

Development of Solid State Lighting Industry And Standardization in China

China Solid-State Lighting Alliance(CSA)

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Status of China SSL Industry

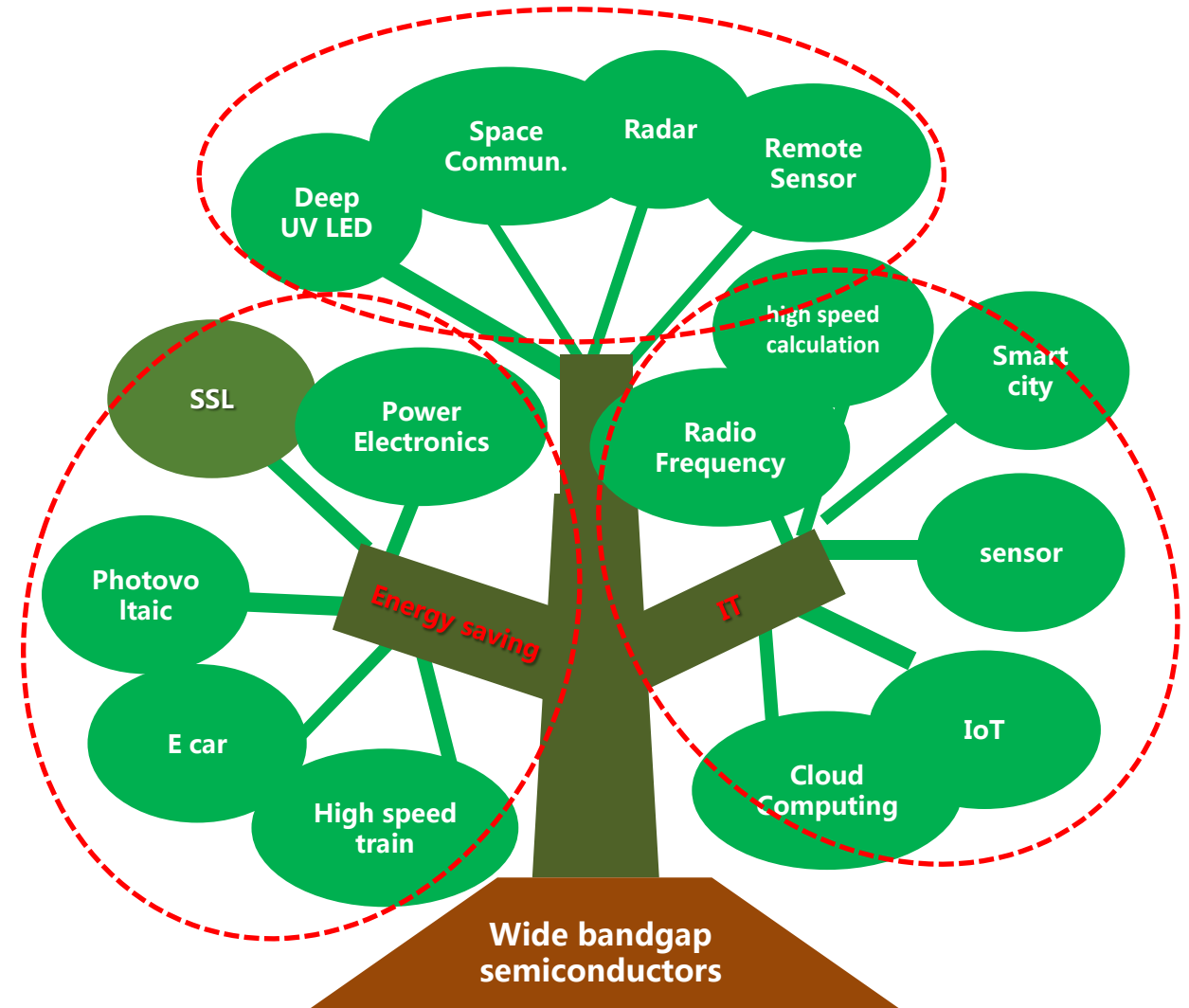
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Standardization of CSA

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The 13th Five Year Plan

- SSL opened the door of joint development of Si and 3rd generation Semiconductors
- The materials (GaN and SiC) and core process are essential for power electronics, communication, ICT, security, etc.



SSL Open the New Era of Next Generation Semiconductor



New Generation
of information
highway

5G Era

Wide-band-gap Semiconductor

Smart home smart
society

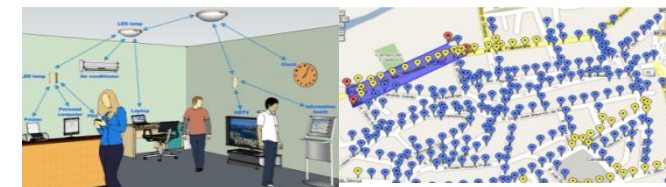
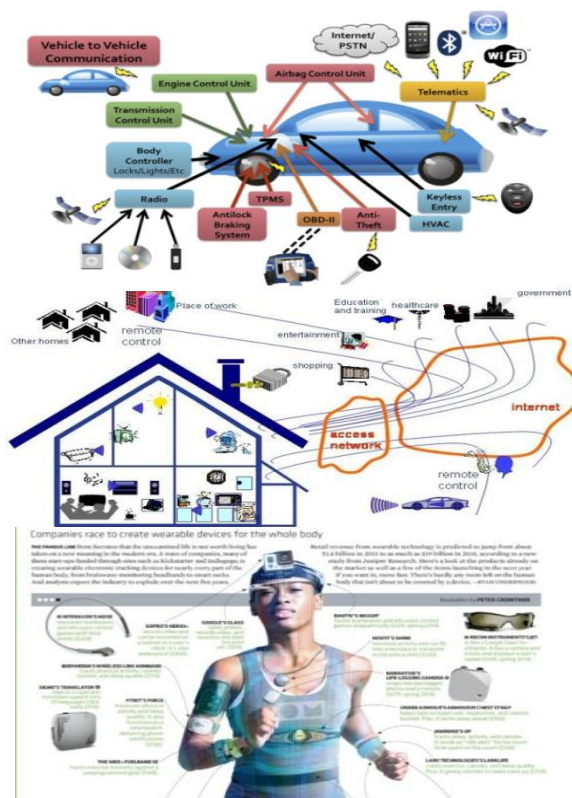
Mobile Internet,
wearable

