



# The development and applications of the Taiwan 2050 Calculator

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# Outline

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- Project background
- Tools development
- Features of Taiwan 2050 Calculator
- Functions and applications
- Engagement

# Project background

## Energy in Taiwan :

- Around 98% energy use relies on imports
- Highly depends on fossil fuel (90% of energy supply)
- Industry sector is the biggest energy consumer
- Increasing demand for both energy and electricity



(source: ITRI)

# Project background

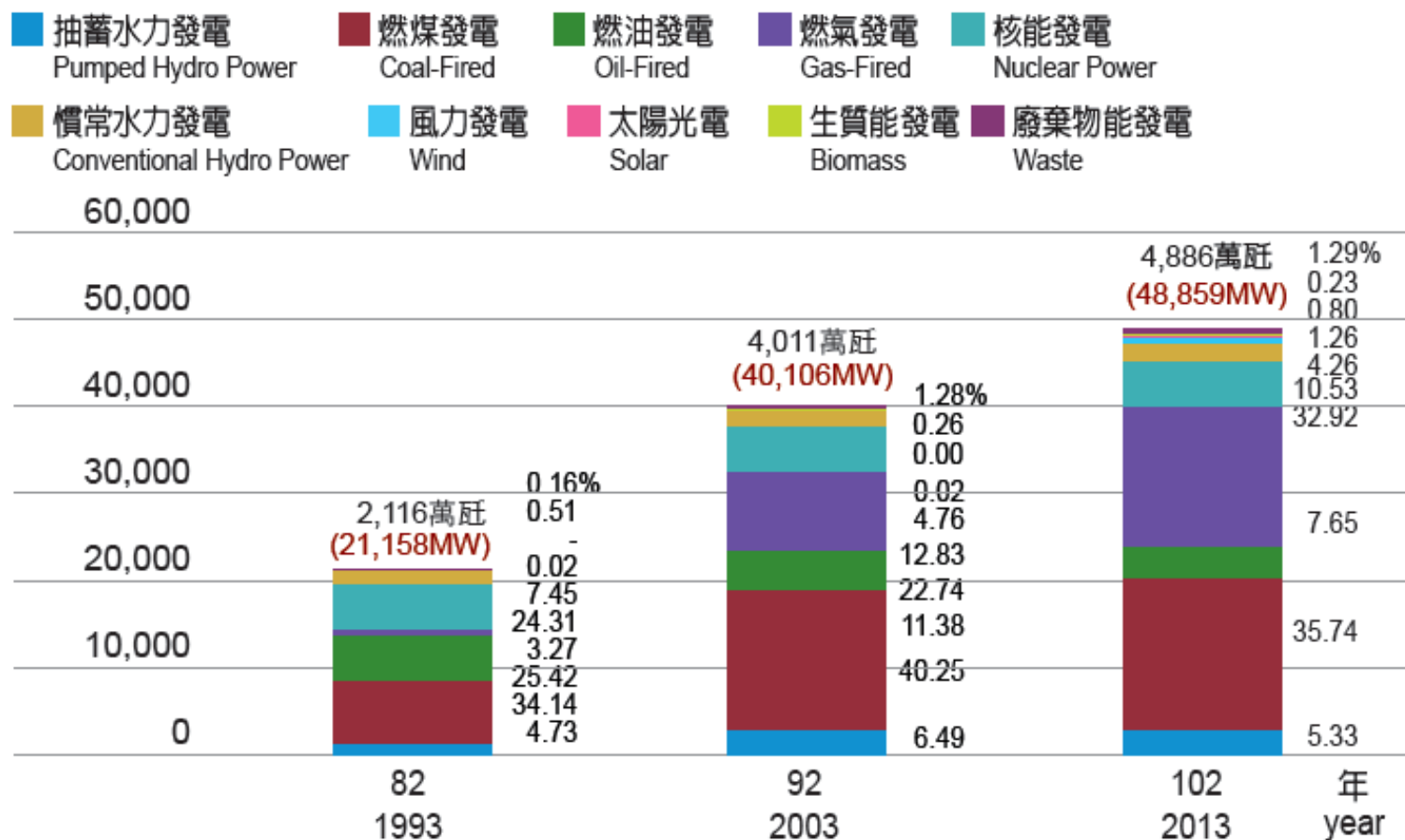


Fig: Power installed capacity in Taiwan (source: BOE)

# Project background

## Energy Challenges of Taiwan :

- No energy transmission link to other countries
- Barriers to develop power facility
- Obligation to decarbonize
- Nuclear development dispute
- No clear consensus on future energy development among the public



(source: ITRI)

