

**ASIA PACIFIC ECONOMIC COOPERATION (APEC)
Workshop on Small Hydro and Renewable Grid Integration**

**Current status and development for grid
integration of small scale RE electricity in China**

**Mr. Lin WAN
Ha Noi, Viet Nam, April, 2013**

Content



1. China's Renewable Energy Development
2. Opportunity & Challenge
3. Cooperation Proposal



Power Source Structure in China, 2011



2011年电力装机和发电量 Power Source Structure in 2011

类型 Type	装机容量 (GW) Capacity		发电量 (TWh) Generation	
	容量	比例	发电量	比例
	(GW)	(%)	(TWh)	(%)
煤电 Coal	765.46	72.5	3897.5	82.54
水电 Hydro	230.51	21.83	662.6	14.03
核电等 Nuclear etc	15.65	1.48	87.4	1.85
风电 Wind	42	3.98	73.2	1.55
光伏 PV	2.14	0.2	1	0.02
合计 Total	1055.76	100.00	4721.7	100.0

Power Source Structure in China, 2020



2020年电力装机和发电量 Power Structure by 2020

类型 Type	装机容量 Capacity (GW)		发电量 Generation (TWh)	
	容量	比例	发电量	比例
	(GW)	(%)	(TWh)	(%)
煤电 Coal	1170	60.47	6100	72.27
水电 Hydro	360	18.6	1200	14.22
核电等 Nuclear etc	130	6.71	590	6.99
风电 Wind	180	9.3	360	4.27
太阳能 PV	50.00	2.58	75	0.89
其它 Others	45	2.33	115	1.36
合计 Total	1935	100	8440	100