Small, lightweight

Visible light
communication

Massive optical
storage

On-demand lighting
, Beyond lighting



Position service



Chips light interconnection

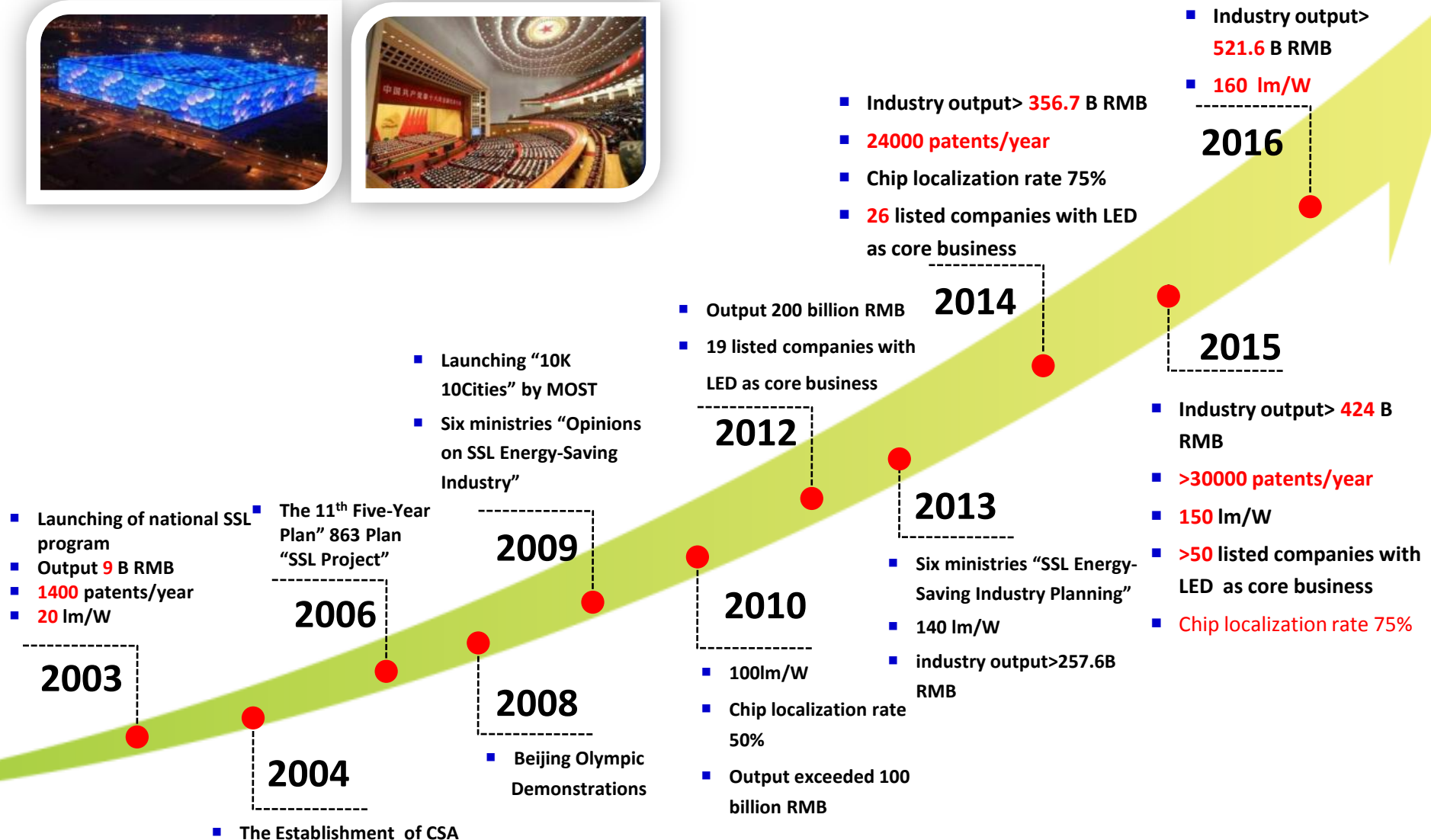


Medical and agricultural applications



High Voltage Transformer

Milestones of China SSL



- **2016, industrial output: RMB 521.6 Billion, GROSP 22.8%; 2015, RMB 424.5 Billion , the past 10 years average annual growth rate exceeded 30%.**

