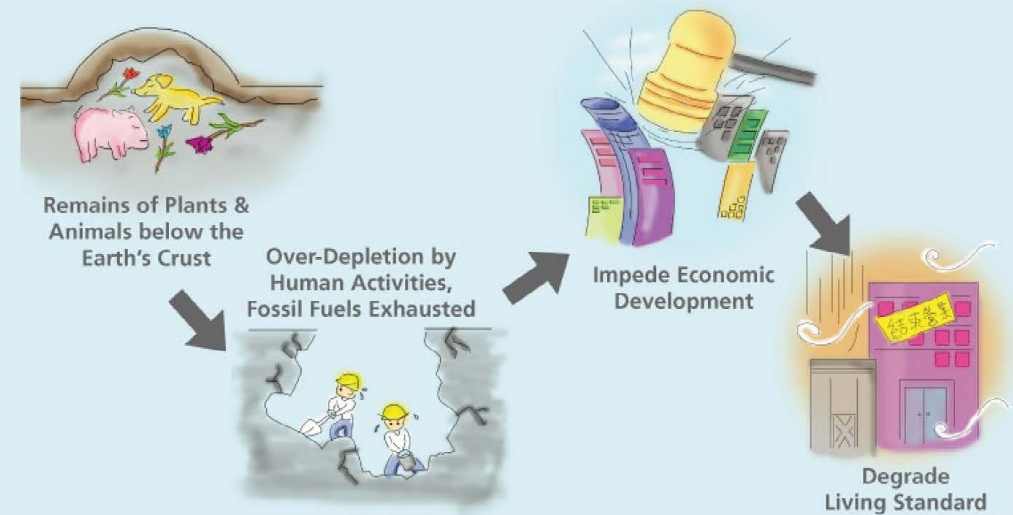
Atmospheric Pollutants Production

Atmospheric pollutants, such as sulphur dioxide (SO₂), nitrogen oxides (NO_x), respiratory suspended particulates (RSPs), etc. will affect human health, with particular adverse effects on the young children and the aged, as well as people with chronic health problems.



Economic Development Hindrance

Fossil fuel reserves have their limits. Over the past decades, we have rapidly depleted these limited natural resources. The shortage of fossil fuels in the not too distant future could affect the activities of all walks of life and impede economic development. This could result in the global degradation of people's living standard.



Reference:

https://www.emsd.gov.hk/filemanager/sc/content_299/re_leaflet_chi.pdf
https://www.emsd.gov.hk/filemanager/en/content_299/re_leaflet_eng.pdf

氣候變化問題

氣候變化包括溫度和天氣模式的長期變化。這些變化可由自然原因造成，例如太陽活動變化和大型火山爆發。但自19世紀，人類活動一直是氣候變化的主因，特別是由於燃燒煤炭、石油和天然氣等化石燃料所導致。

燃燒化石燃料會排放溫室氣體，這些氣體像一張包裹地球的毛氈，持續吸收太陽熱量並阻止熱力離開地球，使溫度不斷升高，造成全球暖化。

全球暖化引起許多問題，例如熱浪和極端降雨等事件會變得更頻密、強烈熱帶氣旋的比例增加、海平面上升、農業產量下降、部份地區水資源枯竭、疾病傳播及生態環境失衡等。

Climate change

Climate change refers to the change in climate as a result of human activities that cause a change in the atmospheric composition, in addition to natural climate variability.

Human activities cause increases in atmospheric concentration of greenhouse gases, mainly through burning fossil fuels. The greenhouse gases act like a blanket in the atmosphere, trapping heat on Earth and lead to global warming.

This general rise in temperature in turn leads to a proliferation of other problems, such as more frequent heat waves and extreme rainfall events, increased global proportion of major tropical cyclones, rise of sea level, reduction in agricultural production, scarcity of water resource in certain regions, spread of disease, loss of ecological and environmental balance, etc.