# Project background

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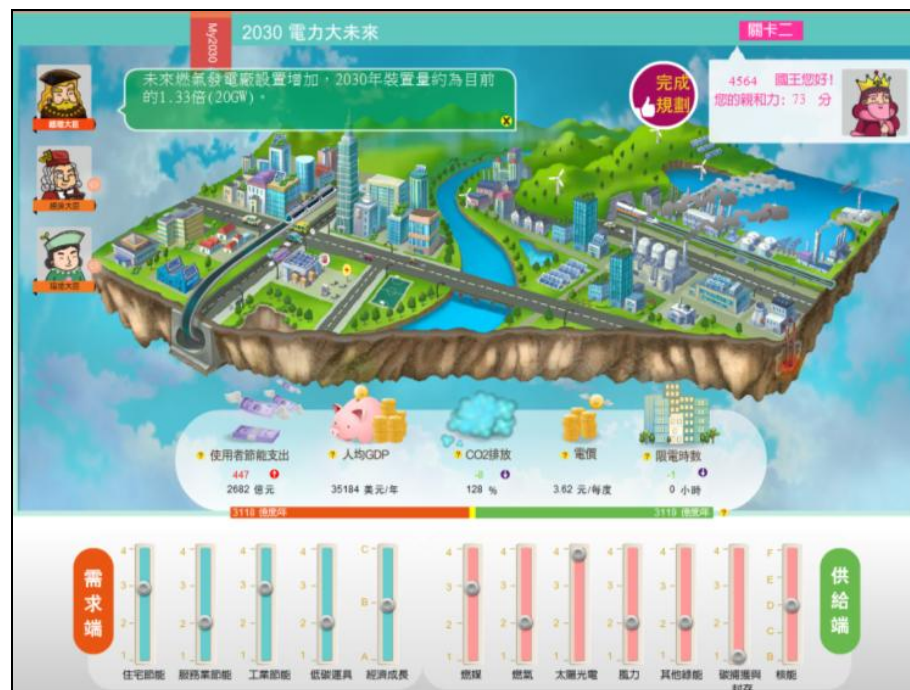
## What do we need in Taiwan?

- A platform which **collect public opinion** and the energy technology information
- A tool which can do **comprehensive analyses** on electricity supply and demand
- An **easy-to-use** tool that can encourages **public engagement** on the discussing future energy mix
- A platform that can analyze the public opinion and **communication**
- A tool for **energy education**

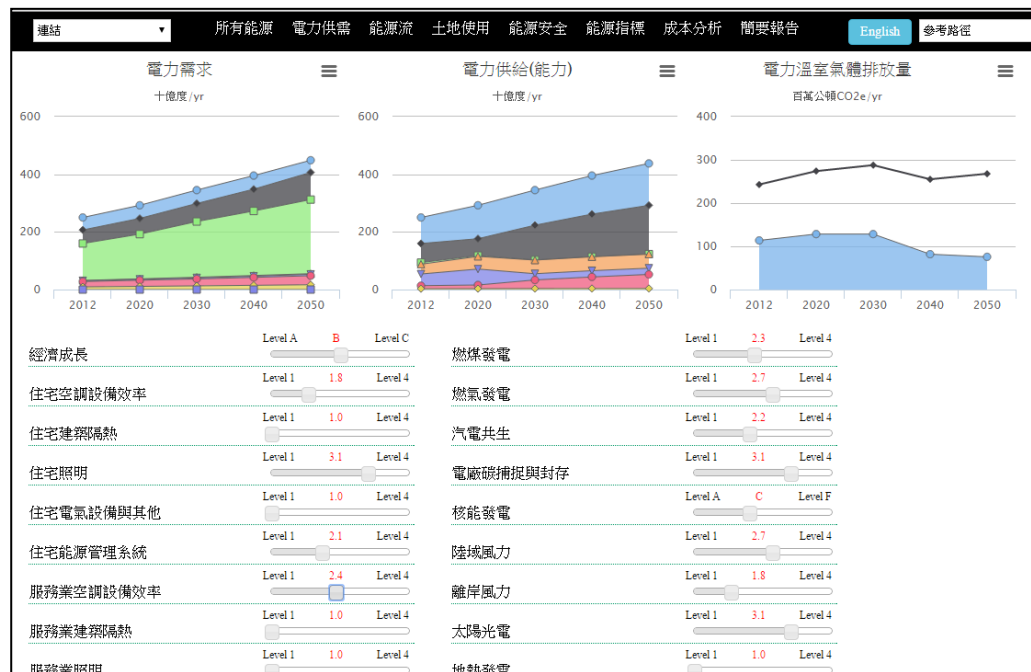
**We needs an open and easy-use energy discussion platform !**

# Project background

Taiwan 2050 Calculator portal:  
[my2050.twenergy.org.tw](http://my2050.twenergy.org.tw)