Epi & chip

Output value 18.2 B RMB, growth rate 20%

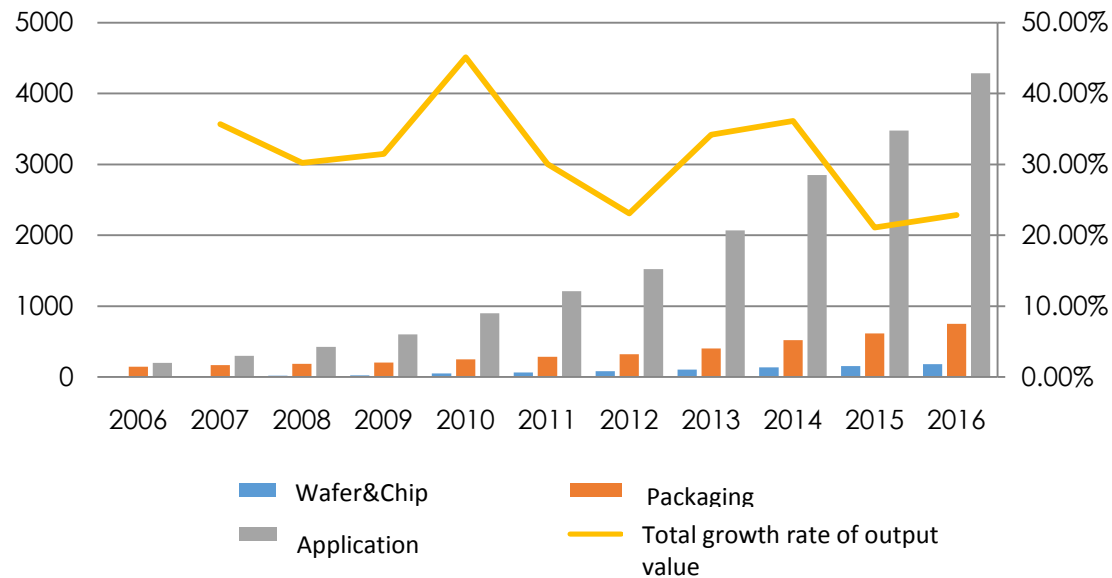
Packaging

Output value 74.8 B RMB, growth rate 21.5%

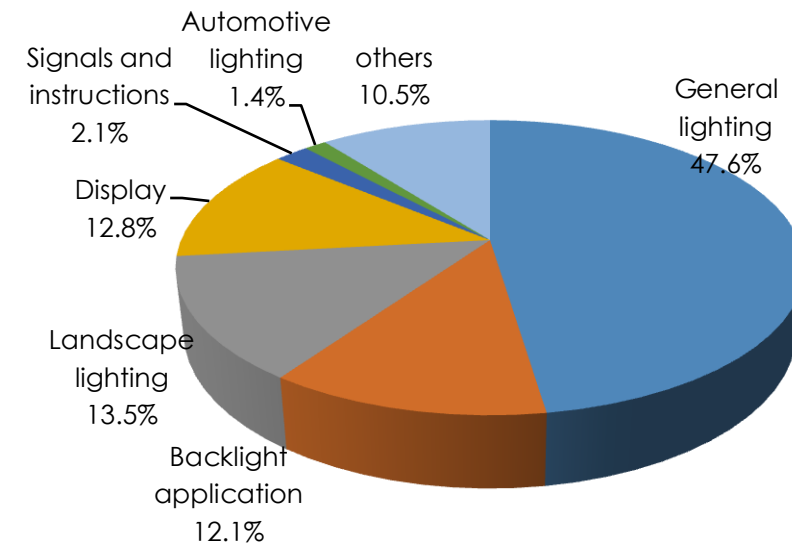
Applications

Output value 428.6 B RMB, growth rate 23%

- **LED general lighting remains the main driving force of the market development**



2006-2016 China SSL Industry Scale with Segments



2016 Application areas of LED products (Output value)

Revenue of listed companies grows rapidly

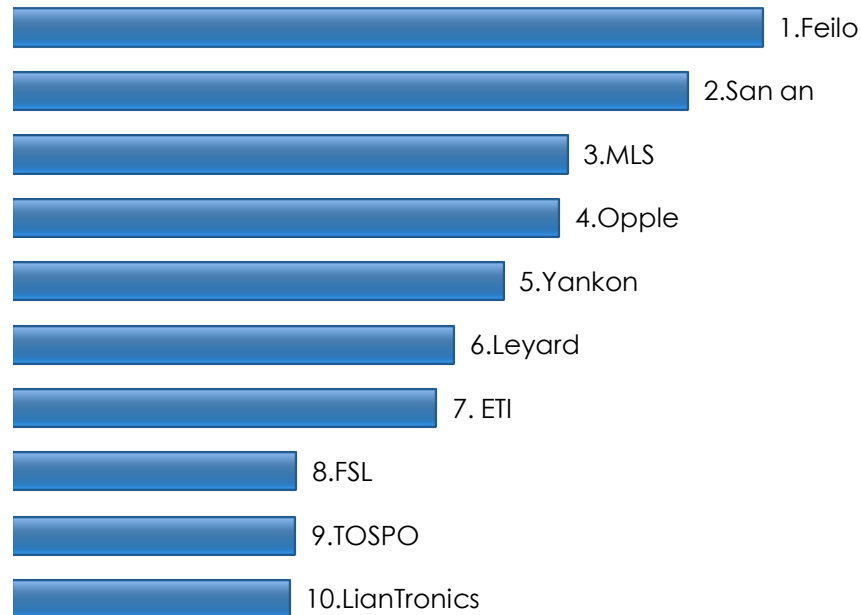


- Market demand of downstream drive chip and packaging prices up
- 2016 Operation revenue of LED listed companies grow by **30%**
 - Operation revenue of 26 listed LED companies: **45.1B RMB**
 - Operation revenue growth rated No.2 in 28 different industries

Operation revenue (10 thousand RMB)				Net Profit(10 thousand RMB)			
NO.	Company	Revenue	Growth	NO.	Company	Profit	Growth
1	Aoto Electronics	15029.38	180.17%	1	CHANGELIGHT	4157.3	7598.90%
2	Mason Technology	46691.92	147.58%	2	HC Semitek	8078.01	681.13%
3	Everfine	10448.43	122.81%	3	Nata	250.41	283.68%
4	HC Semitek	50641.48	110.71%	4	Aoto Electronics	909.82	238.00%
5	LianTronics	70364.86	90.33%	5	Mason Technology	2636.57	217.84%
6	MLS	153580.19	87.36%	6	MLS	13256.89	162.70%
7	San an	198993.49	68.90%	7	Unilumin	4968.88	146.42%
8	JIawei	67787.71	68.30%	8	JIawei	9806.95	111.48%
9	HONGLIZHIHUI	69210.79	57.14%	9	Leyard	17246.92	110.59%
10	RE-FOND	35073.82	52.97%	10	Everfine	2452.06	91.02%

2017 Q1 Operation profit ratio top 10 of LED companies

- Top10 companies average income: **2B RMB**
- Big companies with core competence grow stronger
- Small companies rely on low cost and homogeneity competition struggling to survive

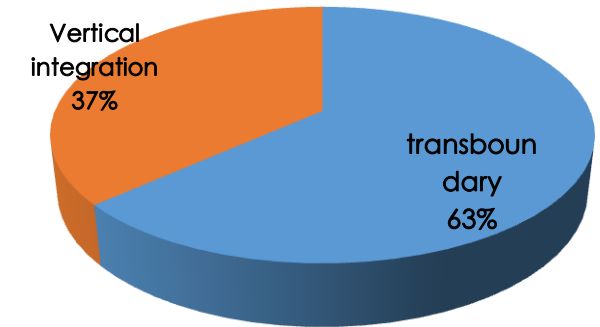


2016 Top10 LED companies in China

Gross profit rate (%)	2013	2014	2015	2016Q3
LED industry	27.8	28.8	27.7	31.9
upstream	28.6	33.7	30.1	25.4
Midstream	26.7	24.7	23.0	23.2
Downstream	22.2	23.5	23.6	26.3
LED display	32.3	35.2	37.4	36.7

Source: CSA Research

- In 2016, **40** major M&As, (worth **>22B** RMB) , covering whole chain & locations
- Break technical and patent barriers through M&A, enlarge scale
- **14 Cross-border M&A** during 2015-2016