Government Sponsored PV Projects



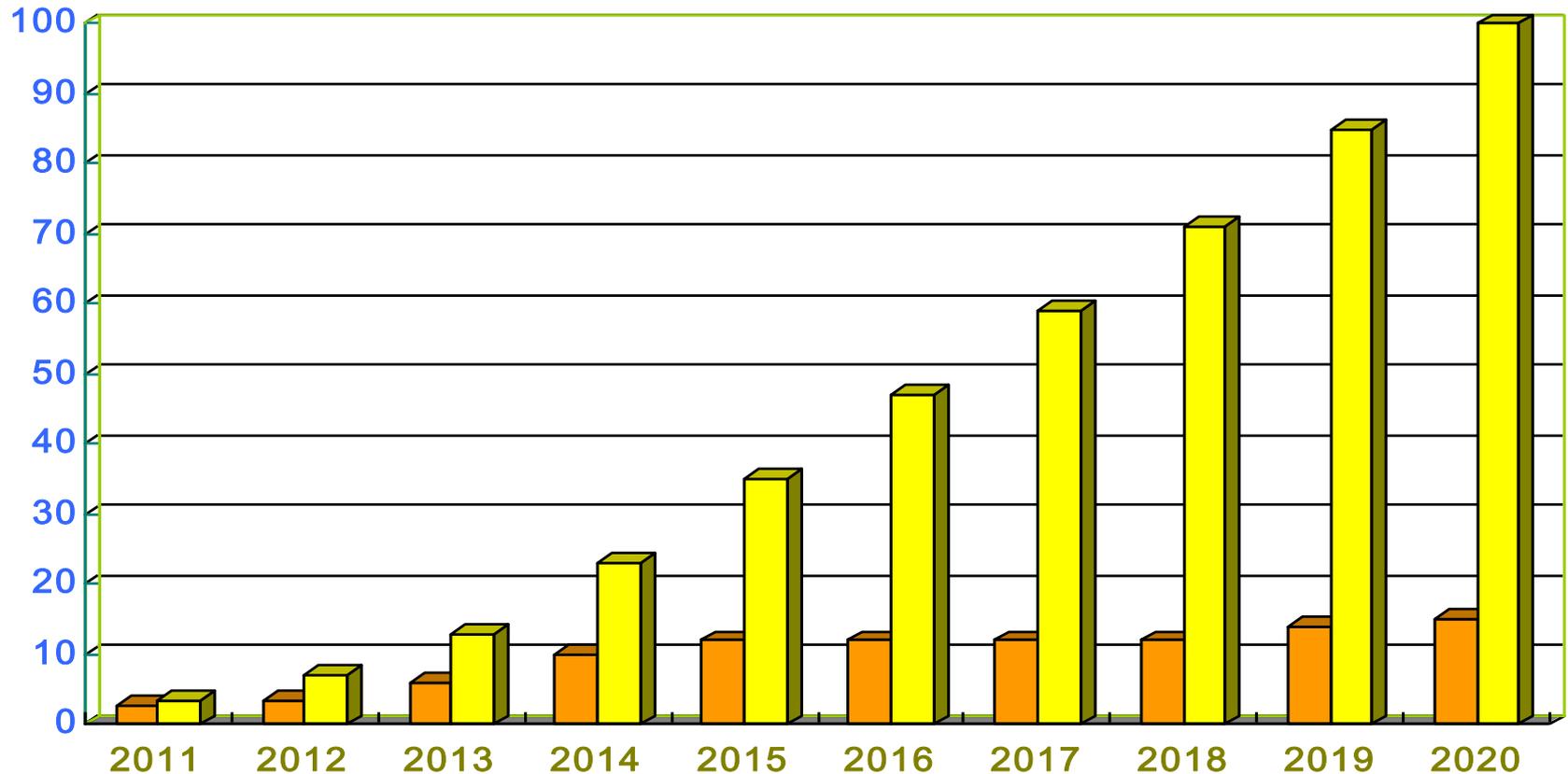
Large Scale PV		
Phases	Approved Capacity	Feed-in Tariff
2011 FIT	2000MW	FIT = 1.15 元/kWh
2012 FIT	2000MW	FIT = 1.0 元/kWh
Total (2009 - 2012)	4300MW	800MW waiting for grid connection
Financial Source	Renewable Energy Surcharge	
PV Building Project		
Phases	Approved Capacity	Subsidy to Capital (Yuan/W)
3rd phase, 2011	106 projects, 120MW	BIPV 12元/W
4th phase, 2012	250MW	BIPV 9, BAPV 7.5
Total (2009 - 2012)	500MW	
Financial Source	Special Fund for Renewable Energy	
Gonden Sun Demonstration		
Phases	Approved Capacity	Subsidy to Capital (Yuan/W)
3rd Phase 2011	140 projects, 690MW	C-Si 9.0, a-Si 8.5
4th Phase 2012	167 projects, 1709MW	PV Building 5.5, off-grid >7.0
Total (2009 - 2012)	2870MW	
Financial Source	Special Fund for Renewable Energy	
Additional PV Building Project and Golden-Sun Demonstration		
Nov. 2012	2830MW	BIPV 7, BAPV 5.5
Financial Source	Special Fund for Renewable Energy	
Total Installed and Approved PV by the end of 2012 is 10500MW		

Government Target for Solar



Targets for Cumulative Installation of Solar Power (GW)				
Market Sectors		2012	2015	2020
Distributed PV	Rural Electrification	0.102	3.0	10.0
	Communication and Industry	0.058	1.0	4.0
	PV Buildings	2.390	14.0	40.0
LS-PV and Others	PV products	0.058	1.0	4.0
	Large Scale PV (LS-PV)	4.392	15.0	40.0
	Solar Thermal Power (CSP)	0.000	1.0	2.0
Total		7.0	35.0	100.0
Share of Distributed PV (%)		36.4	51.4	54.0

Solar Target and Progress Forecast



Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Annual Inst.(GW)	2.7	3.5	6.0	10.0	12.0	12.0	12.0	12.0	14.0	15.0
Cumul. Inst. (GW)	3.5	7.0	13.0	23.0	35.0	47.0	59.0	71.0	85.0	100.0