聯合國訂立的可持續發展目標 (SDGs)

聯合國全體成員國於2015年通過可持續發展目標 (SDGs)，以消除貧窮、減少不平等，並於2030年前建立更和平及繁榮的社會。SDGs也被稱為全球目標 (Global Goals)，呼籲大家採取行動，創造一個可持續發展的世界。

Sustainable Development Goals (SDGs) set by the United Nations

The Sustainable Development Goals (SDGs) were adopted by all United Nations Member States in 2015 to end poverty, reduce inequality, and build more peaceful, prosperous societies by 2030. Also known as the Global Goals, the SDGs are a call to action to create a world where no one is left behind.

Reference: https://www.ndc.gov.tw/nc_14813_36205



UN SDGs:
17 Goals to
Transform
Our World



5R 環保法則

1. Reduce (減少)：減少棄置廢物。
2. Reuse (重用)：重複使用產品。
3. Repair (維修)：重視維修保養，延長物品使用壽命。
4. Refuse (拒用)：拒絕購買過度包裝商品，拒用無環保觀念物品。
5. Recycle (回收)：回收使用再生物品。

若每個人都能記住5R原則：從減量觀念出發，拒絕不必要的購買行為，重用物品，重視維修，做好分類回收，不僅能節省額外開支，亦能使資源循環利用。一個小動作就能為地球的未來盡一分力。

5Rs Principle

1. Reduce: Reduce the amount of waste generated.
2. Reuse: Reuse containers or products.
3. Repair: Emphasize maintenance and repair to extend the lifespan of items.
4. Refuse: Refuse to buy overly packaged products and items that lack environmental consciousness.
5. Recycle: Recycle used materials.

If everyone can remember this 5R principle, starting with the concept of reduction, refusing unnecessary purchases, reusing, prioritizing maintenance, and properly sorting for recycling. Not only can this save extra expenses, but it also allows resources to be reused and recycled. A small action can contribute to our future planet.

中華電力低碳能源教育中心



掃一掃二維碼，了解如何運用低碳能源來應對氣候變化所帶來的挑戰。更可到香港城市大學的中華電力低碳能源教育中心免費參觀，參與具啟發性及教育意義的學習體驗。

Scan the QR code to discover how low-carbon energy addresses the challenges of climate change. Visit the CLP Power Low Carbon Energy Education Centre at the City University of Hong Kong for a free but thought-provoking experience!



關於電動車與汽油車

甚麼是電動車？

電動車為利用電動馬達作為驅動力的車輛。零件主要為電池、電池控制模組及馬達三大類。電動車分為不同類型，有些純以電力驅動，有些則需輔以其他能源。與傳統車輛比較，電動車輛只排放少量或甚至不會排放溫室氣體，是一種更有利可持續發展的交通工具。若以電動車輛取代傳統車輛，將大幅改善路邊空氣質素。

電動車類型	簡介	電動車類型
純電動車	全電力驅動車輛，經外部電源為電池充電，馬達則只以電池驅動。	電池
混能車	主要使用內燃機引擎驅動，配備電池系統，儲存於煞車時回收的能源。	燃油或柴油
插電式混能車	是混能車的一種，能接受充電。	燃油或柴油；電池

What is an electric vehicle?

Electric vehicles (EVs) refer to vehicles that use electric motors as driving force. The main components include batteries, battery control modules, and motors. There are several types of EVs. Some are purely powered by electricity, while some require additional energy sources. Compared to conventional vehicles, EVs emit very little or even no greenhouse gases, making them a more sustainable form of transportation. Replacing conventional vehicles with EVs can significantly improve roadside air quality.

EV type	Description	Energy source
Pure	Battery EVs are all-electric vehicles that store electrical energy from an external source. Their motors are powered by batteries only.	Electricity
Hybrid	Hybrid EVs mainly use the internal combustion engine. They have a backup battery system that captures energy during braking.	Petrol or diesel
Plug-in Hybrid	Plug-in hybrid electric EVs are hybrid EVs that support charging.	Petrol or diesel; Electricity