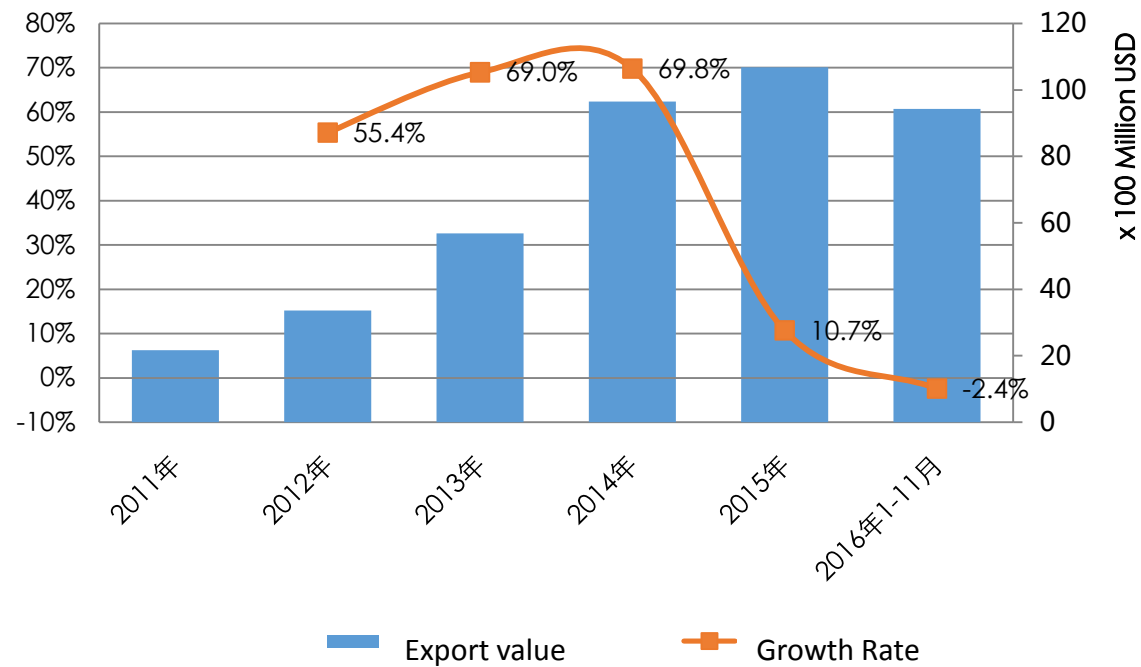


Date	Acquirer	The acquired party	Transaction amount	Transferee equity
2016.1	Feilo videos	Sylvania	1400 million euros	
2016.6	MLS	LEDVANCE	400 million euros	100%

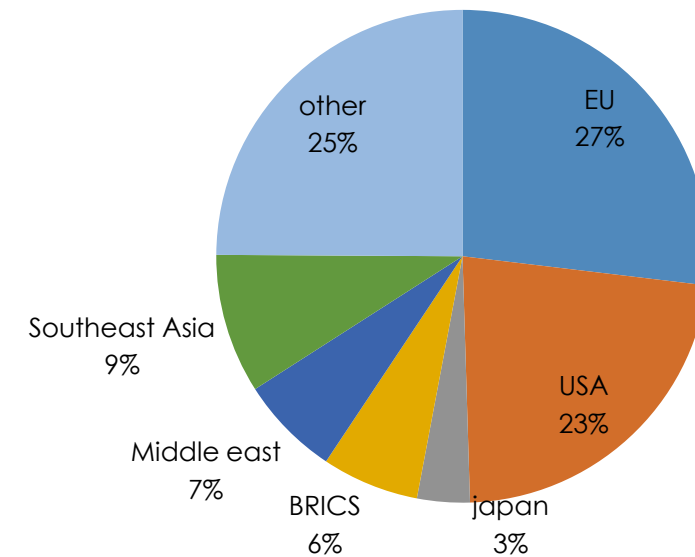
Export growth rate decreases



- In 2016, exports > **USD 10.5 Billion, decrease 2.4%**
- EU and USA are the major export markets
- Market to middle east region grows rate: 27%



2011-2016 Export growth of China LED products



China LED Export Share

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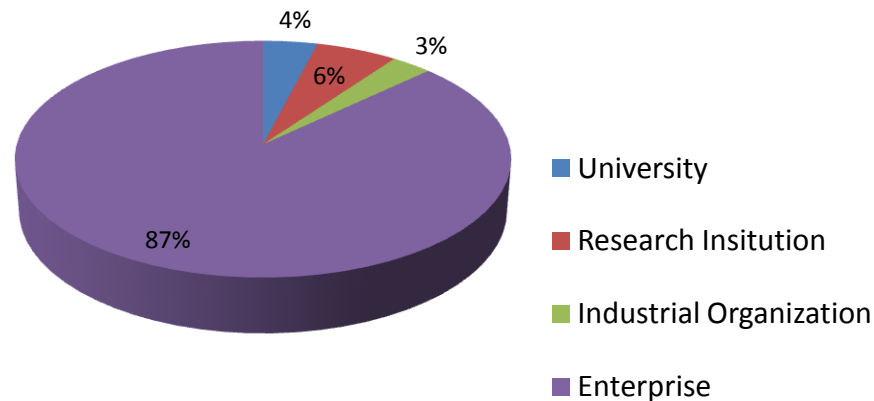
Standardization of CSA

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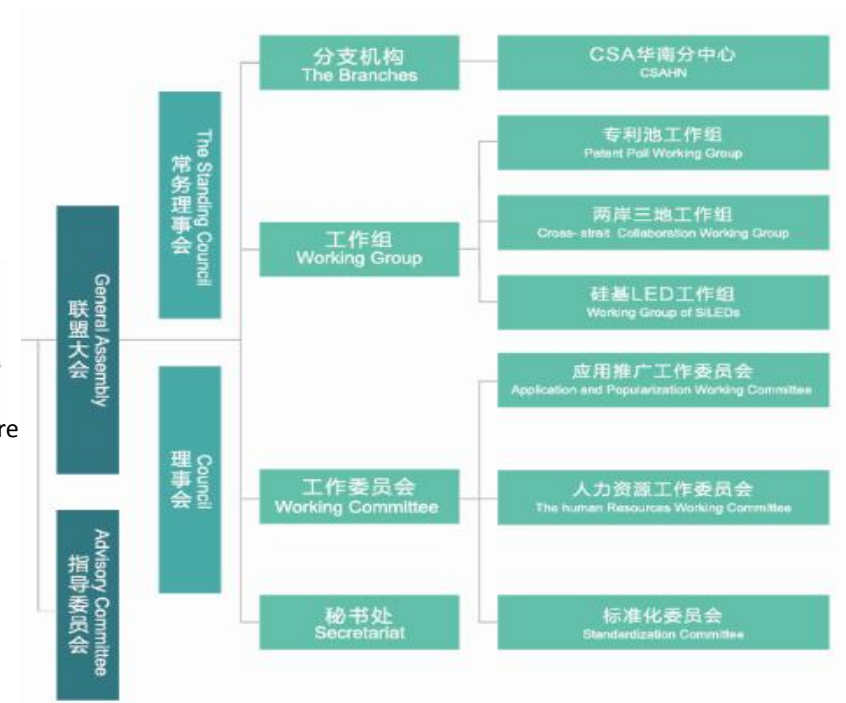
The 13th Five Year Plan