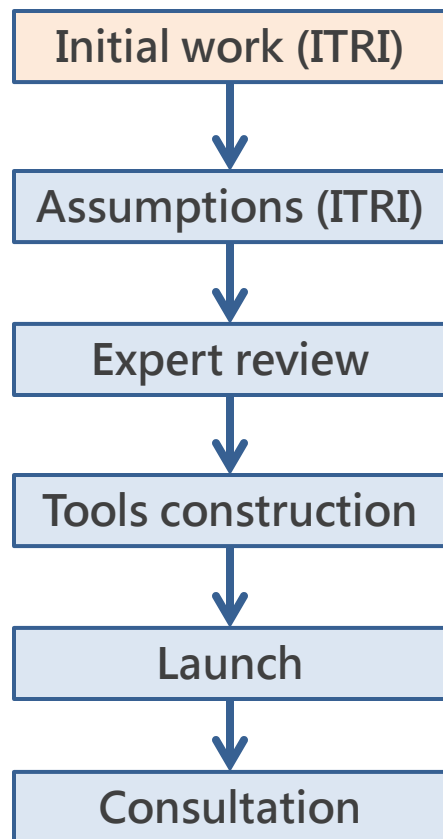


## 2030 Electricity Vision



## Web tool

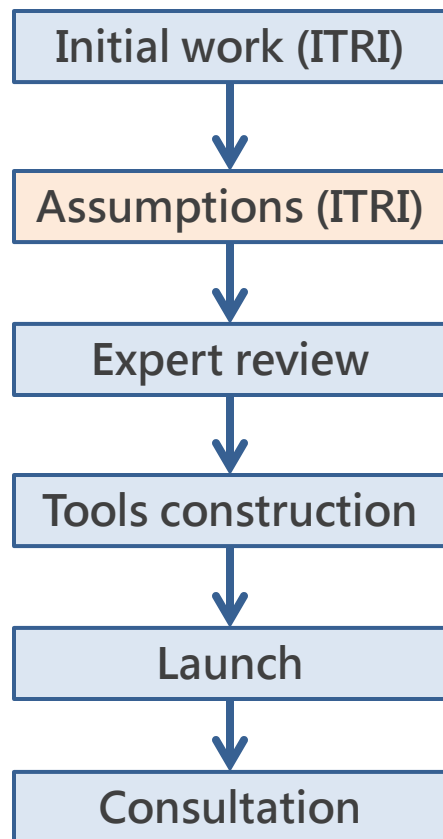
# Tools development



- Recognize project scope
- Initial research on methodology
- Determine sectors and options according to:
  - Share of the energy mix and demand (ex: electronic industry)
  - Technology prospective (ex: offshore wind power)
  - Development in dispute (ex: nuclear power)
- Finalize in 34 major scenario items (approximate 130 technologies)
- Determine the output indicators (ex. emission, price)



# Tools development

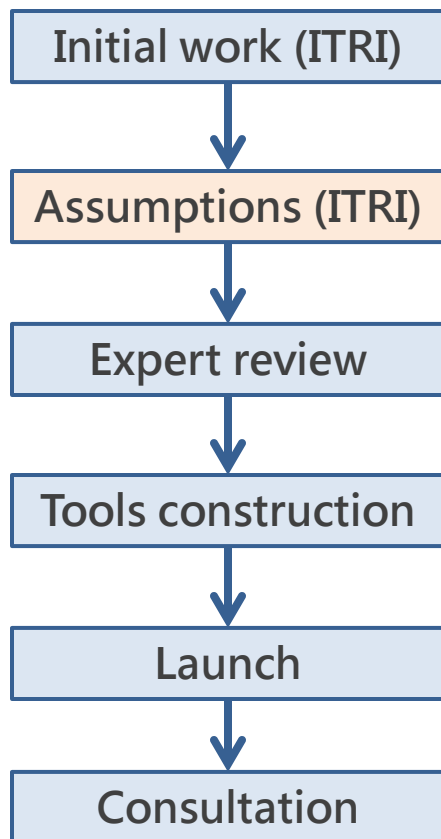


- **Fixed** assumptions
  - Collect data from existing models (ex: **Taiwan MARKAL/TIMES model, MACC**)
  - Data from experts in ITRI
- **Scenario** assumptions
  - Follow DECC's definition – from Level 1(do nothing ) to Level 4(most optimistic)
  - Initially determined in **ITRI** (through 10 consultation meeting, around 70 experts were involved)



(source: ITRI)

# Tools development



- **Example: offshore wind development**
  - Evaluate the **real limit** on land for the development. Considered factors:  
**wind speed, water depth, environmental conservation areas, ship course, military areas** and so on.  
(aprx.70GW)