你有見過電動車嗎？

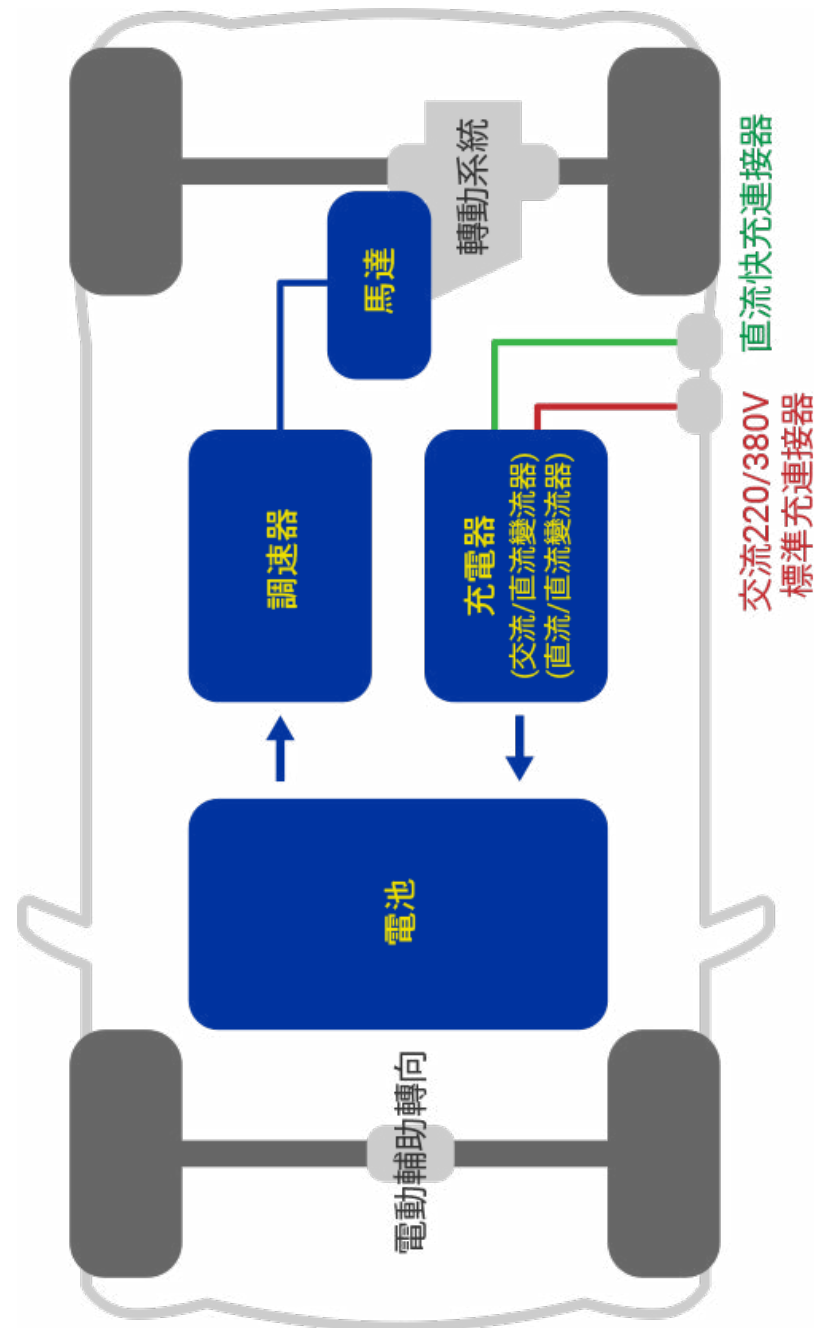
電動車 vs 汽油車

電動車	汽油車
污染較少，純電動車甚至不會排放廢氣	污染較多
里程較少	里程較長
充電速度較慢（需數小時）	加油速度較快（只需數分鐘）
駕駛及維修保養費用較低	駕駛及維修保養費用較高
時速較低（約每小時160.9公里左右）	時速較高（超過每小時482.8公里）
能源成本較低（每公里0.97港元）	能源成本較高（每公里逾5.81港元）
能源效益較高（停車時電動機完全靜止，沒有不必要的能量消耗）	能源效益較低（停車時引擎仍然需怠速轉動，浪費不必要的浪費燃料）
比較安靜	噪音較多

