

# Total Solution for Syngas Analysis



Hubei Cubic-Ruiyi Instrument Co.,Ltd.



**Syngas** (synthesis gas), which is also called as coal gas or producer gas, is a kind of combustible gas mixture of nitrogen, carbon monoxide, and hydrogen, mainly generated by passing air with steam over burning coke or coal in a gasifier and used as fuel for different industries like steel making, cement, power plant, and other high fuel consumption industries.

### Applications

#### Energy production:

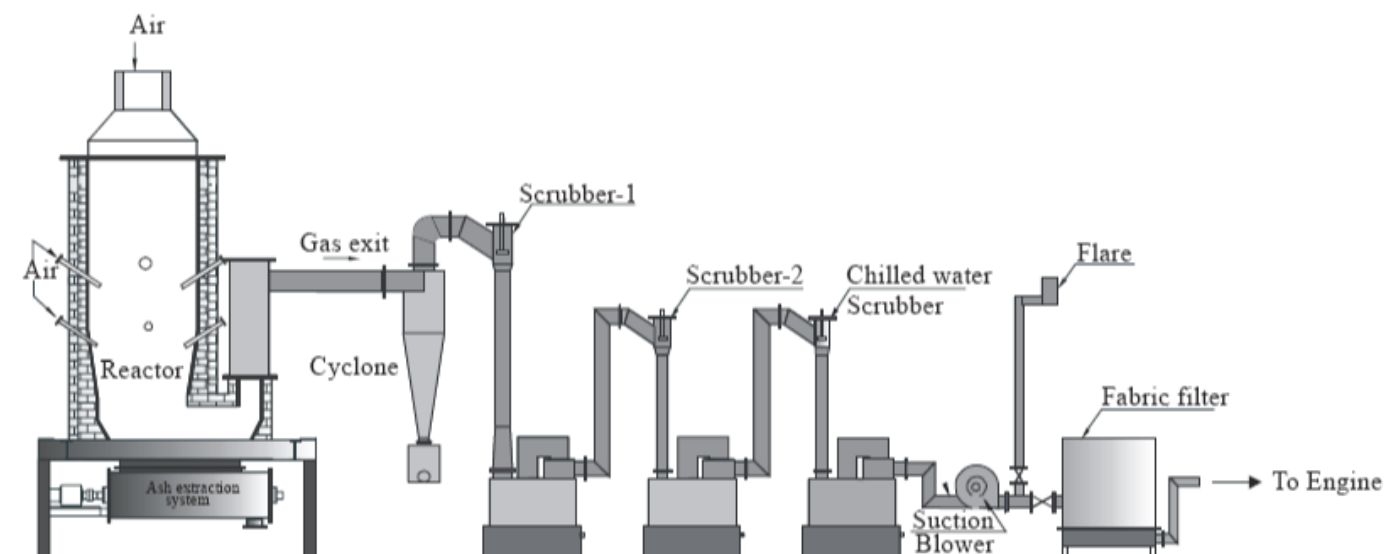
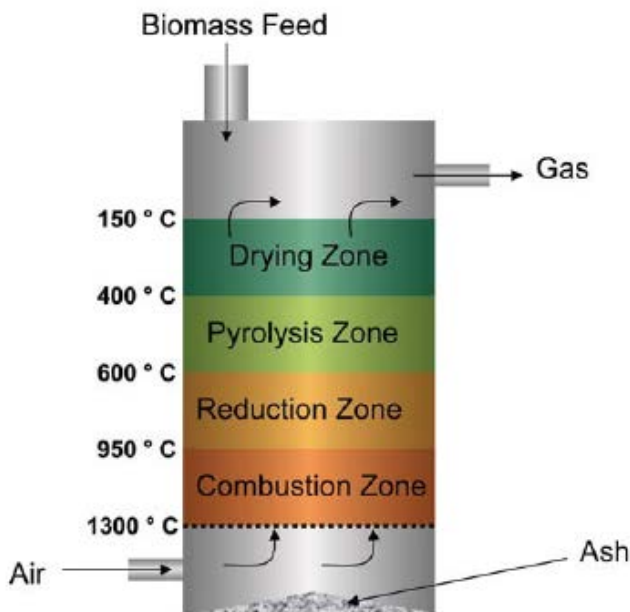
- Biomass or coal gasification /pyrolysis
- Waste to Energy
- Plasma gasification