- Established in 2004 ; 2014 Legally Registered in Zhong Guancun
- 578 Members , 87% are Manufactory companies , cover 70% China SSL Output
- 2014 , First batch of Pilot Alliance of S&T service industry Supported by MOST and MOF

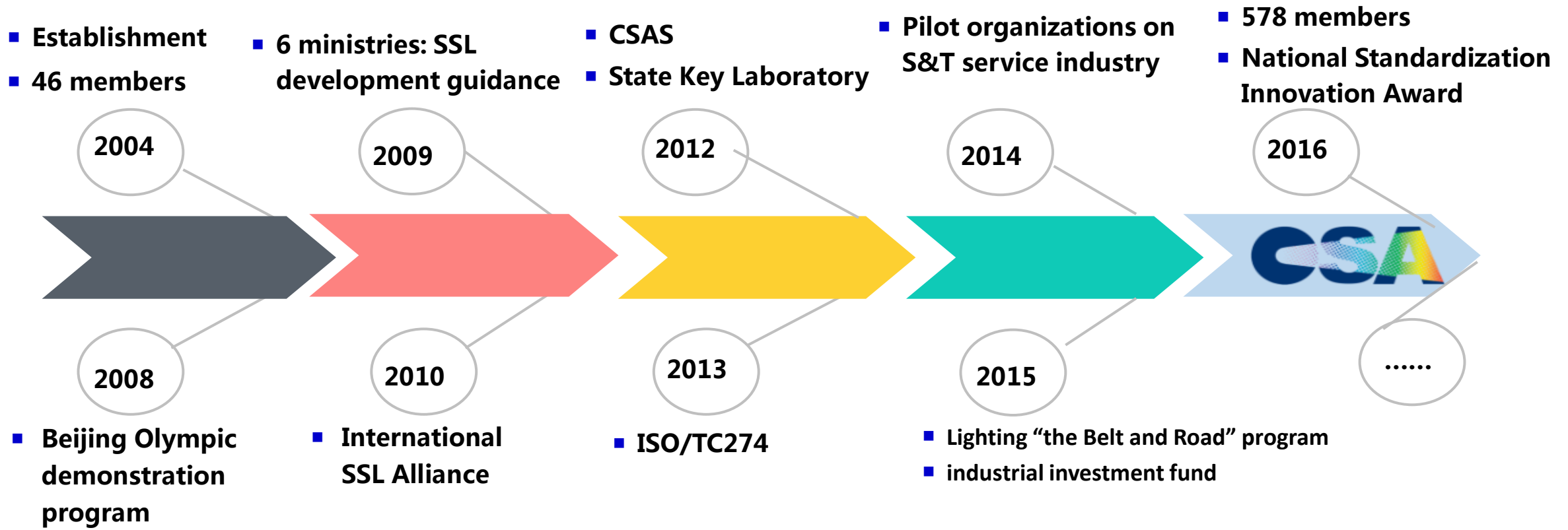
Classification of Members



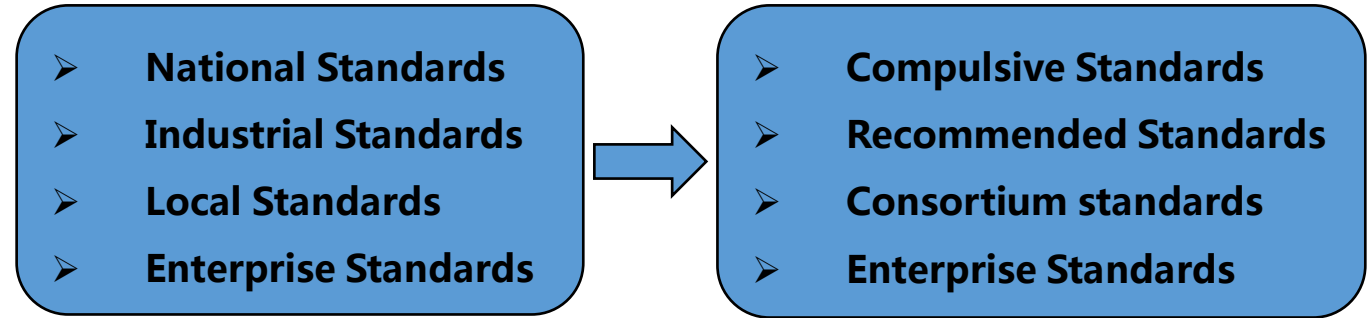
CSA
组织架构
Organization Structure



- Promote the Industry by Technology Innovation, Industry Service and International Cooperation
- Bring S&T innovation to standardization



- **Reform of national standardization**
- **Add Consortium standards to the national standards system**

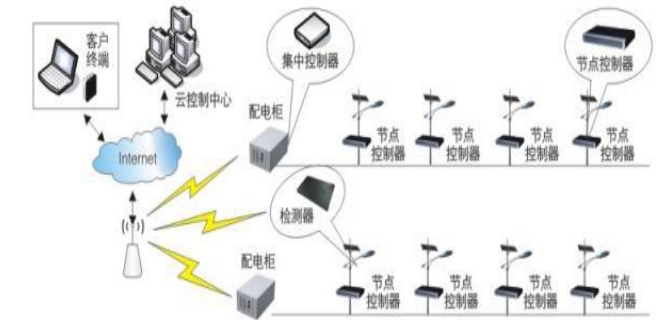


2015.3	The State Council: Reform on National Standardization Works
2015.5	Standardization Administration of China: Recommend pilot organizations on Consortium standards ,CSA is one of the pilot organizations
2015.12	The State Council: Plans on National Standardization Working Systems (2016-2020)
2016.3	Standardization Administration of China, General Administration of Quality Supervision, Inspection and Quarantine of China: Consortium standards development guidance
2016.4	<i>GB/T 20004.1-2016 Consortium standards</i> is published

Demanding for Alliance Standard



- Former standard system :organized by the government
- **Long cycle** for standards development by the government; Small and private enterprises, R&D expenses is insufficient and dispersed
- Alliance standard is part of Consortium standards: **Joint participation** , **Collaborative innovation**
- **Short developing cycle**, rapid response to market, combined relatively and flexibly with intellectual property; As cooperation organizations of industry, university and institute, alliance can exert **innovation capability** with advantages; **Close to the industry**, reflecting the advanced technology, improve international competitiveness
- Technology and standardization trends: normalized products, reliability test and evaluation, intelligent lighting, OLED, etc.