Electric Vehicles vs Petrol Vehicles

Electric Vehicles	Petrol Vehicles
Emits less pollution, pure electric cars emit no exhaust	Emits more pollution
Lower mileage	Higher mileage
Slower charging (takes several hours)	Faster refuelling (only takes few minutes)
Lower driving and maintenance costs	Higher driving and maintenance costs
Lower speed (around 160.9 km/h)	Higher speed (over 482.8 km/h)
Lower energy cost (HKD 0.97 per km)	Higher energy cost (over HKD 5.81 per km)
Higher energy efficiency (motor completely stops when parked, no unnecessary energy consumption)	Lower energy efficiency (engine idles when parked, wasting fuel)
Quieter	More noise

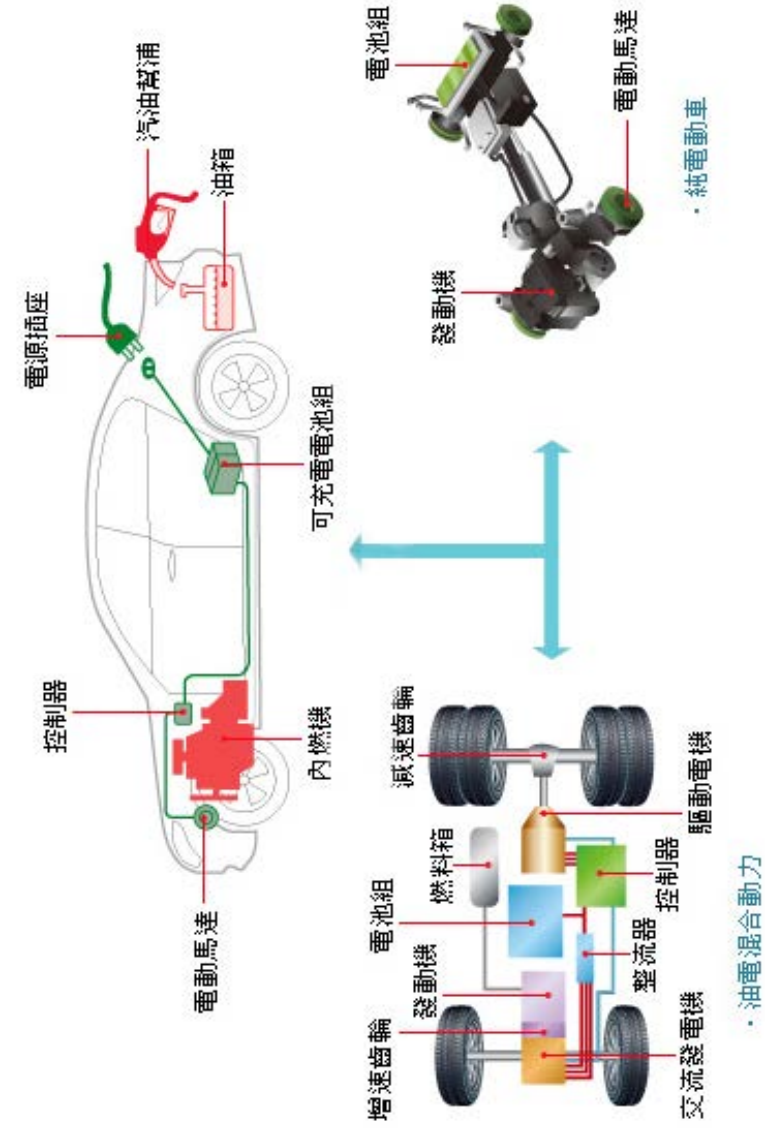
電動車大解構



電動車大解構

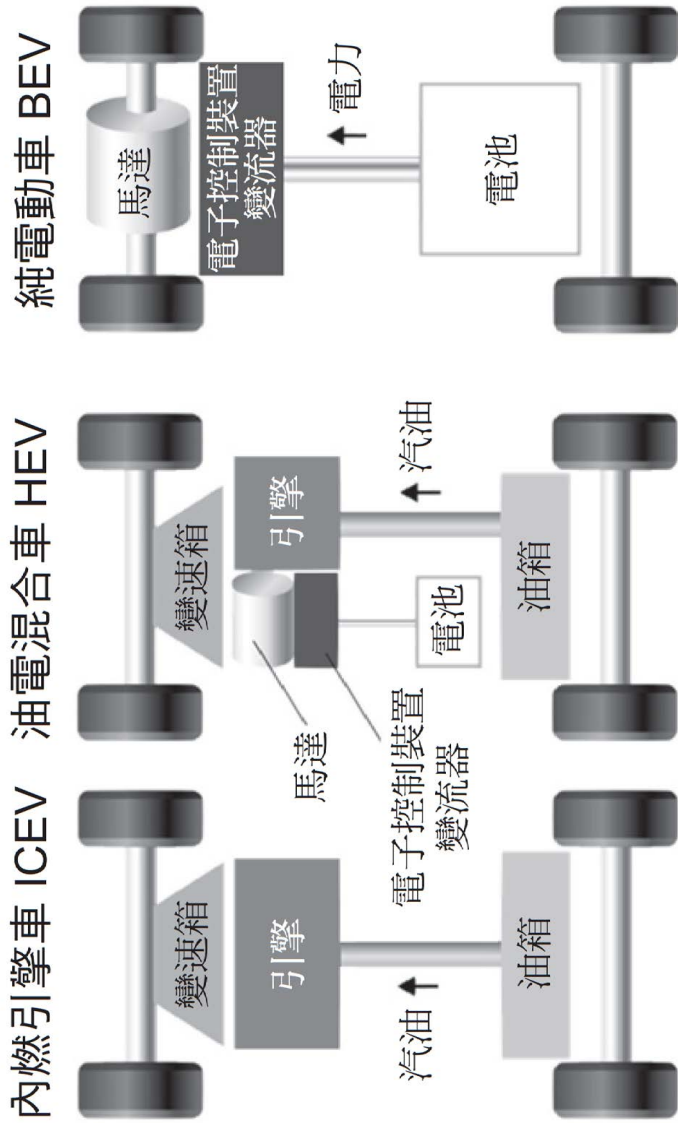
- 電池 (Battery): 為車輛提供動力。 Powers the vehicle.
- 調速器 (Controller): 調節電池到電動馬達的電力。 Regulates the power from the battery to the motor.
- 馬達 (Motor): 將電能轉化成機械能，從而產生動能驅動車輛。 Convert electrical energy into mechanical energy which is then translated into kinetic energy, resulting in moving the vehicle.
- 轉動系統 (Transmission system): 將動力傳遞至車輛。 Transfers power to the wheels.
- 充電器 (Charger): 管理電池充電，支援交流/直流充電。 Manages charging of the battery, and supports both AC/DC charging.
- 電動轉向 (Electric power steering): 輔助轉向操作。 Assists with steering.
- 交流220/380V標準充電接口 (AC 220/380V standard charging connector): 適用於標準充電。 For standard charging.
- 直流快充連接器 (DC Fast charging connector): 適用於快速充電。 For fast charging.

電動車大解構



Reference:
<https://newjust.masterlink.com.tw/HotProduct/HTML/Basic.xd.htm?A=PA52-1.html>