#### Steel making

- Blast furnace
- Converter
- Coking
- Direct iron ore smelting reduction processes
- Heat treatment

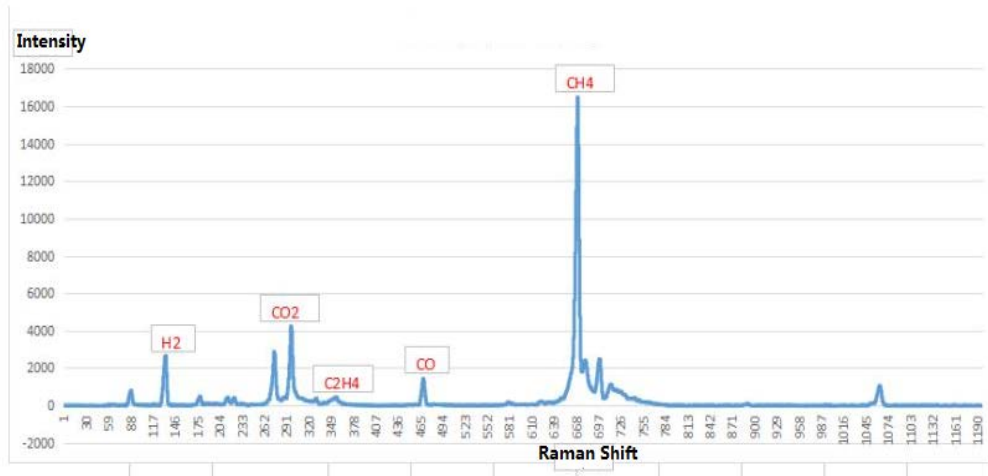
#### Chemical conversion:

- Hydrogen,
- Methanol,
- Ammonia
- and other chemicals



### Typical composition of syngas

	CO	CO <sub>2</sub>	H <sub>2</sub>	O <sub>2</sub>	CH <sub>4</sub>	C <sub>2</sub> H <sub>2</sub>	C <sub>2</sub> H <sub>4</sub>	C <sub>2</sub> H <sub>6</sub>
Biomass Gasification	28%	15%	18%	1%	12%	<0.5%	<1%	2%
Coal Gasification	30%	6%	48%	0.2%	<1%	<1%	<1%	<1%
MSW gasification	19.8%	13.2%	14.7%	0	16.4%	3%	5.4%	1.2%



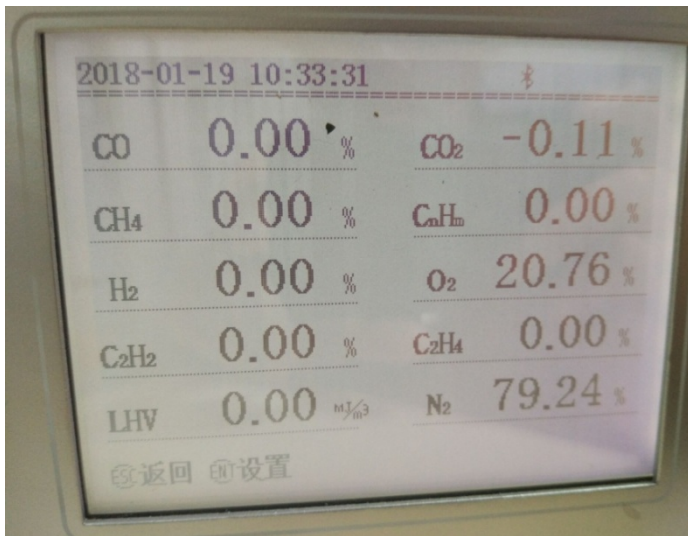
### Importance to measure C<sub>2</sub>H<sub>2</sub> and C<sub>2</sub>H<sub>4</sub>

- C<sub>2</sub>H<sub>2</sub> and C<sub>2</sub>H<sub>4</sub> has great interference on H<sub>2</sub> measurement.
- CnHm sensor has no response to C<sub>2</sub>H<sub>2</sub> and C<sub>2</sub>H<sub>4</sub>.
- C<sub>2</sub>H<sub>2</sub> and C<sub>2</sub>H<sub>4</sub> content has higher contribution to total calorific value than H<sub>2</sub> and CO.
- In MSW gasification and pyrolysis application, C<sub>2</sub>H<sub>2</sub> and C<sub>2</sub>H<sub>4</sub> content are much higher than CnHm content.