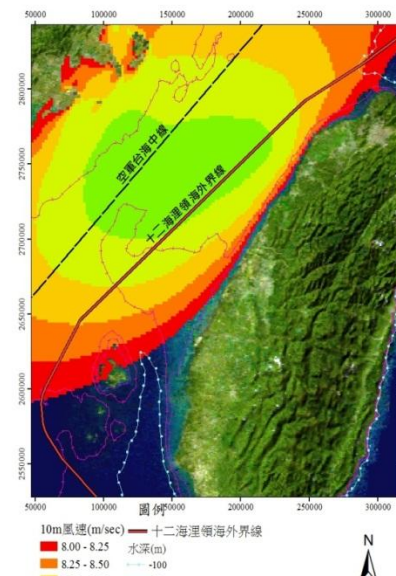
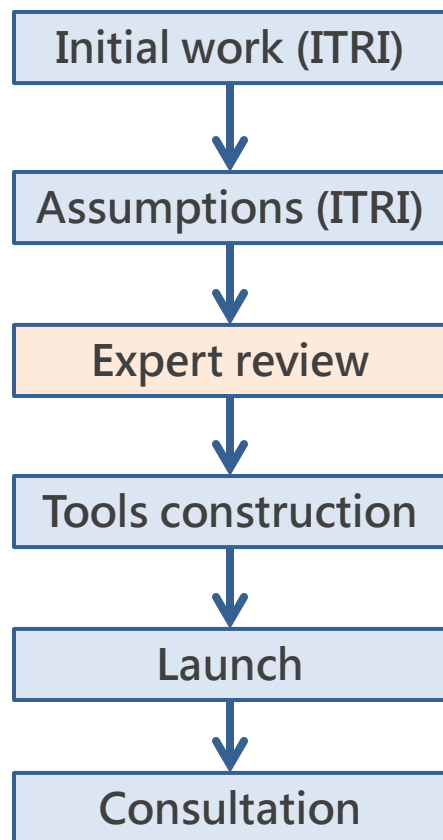


Fig: offshore wind resource map (source: ITRI)

Capacity (MW)	Scenario	2015	2020	2025	2030	2035	2040	2045	2050
L1	No action	0	224	1162	2100	3600	3672	3672	3,672
L2	Ambitious	15	320	1520	3000	4200	5400	6600	7,800
L3	Very Ambitious	15	394	582	2645	5945	10895	14000	14,000
L4	Physical limit	56	582	2645	5945	10895	15845	30245	69,620

Table: Trajectory assumption on offshore wind development in Taiwan 2050 Calculator

# Tools development

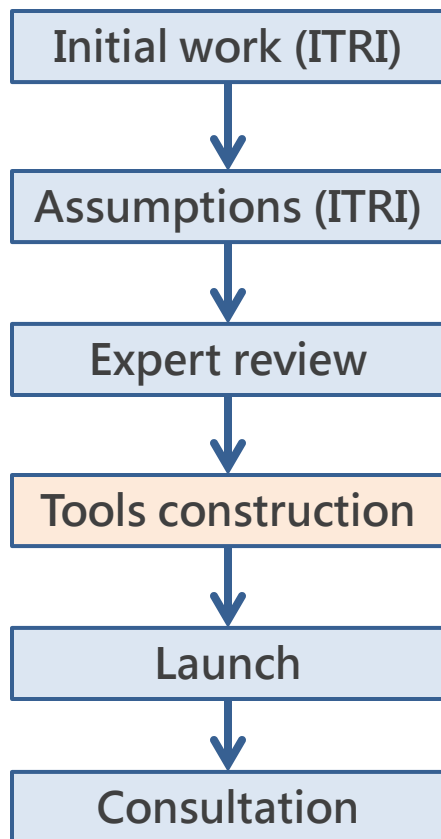


- **Expert review** on all assumptions
- Over **100 experts** from electricity system operator, academia, business, government, NGO, and other organizations participated
- Also review on preliminary sectorial result
- Suggestions were collected, and then modified the model. For those suggestions were not accepted(ex. lack of evidence), the team gave official responses.



(source: ITRI)

# Tools development



- Construct **excel core model**
- Design and build **web tool** and My2050 tools (based on the same excel core model)