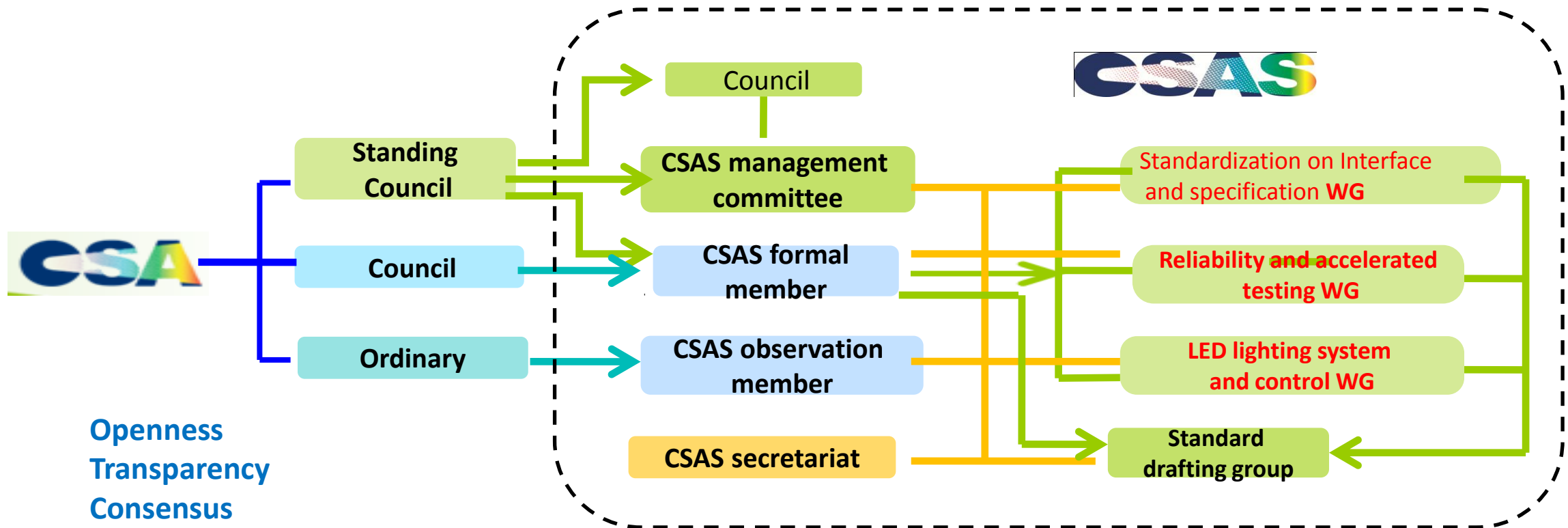


智慧公共照明管理平台组成结构图



- 2007 ,CSA SSL standardization promoting workgroup founded
- 2012, Establishment of CSA Standardization Committee(CSAS) supported by SAC
- 2015, The Sate Council released standardization reform proposal :

cultivate and develop consortium standards



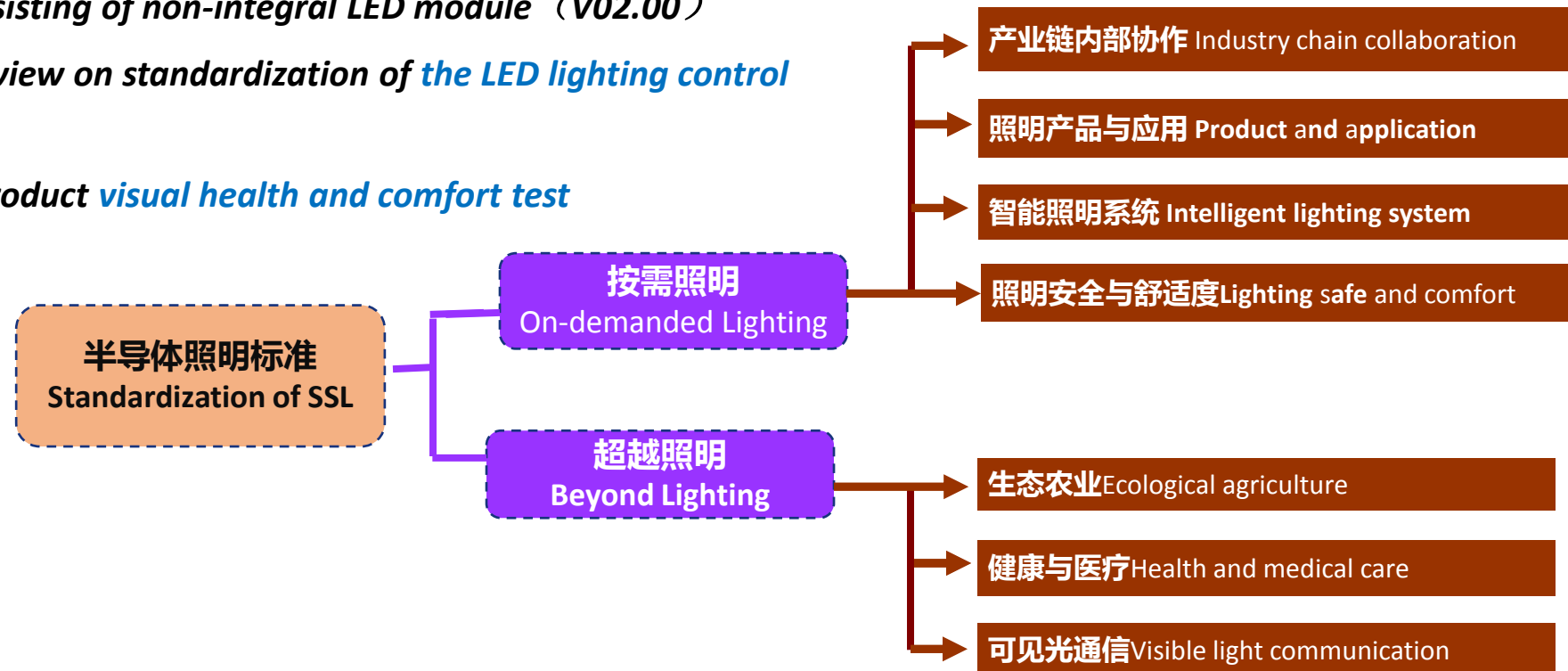
- Promoting Standard, Testing System Construction
 - BY now, **47** National Standards (term definition testing, safety, etc.),**35** Industry Standards
 - **CSAS** :Featuring short cycles, quick market responses and combining with IPRs;
41 Alliance Standards, 10 National Standards, and 5 International Standards
 - Publish quality inspection reports regularly from CSAS