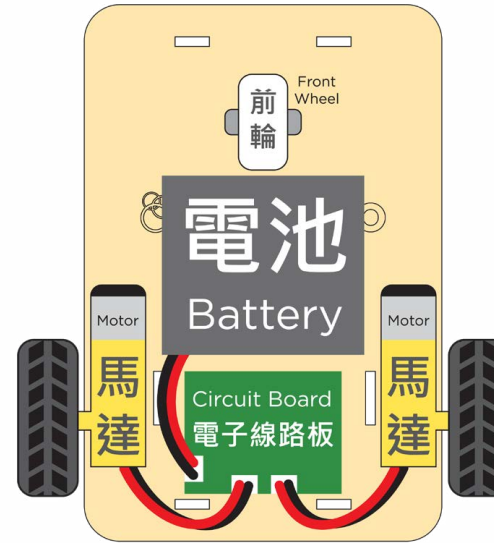


Reference:
<https://www.bsmi.gov.tw/wSite/public/Attachment/f1337848191987.pdf>

透視電動車 Understanding EV Car

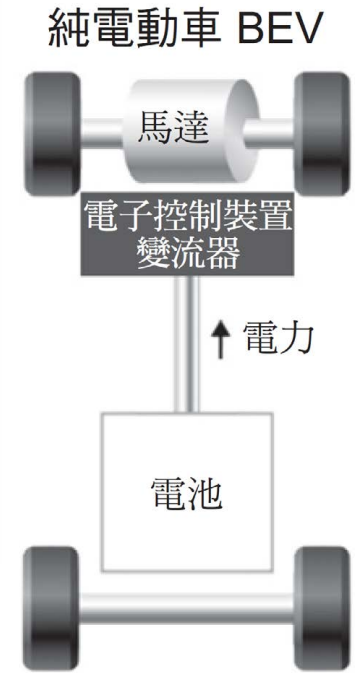
電能電動車 EV Car的主要結構由三部份組成，分別為：電池、電子線路板和馬達。電池為電子線路板提供電能，經電子線路板傳至馬達，使電動車前進。

An InnoCar (EV Car) has three main parts: a battery, a circuit board, and a motor. The battery gives power to the circuit board, which sends that power to the motor, helping the car move.



- 前輪 Front Wheel
- 電池 Battery
- 馬達 Motor
- 電子線路板 Circuit Board

電動車 EV Car 的部件 Parts of the EV Car :
 電池+馬達電子線路板+馬達 Battery + Circuit Board + Motor
 與純電動車 BEV 類似 It is similar to a Battery Electric Vehicle (BEV).



甚麼是電路 What is a Circuit?

可以將電路想像成一條河。河裡的水就像電流，從高處流向低處，而電流則從正極流向負極。電流在電線裡流動，就像水在河裏流動一樣。

Think of a circuit like a river. The water in the river is like an electric current, flowing from high places to low places, and electric current flows from positive to negative. The current moves through wires, just like water flows in a river.

電路的部件 Parts of a Circuit:

電池 能量來源，為電路提供能量。

Battery The power source which gives energy to the circuit.

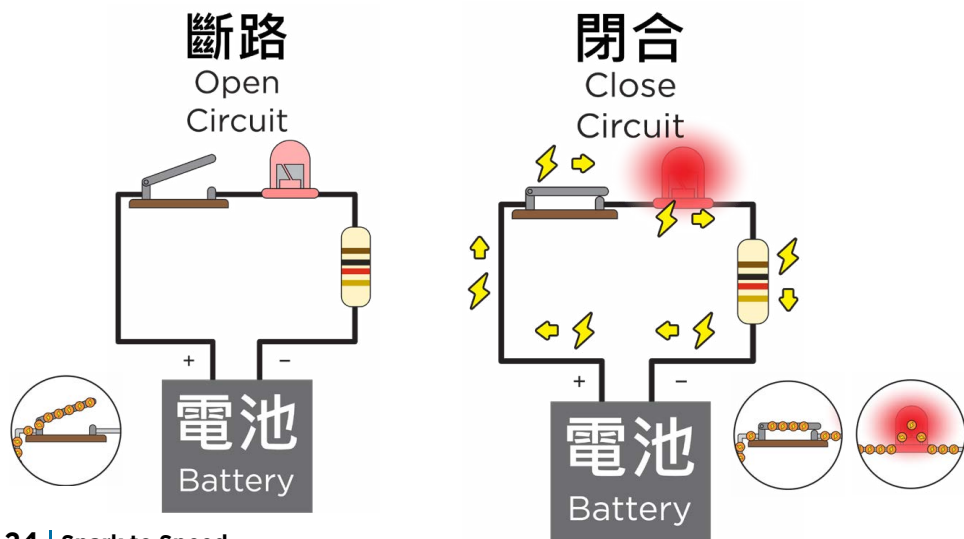
導線 連接不同部件，讓電流從電池流向其他部分。

Wires These connect everything and let the current flow through the parts.

當你關上開關時，它會關閉電路（閉合狀態），讓電流通過。

開關 當你打開開關時，它會打開電路（斷路狀態），停止電流。

Switch When you turn on the switch, it closes the circuit, letting current flow. When you turn it off, it opens the circuit and stops the current.