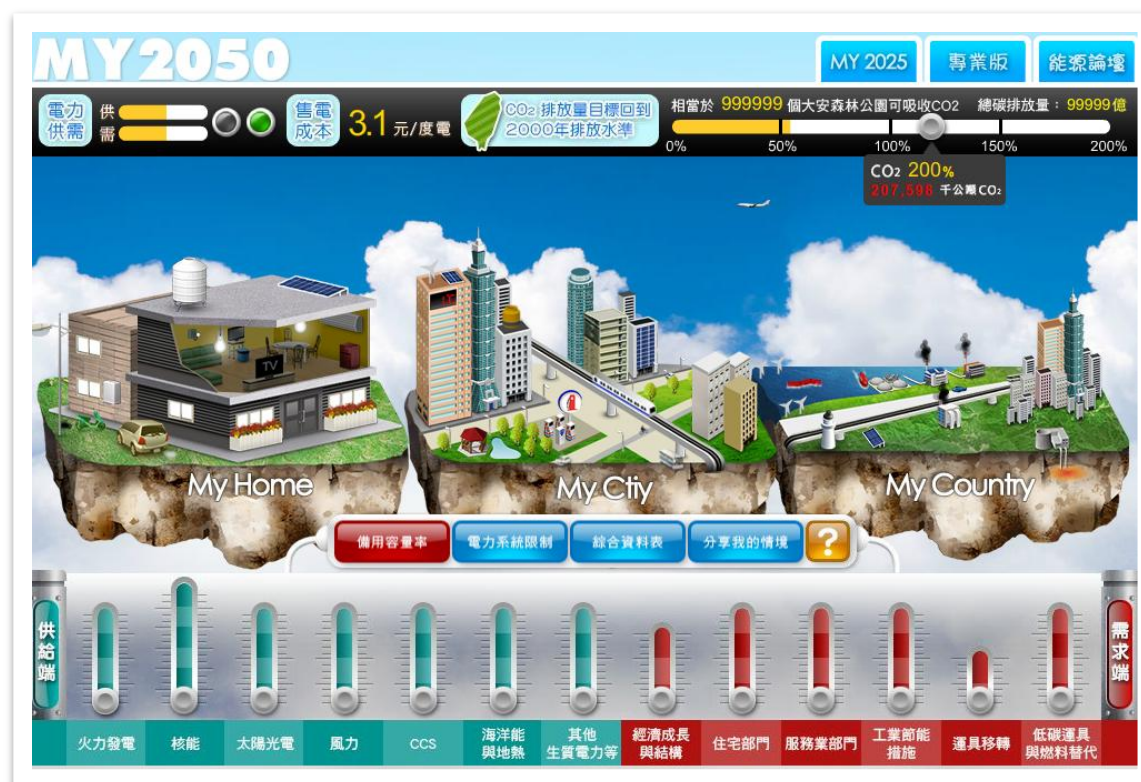
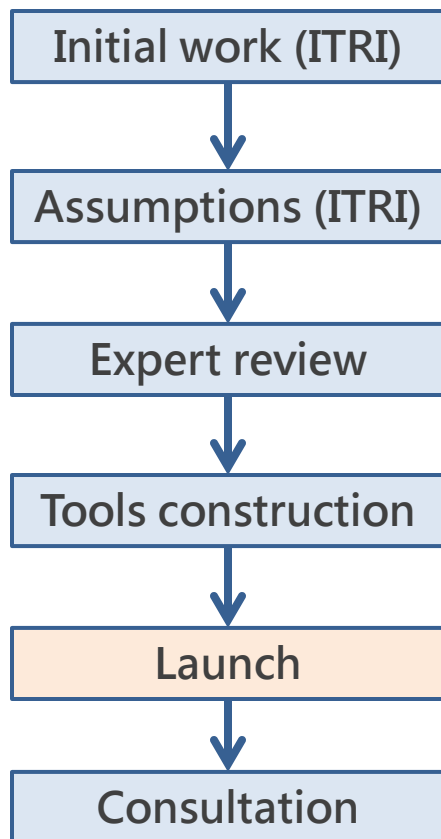


Fig: Taiwan My2050 interface (source: ITRI)



# Tools development



- Tools were launched **7 months** after its start
- ITRI become the **fifth** party to launch the tools
- Promotional activities followed

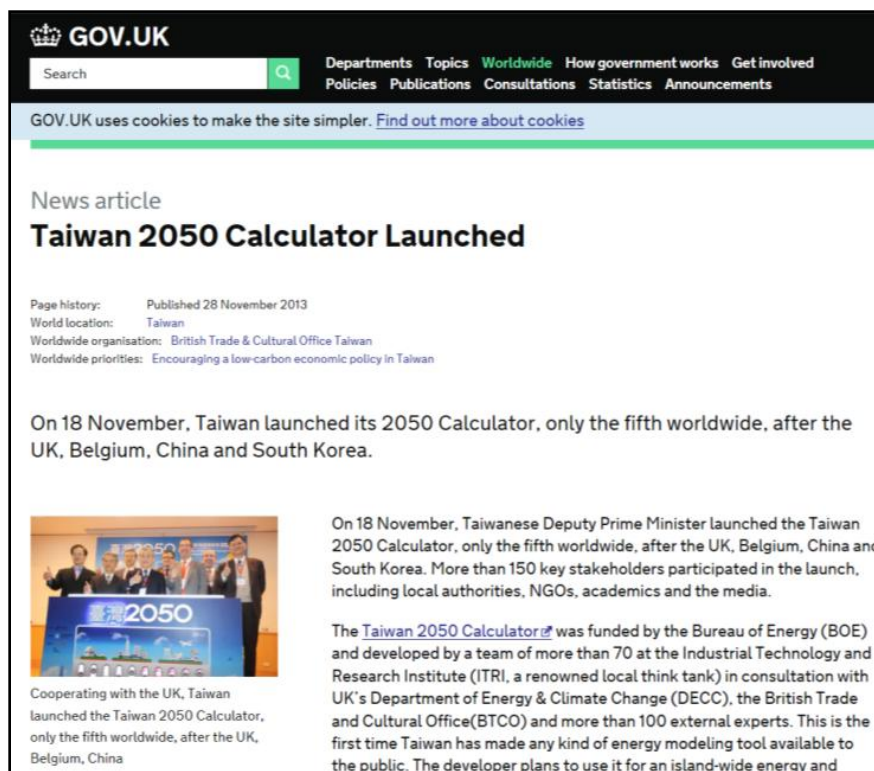
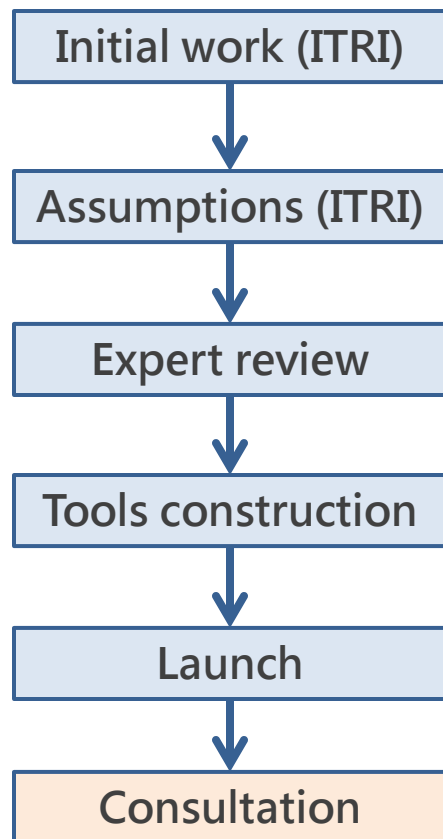