- Launching Product Quality Certification
 - ELI (Efficient Lighting Initiative), focusing on product quality and efficiency
 - In 2014-2015, “TOP-RUNNER” according to CSA standards, cultivating leading brands



- *CSA 041-201X Smart Home Lighting Function Attribute Specification*
- *CSA 040-201X Smart Home Lighting Communication Module Interface Specification*
- *CSA/TR 004-201X Technical report of control protocol for **LED smart home** connected lighting*
- *CSA/TR 003-201X Architecture of smart home lighting system and interconnection technology*
- *CSA 018-2013 Application layer communication protocols for the interface in intelligent public LED lighting systems*
- *CSA 016-2015 Application and interface requirements for LED lighting – Street/tunnel light consisting of non-integral LED module (V02.00)*
- *CSA/TR 001-2014 Overview on standardization of **the LED lighting control system***
- *CSA 035 LED lighting product **visual health and comfort test***



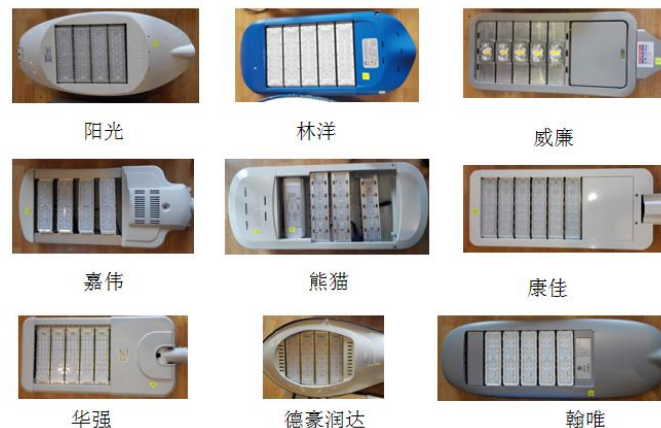
CSA016 Street light consisting of non-integral LED module



- The core competitiveness of products support the industrial development
- Market regulation、Large-scale Production、Cost reduction
- The interface specification for the optical , electrical , thermal and mechanical
- Joint-design with enterprises
- 20%-30% of LED Street light sales are using CSA016 in 2016,
- >500,000 LED street lighting and tunnel lighting products, >4,000,000 LED modules using CSA016
- >100 LED street lighting companies developed products according to CSA016



Companies using CSA016



Products using CSA016



CSA016
National Standardization Innovation Award



CSA016 has become
National standard

International Standardization: ISA



- Based on CSA standards, develop ISA recommendations and standards, 6 CSA standards (CSA020、 CSA016、 CSA005、 CSA035、 CSA 017、 CSA032) have been translated into ISA Recommendations by Dec. 2016.
- International standardization cooperation through ISA
 - “ISA Recommendations on Accelerating Depreciation Test Method for LED Lighting Products” (ISATCS-90012014, based on CSA 020), the research cooperation with Russia and India had been initiated. This has also been recommended to VLA of Vietnam.
 - “ISA Recommendations on Interface Requirements for Application of LED Lighting Street Light” (ISATCS-SN-90022014, based on CSA016) has already been recommended to BIS and BEE of India, ILMA of Iran.
 - “ISA Recommendation on Human Factor Testing on the Index of Healthy and Comfortable Lighting: Terms and Definitions” (ISATCS-SN-70012016, based on CSA035) has been recommended to CIE.



International Standardization: ISO/TC274



- ISO/TC274 light and lighting : concerning **vision, photometry and colorimetry**, involving natural and man-made radiation over the UV, the visible and the IR regions of the spectrum, and application subjects covering all usage of light, indoors and outdoors, energy performance, including environmental, non-visual biological and health effects
- CSA is the **working group leader** of China, build bridges between China industry and ISO/TC274, support the development of standardization
- **Proposal** ISO/PWI 21274 Light and Lighting - Adaptive Lighting Systems - Commissioning Process
- **Organize WG2**, Chinese representative is the working group convener



ISO/TC274 member meeting

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The 13th Five Year Plan

- Demand driven : Low carbon and intelligence
 - Energy-saving and environment protection has become the mainstream in 21st century
 - The era of big data need more efficient, personalized, intelligent
- Application driven: new type industrialization, new urbanization, ageing problem