### Challenges in syngas analysis

- Cross-sensitivity between CO and CO<sub>2</sub>.
- Cross-sensitivity between CH<sub>4</sub> and other hydrocarbon gases like C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>6</sub> and so on.
- H<sub>2</sub> measurement in complicated background gases.

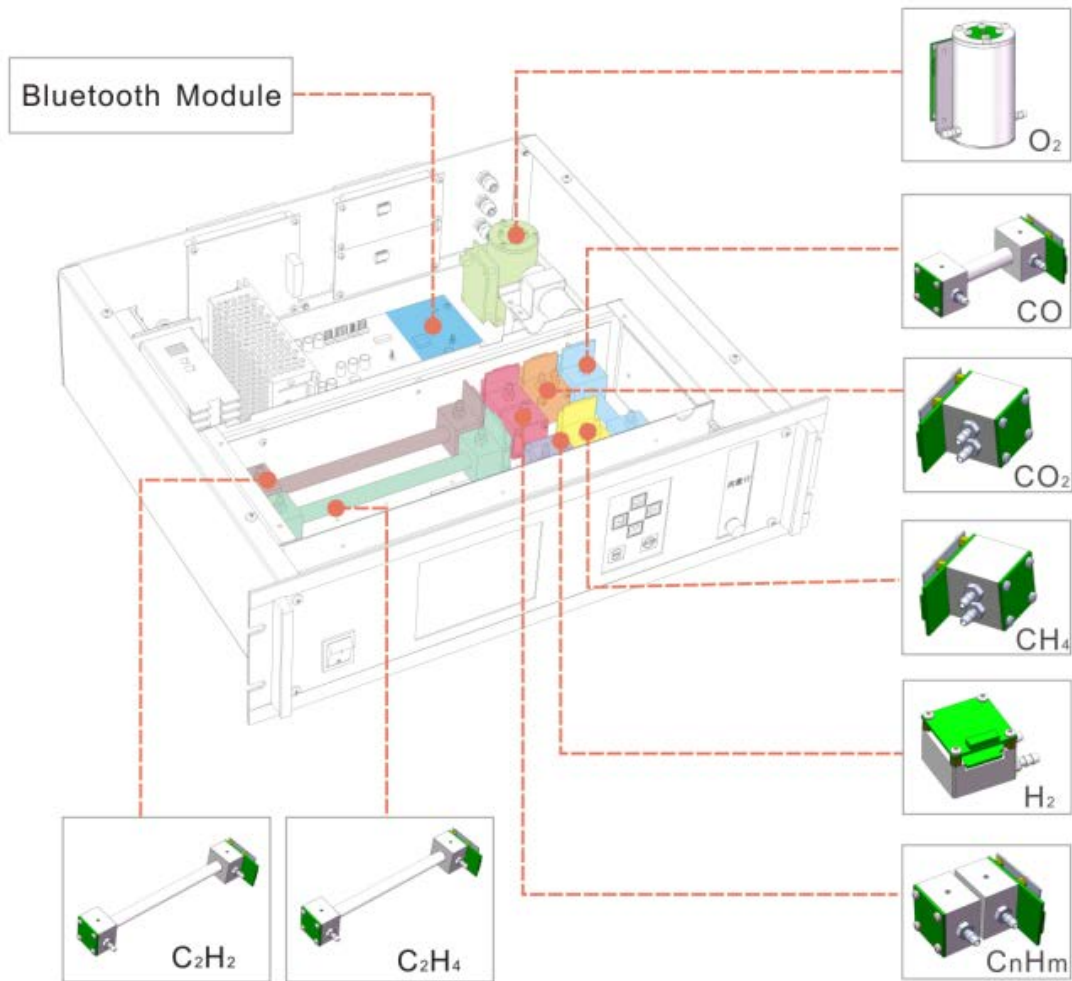


### Unique Advantages

- Full gas composition reading in one device.
- Online real time reading without consumable materials.
- Modular designed gas sensors for easy maintenance.
- Bluetooth communication for remote diagnosis.
- Constant gas bench temperature control for best accuracy.
- Self-manufactured gas sensor bench to reach most reliable quality control and competitive price system.
- Patented technology for unique syngas measurement.
- Independent running gas sensors for each gas component.
- Full range measurement from 0-100%



## Modular Design & Smart Communication



### Modular Design

- Every sensor can be replaced onsite, without factory return maintenance and re-calibration.