Fig: News on Taiwan 2050 Calculator Launch event (source: GOV.UK)

# Tools development



- All materials are available online (energy forum)
- **Facebook** pages were created as a channel for discussion
- Relevant materials were sent to **regional energy think** tanks for review
- **Consultative meetings** with major stakeholders: state-owned utility company, energy and environment authorities, industry leaders and NGO groups
- Suggestions on methodology, assumption and interface were proposed from all activities above
- **New functions** were suggested or inspired
- A **game-based version(My2030)** was proposed and has been developed to replace the previous My2050

# Features of Taiwan 2050 Calculator

- Energy demand was integrated with **economic scenarios**
  - GDP growth and industry structure
- Integrate with **130 energy technology** development assumptions
- Integrate with **Taiwan energy resource survey** data and research



Fig: Cement CCS facility in Taiwan  
(source: ITRI)

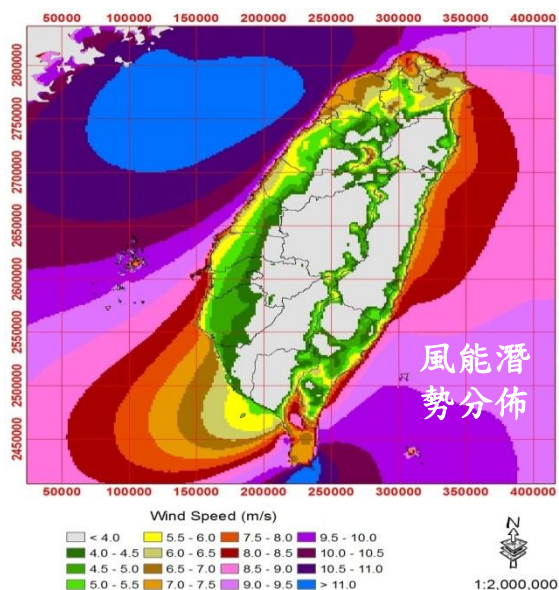


Fig: Wind resource map in Taiwan  
(source: ITRI)

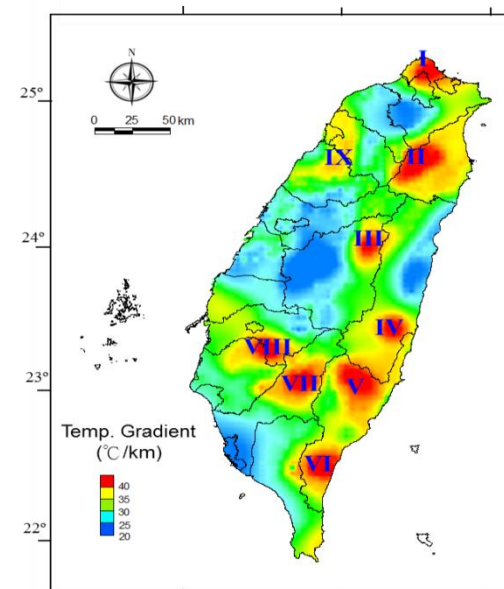


Fig: Geothermal resource map in Taiwan  
(source: ITRI)

# Features of Taiwan 2050 Calculator

- **Localized** energy technology items and energy usage patterns



- **More essential information**
  - Reserve margin capacity, **Brownouts issue**
  - Energy development marginal cost
  - **Electricity price**, economic impacts
  - Energy intensity, emission intensity
  - Land use for renewable energy development
  - Development **difficulty index**