R&D Progress in PV



R&D at both Laboratory level and Industry Level						
Poly-Silicon Industry Level			BOS and PV Systems			
Hydrogen Reduction	60kWh/kg		Inverters	Total Capacity	3GW/Year	
Total Power Consumption	120kWh/kg			Types	off-grid, centralized, string inverter, micro-inverter	
By-products Recycling	100%			Power Range	100W - 1MW	
Capacity/Factory	1000 - 60000 Ton/Year		Energy Storage	Lead-Acid	Industrialized	
Total Capacity	100000 Ton/Year			Lithium Battery	Industrialized	
Cost	\$15-20USD/kg			Vanadium Redox Battery	Industrialized	
Efficiency of Solar Cells				Na-S Battery	No	
PV Cells	Laboratory (%)	Industry (%)		Flywheel	No	
Mono-Si	20.40	19.0		Super-Capacitor	Industrialized	
Poly-Si	18.00	17.0		Pumped Storage	Industrialized	
D-Junction a-Si	9.20	8.0		Compressed Air Storage	No	
u-Si/a-Si M-Junction	11.80	10.0		PV Systems	Off-grid PV	Mature
GaAs	29.25	No			LS-PV	Mature
CIGS	14.30	12.0	PV Buildings		Mature	
CdTe	13.38	11.0	Sun Trackers		Mature	
DSC	7.40	No	Micro-Grid		Demonstration	
HIT	17.27	No	PV Products		Mature	
Back-Contact	No	No	Monitoring Sys.		Mature	

PV Module Production in China (2011,2012)



No.	Company	2011	2012
1	Yingli Green Energy	1603	2100
2	Canadian Solar	1323	1900
3	SunTech Power	2090	1800
4	Trina Solar	1510	1800
5	Tianwei New Energy	900	1000
6	Hanwha SolarOne	844	1000
7	Jinko Solar	760	900
8	JA Solar	500	900
9	Hareon Solar	428	800
10	LDK Solar	600	750
11	Others	10422	10050
	Total	21000	23000

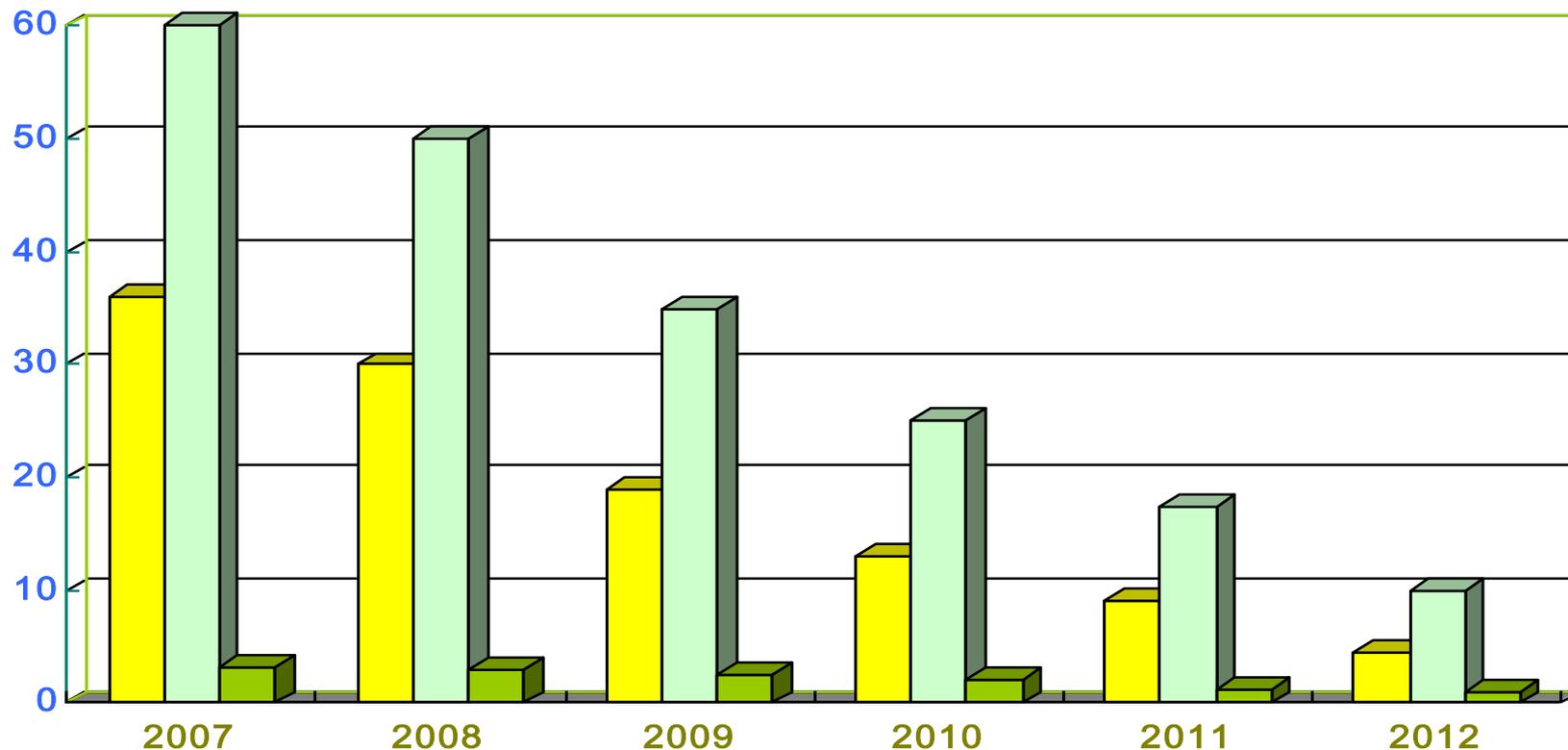
Domestic PV Installation by Sectors 2012