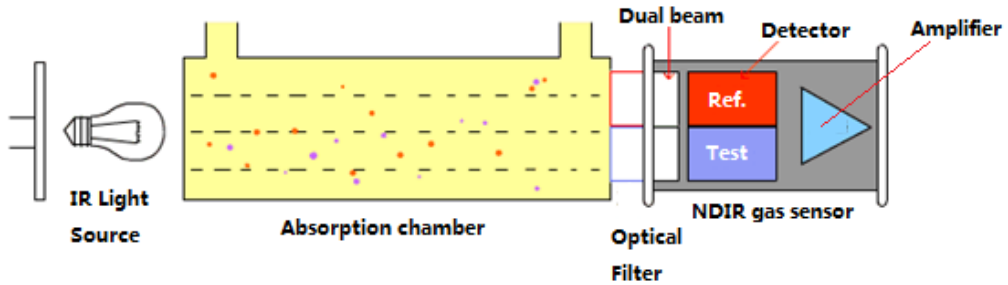
### Bluetooth communication and remote diagnosis

- Bluetooth module and Smartphone APP software for remote control, data download, and remote online diagnosis functions.

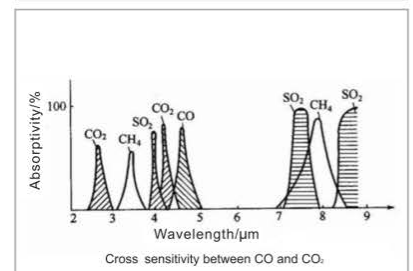
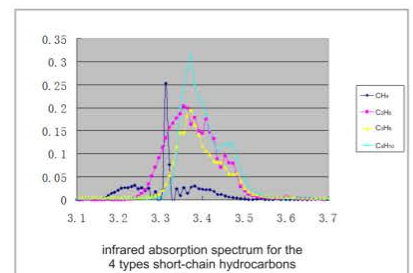




## Technical Strength



- International patented NDIR and TCD gas analysis technology.
- Measure CO, CO<sub>2</sub>, CH<sub>4</sub>, H<sub>2</sub>, O<sub>2</sub>, CnHm, C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>4</sub> simultaneously in one unit.
- Precise CH<sub>4</sub> reading without interference from CnHm.
- Precise CO reading in high concentration CO<sub>2</sub>.
- Patented Thermal Conductivity Detecting technology for H<sub>2</sub>, with linear correction for all background gases.
- No effect from flow fluctuation on H<sub>2</sub> reading.
- Online Heating Value calculation in real time.





## Portable Syngas Analyzer Gasboard-3100P



**$\text{CO}\% + \text{CO}_2\% + \text{CH}_4\% + \text{C}_n\text{H}_m\% +$   
 $\text{C}_2\text{H}_2\% + \text{C}_2\text{H}_4\% + \text{H}_2\% + \text{O}_2\%$**

- Modular sensor design.
- Bluetooth module and mobile phone APP for remote diagnosis.
- Constant gas bench temperature control.
- Auto-Zeroing with air.
- In-built gas sampling pump.
- Rechargeable Li-ion battery.
- Data logging software for data output and monitoring on computer.