# Features of Taiwan 2050 Calculator

- My2030 electricity vision
  - A modified game version to make the tool **more attractive**
  - Users are **guided to learn** the features of each item
  - User need to **choose a king (from 5 candidates) to start** the game. The property of the king will reflect on the initial lever setting.
  - **Summary pages** to compare the initial choose and final pathway



# Features of Taiwan 2050 Calculator

- My2030 electricity vision



Roles with  
opinions

5 Key output

Electricity  
balance

12 levers

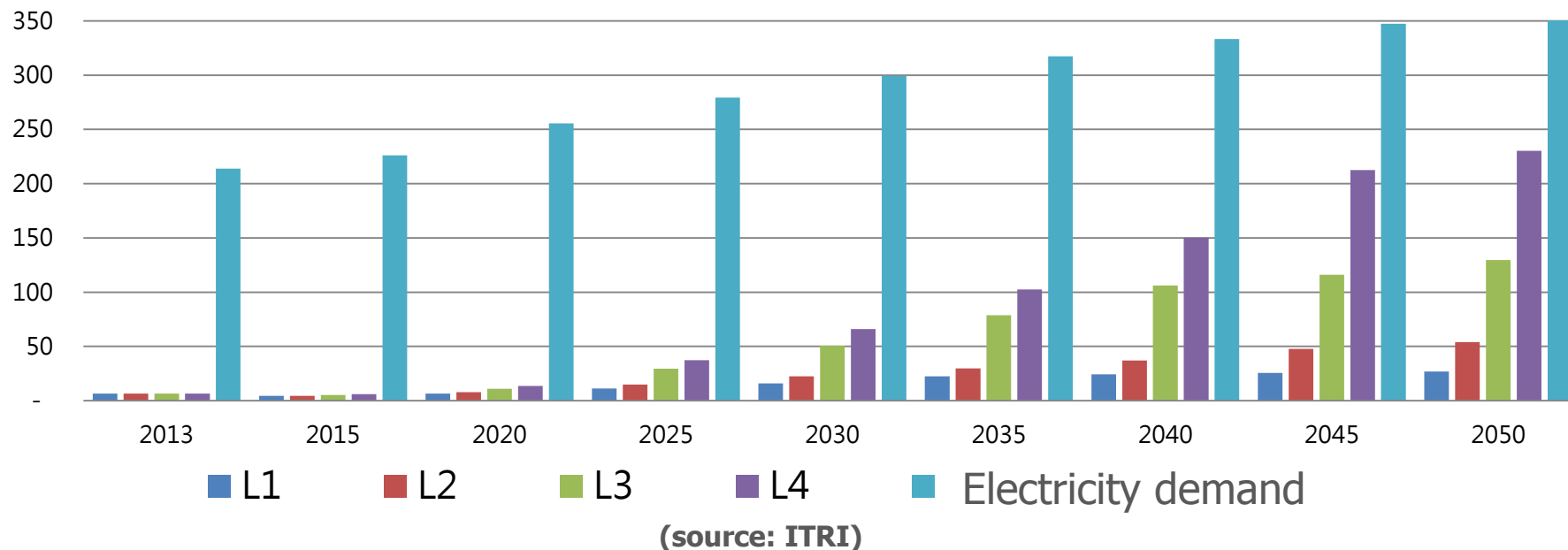
Reflects king's  
reputation

Interactive  
elements

# Functions and applications

- Possible **alternative** to power development and the impacts
- Analysis on the real **potential of renewable** energy development  
(and help to identify the challenges)

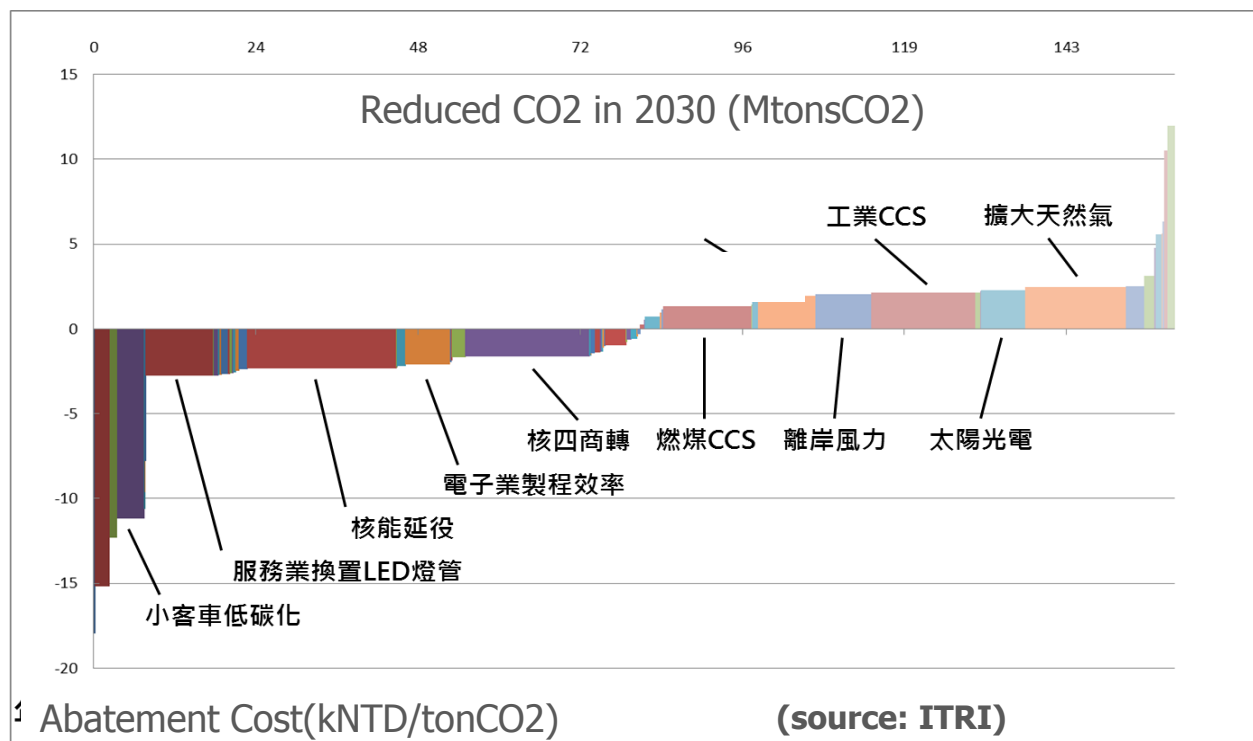
Comparison of all renewable power generation and estimated demands (TWh)