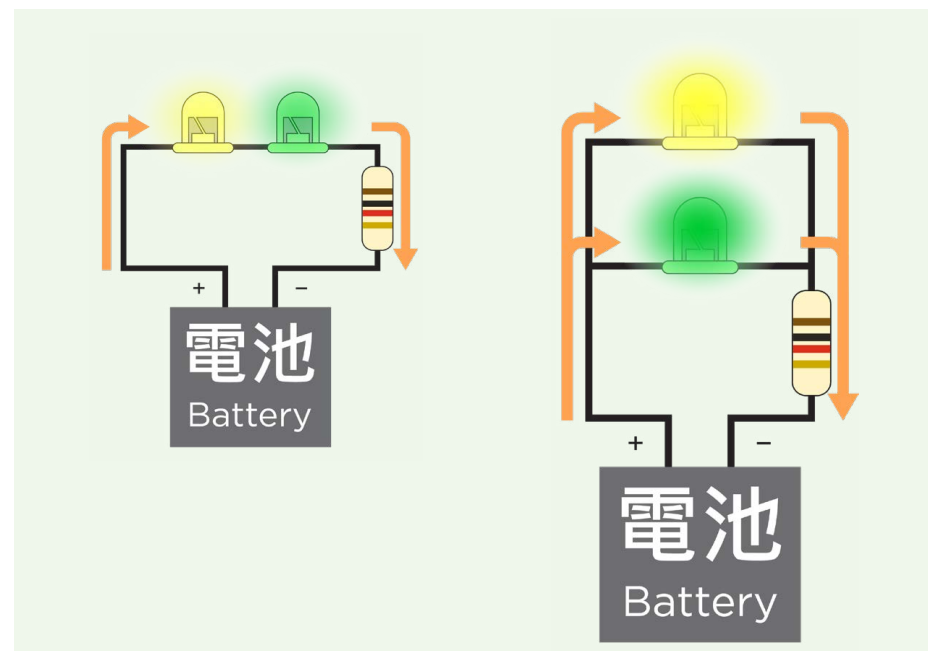


串聯電路 vs 並聯電路 Series Circuit vs Parallel Circuit

電路的連接方式分串聯和並聯兩種，各有所長。

There are two ways to connect circuits: series and parallel, each with its advantages.

串聯電路 Series Circuit	並聯電路 Parallel Circuit
以一條電流路徑連接所有元件 All parts are connected by the same current paths	以多條電流路徑連接元件 Parts connected by different current paths
不同元件分享電流 Different components share the current	不同元件各自取得所需電流 Different components each receive the required current
消耗較少電量 Uses less power	消耗較多電量 Uses more power



電動車的電子線路板 **Circuit Board in the EV Car**

電動車 EV Car 使用到的電子線路板透過並聯電路，以兩組按鈕和馬達組成兩個獨立電路。

The circuit board in the EV Car uses a parallel circuit with two buttons and motors.

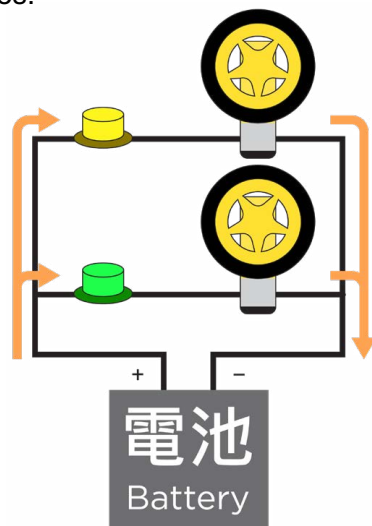
- 按下黃色按鈕時，電流便會通過電路上方路徑，使上方馬達轉動；
Pressing the yellow button allows current to flow through the upper path of the circuit, making the upper motor turn.
- 按下綠色按鈕時，電流便會通過電路下方路徑，使下方馬達轉動；
Pressing the green button allows current to flow through the lower path of the circuit, making the lower motor turn.
- 同時按下黃色和綠色按鈕時，電流便會通過電路上方和下方的路徑，使兩個馬達同時轉動。
Pressing both the yellow and green buttons together allows current to flow through both paths of the circuit, making both motors turn at the same time.

透過掌握按下按鈕的組合和時機，控制你的電動車 EV Car 穿過不同阻礙吧！

By mastering the combination and timing of pressing the buttons, you can guide your EV Car through obstacles!

動動手，製作你的電動車！

Let's Build Your Electric Car!



鳴謝 **Acknowledgement**

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CLP 中電


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