## Online Syngas Analyzer Gasboard-3100

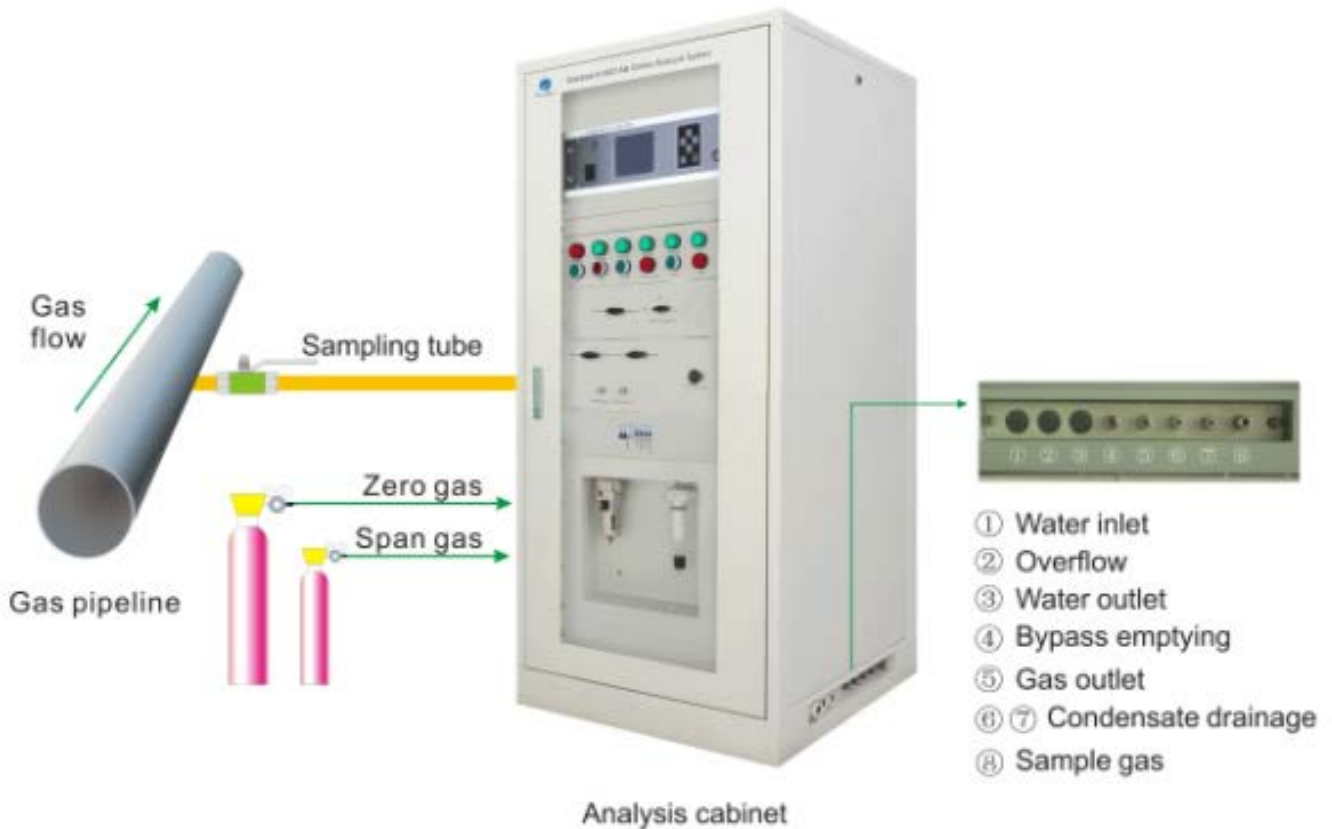


**$\text{CO}\% + \text{CO}_2\% + \text{CH}_4\% + \text{C}_n\text{H}_m\% +$   
 $\text{C}_2\text{H}_2\% + \text{C}_2\text{H}_4\% + \text{H}_2\% + \text{O}_2\%$**

- Modular sensor design.
- Bluetooth module and mobile phone APP for remote diagnosis.
- Standard 19" 3U industrial enclosure design.
- Constant gas bench temperature control.
- Auto-Zeroing with air.
- RS232 digital output and 4-20mA analog output.



## Syngas Monitoring System Gasboard-9021



## Applications

**Producer gas:** CO, CO<sub>2</sub>, H<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub>, CH<sub>4</sub>, C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>6</sub>, C<sub>3</sub>H<sub>8</sub>, H<sub>2</sub>S ...

**Coal gas:** CH<sub>4</sub>, C<sub>2</sub>H<sub>6</sub>, C<sub>3</sub>H<sub>8</sub>, iC<sub>4</sub>, nC<sub>4</sub>, CO, CO<sub>2</sub>, H<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>S, H<sub>2</sub>O ...

**Synthetic Ammonia/Carbamide:** CO, CO<sub>2</sub>, H<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub>, CH<sub>4</sub>, NH<sub>3</sub>...

**Coal to Gasoline/Methanol/DME/Ethylen Glycol...**



## Parameters



Measurement Time	1-300S (adjustable)
Measurement Range	0-100% (Macro Components, adjustable) 0-5000ppm (Micro Components, adjustable)
Accuracy	1% FS (Full Scale)
Resolution	0.01% (Macro Components) 1ppm (Micro Components)

## Features

- High precision with Laser Raman gas characteristics fingerprint technology.
- Full function to measure all the main components in synthesis gas in one instrument.
- Can online measure multi-components gas, including H<sub>2</sub>S, in real time.
- Wide detection range from 0.01 -100%, for full-range gas concentration measurement.
- Quick response, directly show all the composition after sample gas enter into analyzer.
- Low operation & maintenance cost, no carrier gas, no consumables.