# Functions and applications

- **Brownouts simulation**
- **Electricity price**
- **Marginal Abatement Cost Curve (MACC)**

Fig: MACC constructed from Taiwan 2050 Calculator model



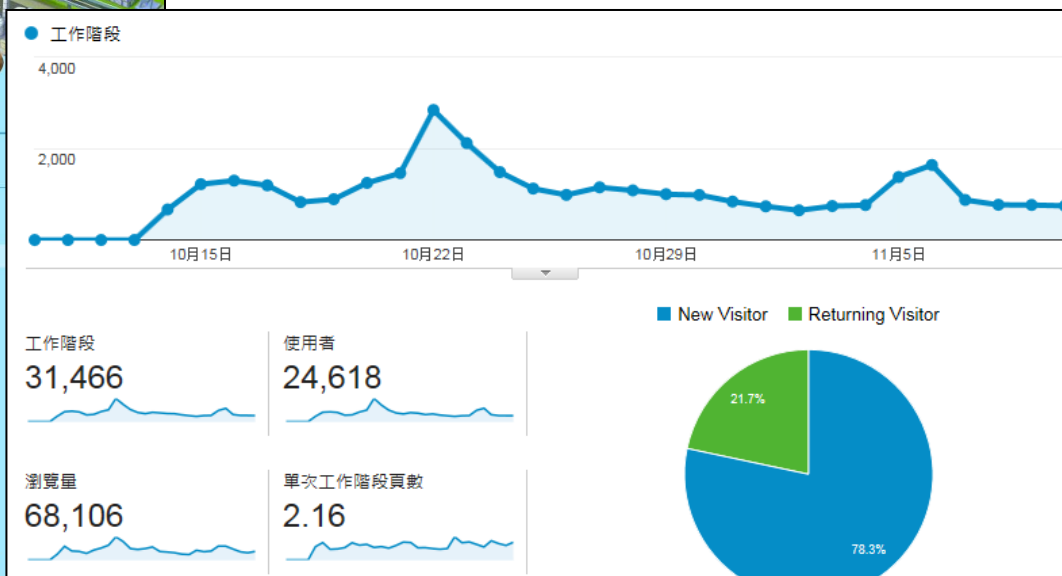
# Engagement

- **Online tools** (with some promotion scheme)
  - **Web tool** – 7,000 visits in the first year
  - **My2050** – 4,000 visits in the first month (1,300 pathways submitted)
  - **My2030** – **30,000 visits** in the **first month** (**6,000 pathways** submitted)



(source: ITRI)

Fig: Net flow of My2030 in the first month



(source: ITRI)



# Engagement

- NGO groups and bloggers post [articles](#) introducing the tools
- [Workshops](#)
  - 1 for general public – 25 participants (collaborate with BTCO)
  - 1 for high school teachers – 20 participants
  - 4 for university professors – 90 participants
- Local promotion activities in [book stores](#) (for public, 8 events)



Fig: Workshop for general public at Taipei  
(source: ITRI)



Fig: Workshop in book store at Taichung  
(source: ITRI)

# Engagement

- Evidence base in the 4<sup>th</sup> National Energy Conference
- University and research
  - Adopted in postgraduate seminars at 3 universities
  - Sessions topic in general education courses at 6 universities (9 sessions, 533 participants)



Fig: Seminar in National Taiwan University  
(source: ITRI)



Fig: General education course in National Chungshin University



# Taiwan 2050 Calculator

## Thank You!