2012 Domestic PV Market by Sectors

No.	Market Sector	Annu.Ins.	Share	Cumm. Ins.	Share
		(MWp)	(%)	(MWp)	(%)
1	Rural Electrification	20	0.57	102.5	1.5
2	Comm.& Indus.	10	0.29	58.0	0.8
3	PV Products	10	0.29	57.5	0.8
4	Building PV	1460	41.71	2390.0	34.1
5	Ground Mounted LS-PV	2000	57.14	4392.0	62.7
	Total	3500	100.00	7000.0	100.0

Price Reduction of PV During Last 6 Years



Year	2007	2008	2009	2010	2011	2012
Cumulative Installation (GWp)	0.10	0.14	0.30	0.80	3.30	7.00
Module Price (Yuan/Wp)	36.0	30.0	19.0	13.0	9.0	4.5
System Price (Yuan/Wp)	60.0	50.0	35.0	25.0	17.5	10.0
Reasonable Tariff of PV (Yuan/kWh)	3.20	3.00	2.50	2.00	1.15	1.00

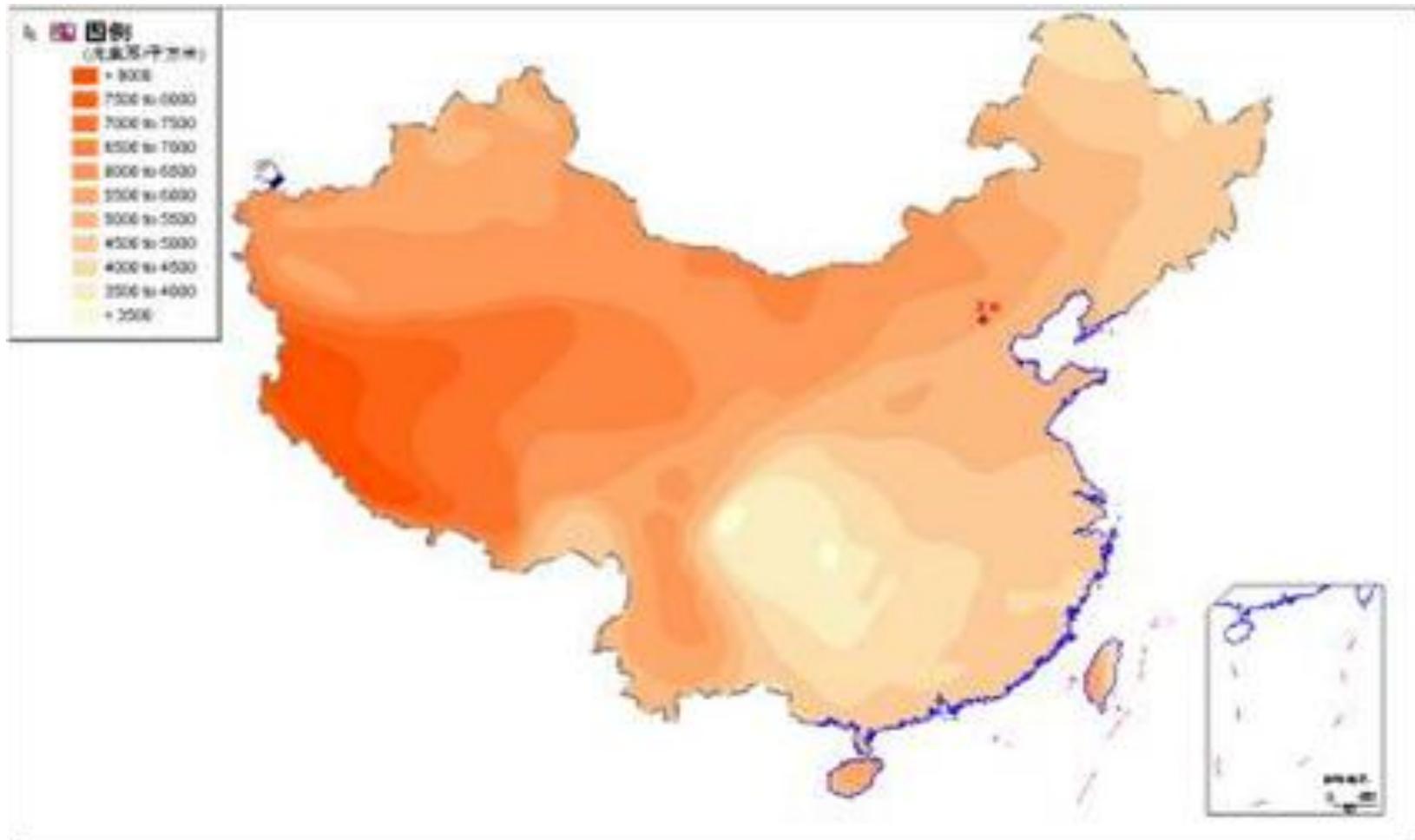
Hydro Power in China



Wind Power in China



Solar Resources in China



First Wave of RE Development



- Pushed by global fiscal subsidy and support
- Leading role: Manufacture, especially PV Module
- Main character and achievement
 - Large Scale
 - Lower Cost
 - Fast Speed



Second Wave of RE



- Pushed by: Grid Parity
- Leading Role: System Solution provider, Developer
- Five Characters
 - Innovation of Application
 - Quality & Risk Management, Evaluation System
 - Insurance: Yield Index & Revenue Insurance
 - Investment: Professional, Long-term Investor
 - Second hand market and Quit Scheme



Third Wave of RE



- Pushed by: urbanization
- 100 Low Carbon Model Town
- Risk of Carbon Tsunami, Global Carbon Taxation could bring the third wave of PV development