	GASBOARD Syngas Analyzer	Micro-GC-FID	Laser Raman
Measured gases	CO, CO <sub>2</sub> , H <sub>2</sub> , O <sub>2</sub> , CH <sub>4</sub> , C <sub>n</sub> H <sub>m</sub> , C <sub>2</sub> H <sub>2</sub> , C <sub>2</sub> H <sub>4</sub>	CO, CO <sub>2</sub> , CH <sub>4</sub> , C <sub>n</sub> H <sub>m</sub> , H <sub>2</sub> , O <sub>2</sub> , N <sub>2</sub> , Up to C <sub>12</sub> if FID detector is heated at $\geq 220^{\circ}\text{C}$	CO, CO <sub>2</sub> , H <sub>2</sub> , N <sub>2</sub> , O <sub>2</sub> , CH <sub>4</sub> , C <sub>2</sub> H <sub>2</sub> , C <sub>2</sub> H <sub>4</sub> , C <sub>2</sub> H <sub>6</sub> , C <sub>3</sub> H <sub>8</sub> , , iC <sub>4</sub> , nC <sub>4</sub> , H <sub>2</sub> S, H <sub>2</sub> O, NH <sub>3</sub> ...
Real time calculation	N <sub>2</sub> , high/low gas calorific value	NO	Yes, can be configured
Measuring technologies	6x NDIR – 1x TCD – 1x ECD	Gas chromatography	Laser Raman Scattering
Real time measurement	YES	NO	YES
Response time (TD+ T90)	NDIR/ECD $\leq 10\text{ sec}$ TCD $\leq 15\text{ sec}$	Measuring cycle generally from 2 to 3 min. (30 to 150 sec for the fastest $\mu$ -GC depending on gas species to measure)	$\leq 15\text{ sec}$
Gas Pre-treatment	Required. A specific syngas washing, filtering and drying unit to be used with the gas analyzer.	Required. Heated gas injection with filtration system for particles and liquids.	Required
Measuring cells protection	Not required	Back-flush system to protect gas separation columns	Not required
Maintenance	Practically none – limited to filter replacement and regular calibration	Regular maintenance is required due to risk of clogging of gas injection system by tars. Regular calibration is also required.	Practically none
Consumables	Gas analyzer: Filter elements Gas washing unit : water, charcoal, filter element	Carrier gas (Ar or N <sub>2</sub> /He mix) Combustion air (synthetic air)	No Consumable parts
Advantages	Good accuracy (generally $\leq 2\%$ FS) ; On-site measurements : excellent portability, compact, autonomous operation (internal batteries, gas sampling pump, data logging function)	Instrument more dedicated for research. Excellent accuracy ( $< 1\%$ FS)	Ideal for real time process monitoring; One equipment for all kind of application Excellent accuracy ( $< 1\%$ FS)
Disadvantages	Can not provide accurate value of hydrocarbon, H <sub>2</sub> O, N <sub>2</sub> and so on	No real time measurement. Low portability (needs gas/air supplies) ; High operation & maintenance cost	Not portable High cost

## Reference List



### Companies

- Ankur Scientific Energy Technologies Pvt., ltd, India
- ALL Power Labs, USA
- GUASCOR POWER, Spain
- Bio-Gen Ltd, Corp., Dominica
- ArcelorMittal Brasil SA, Brazil
- Aust. Dynamic Technologies, Australia
- Piramoon System Qeshm Inc., Iran
- Monro Enerji ltd. Co., Turkey
- PT Teknologi Energi Terpadu
- Kemik Corporation, Indonesia

### Research Institutes

- Radhe Renewable Energy Development Pvt. Ltd., India
- Mongolian Academy of Sciences, Mongolia
- National Metal and Materials Technology Center (MTEC) , Thailand
- CGPL at the Indian Institute of Science (IISc), India
- National Research Institute for Chemical Technology, Singapore
- Masdar Institute, UAE
- Institute of microbiology, Bulgarian Academy of Sciences, Bulgaria
- Universidad Nacional de Colombia, Colombia



## Projects



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