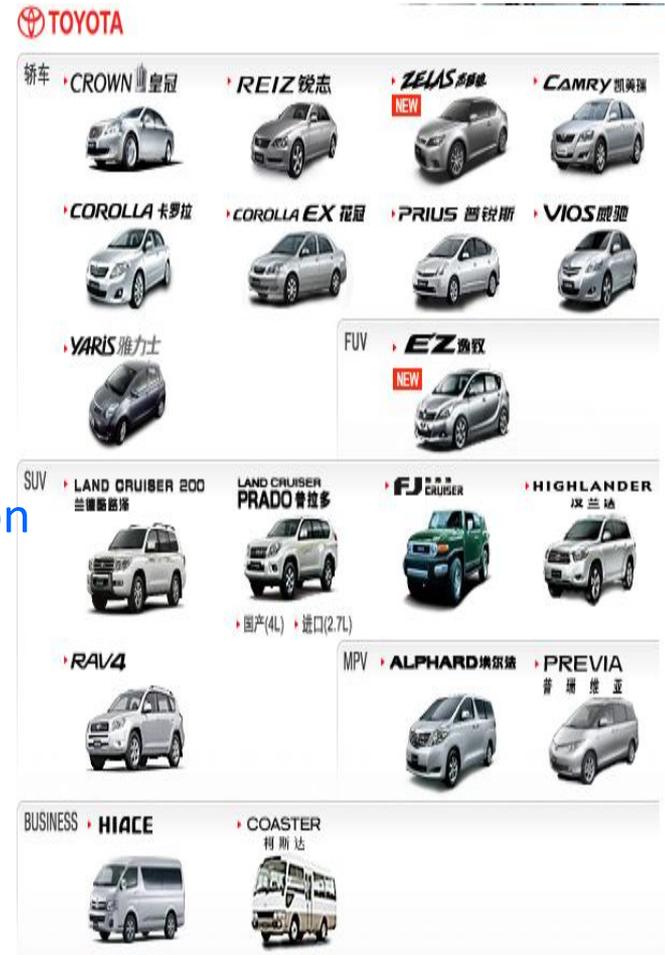
Risk & Casualty



Learn from other Industry



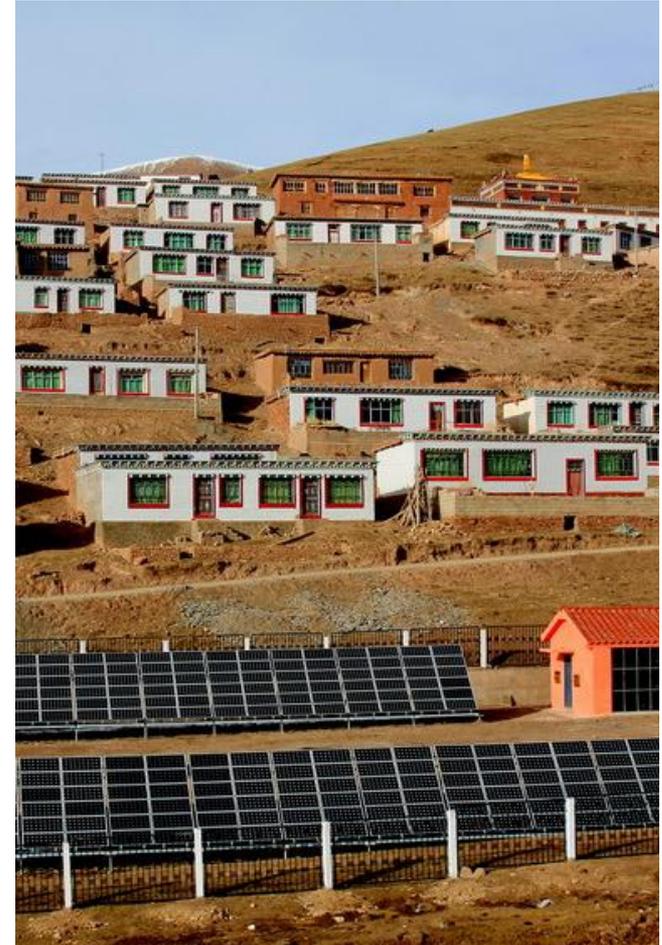
- Who shall we learn from
 - Real Estate
 - Automobile
 - Clean Development Mechanism
- What shall we learn
 - Mature Industry & Mature Market
 - Risk Management, Technology & Innovation
 - Financing, Insurance, Marketing & Service



3. Cooperation Proposal



1. Roadmap
2. Model
3. Tool Kits
4. How to expand LCMT



3.1 Roadmap



- Goal: sustainable development
- Possible choices: what kind of technology, solution can we use
- Learn from other Industry
- Who shall we learn from
 - Real Estate
 - Automobile
 - Clean Development Mechanism
- What shall we learn
 - Mature Industry & Mature Market
 - Risk Management, Technology & Innovation
 - Financing, Insurance, Marketing & Service



3.2 New Model: RE Real Estate?



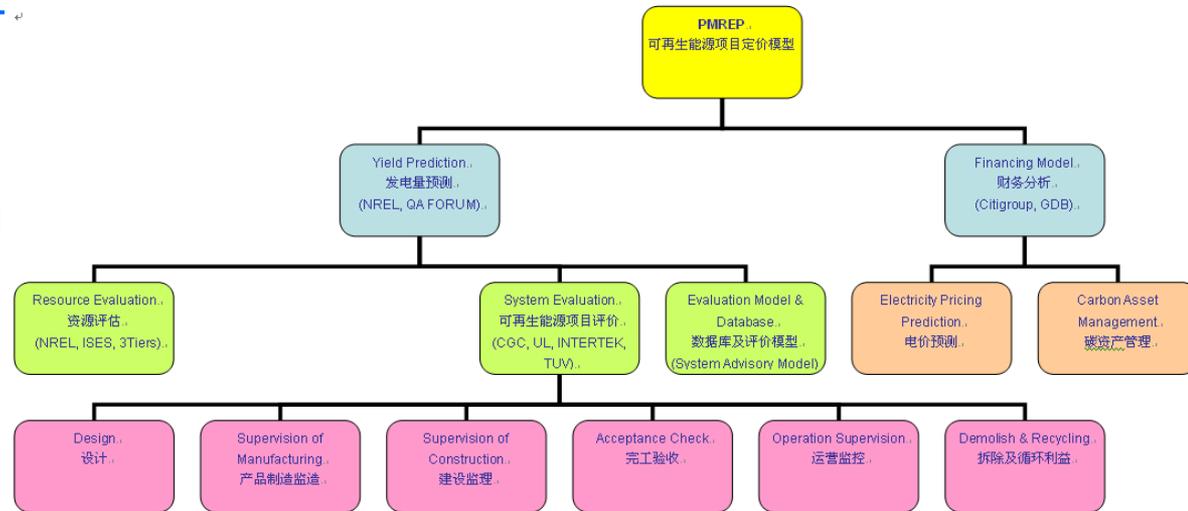
- Business & Financing Model
- Low Carbon Model Town (LCMT)
- Industrial Real Estate Developer
 - Industry, Agriculture, Others
 - More support & Subsidy
 - Towards RE Community, City
 - Hainan Pilot Project
 - Example from Dalian
- LSPV
- Residential



3.2 Price-setting Model



- Electricity Price
- Power Consumption
- Grid Connection & Transmission Cost
- Stakeholders' credit
- Liquidity & Bankability
- Carbon Asset Value & Financing Cost
- Net Cash Flow & Reasonable Price



3.3 Tool Kits



1. Due diligence
2. Resource evaluation
3. Design evaluation
4. Equipment manufacturing supervision
5. Construction supervision
6. Complete acceptance check
7. Operation & maintenance
8. Ex-post evaluation
9. Life cycle yield prediction
10. Financing and insurance related service



3.4 How to expand LCMT



- Pilot Project: New District of Turpan
- “Local unique clean energy and suitable ecological technology will be used in New District of Turpan, which will become a distinctive, residential, and harmonious ecological demonstration urban.”
——Planning of New District of Turpan(2009-2020)



太阳能综合利用为核心
Core: Photovoltaic Technology



慢行及公交出行为主导
Predominate: Electric Vehicle



低碳社区
Low Carbon Community

Thank you for your precious time



Mr. Lin WAN

T: 0086 1360 133 0507

E: lwan@vip.sina.com

wanlinuk@gmail.com

- Mr. WAN Lin graduated from Renmin University of China in 1994, majored in Industrial Economics and International Economics.
- He joined China Classification Society, CCS in 1994, having worked as strategy researcher, production inspector, project manager, cooperation department manager, assistant to Chairman of International Association of Classification Society (IACS). He was appointed as the general manager of China Classification Society London branch in 2003.
- In 2005, he acquired the Master degree in MSc Shipping, Trade and Finance at CASS business school, City University, London. He went to the US for Tri-State (New York, New Jersey, Connecticut) Maritime Cluster Research sponsored by the Baltic Exchange scholarship in 2005.
- He joined China General Certification Centre (CGC) as vice president in 2008, in charge of PV, solar thermal business, as well as Strategy & International Cooperation.
- He is CCAA Senior Auditor, member of China's national PV standard committee and IEC, and main contact window in renewable energy cooperation between China and US, EU, AFRICA, APEC, BRICS, Mainland and Taiwan, as well as Co-Chairman of WG Standard, Testing & Certification in China-US RE cooperation, and steering committee member of PV Quality Assurance Forum.