New type industrialization



New type urbanization



Medical care

From Functional Lighting to Beyond Lighting



Ecological lighting source with the
advantage of cost performance

On-demand lighting
Beyond lighting

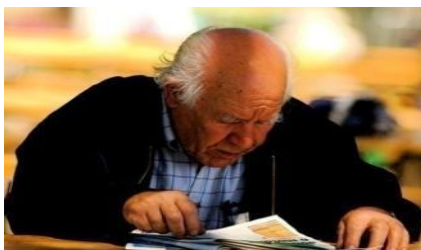


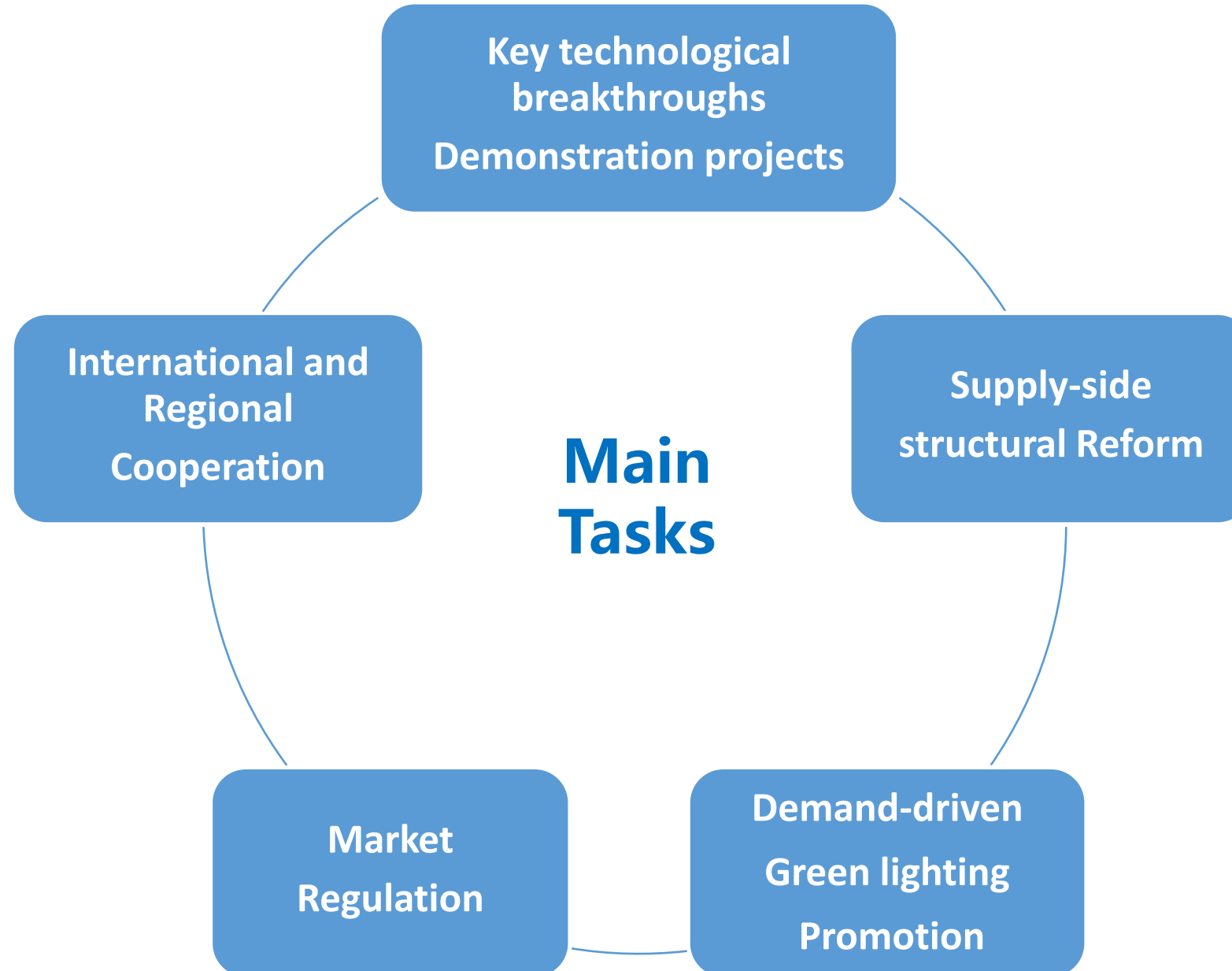
On-demand lighting

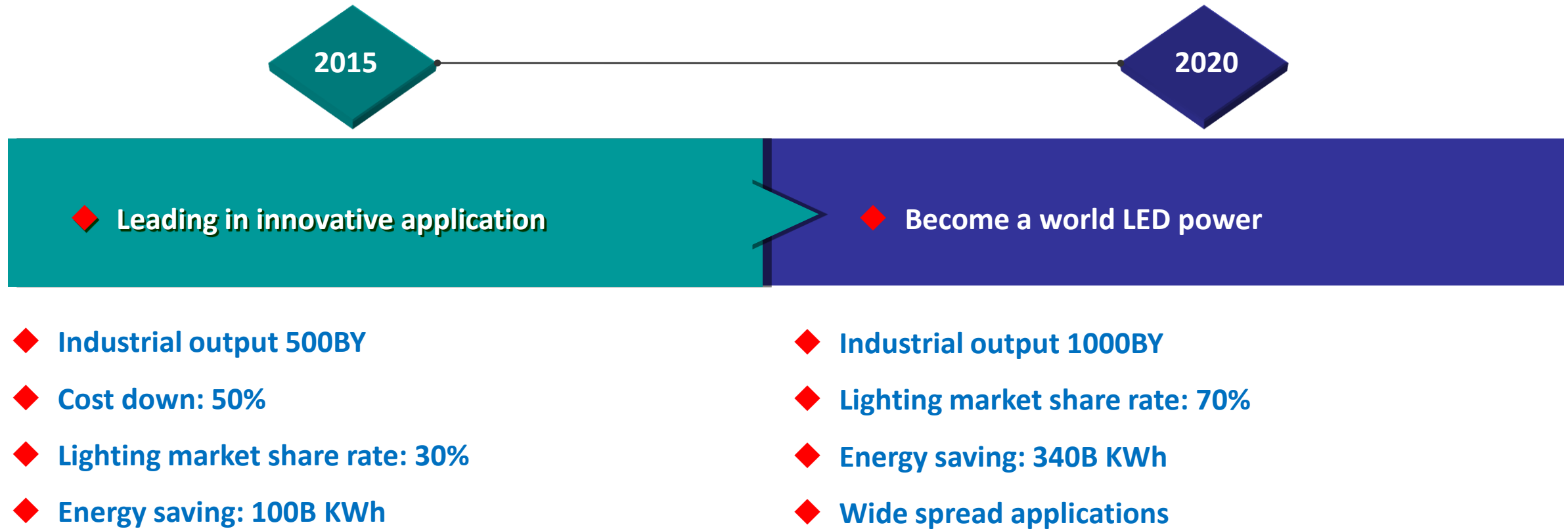
- To improve lighting quality and meet the needs in people's safety, physiology and psychology
- To create a more healthy, comfortable and smarter "light environment"

Beyond lighting

- Agricultural applications
- Medical applications
- Visible light communications , location-based services, etc.







1 Innovation Chain

- From fundamental research, frontier technology, system integration to the demonstration system deployment

2 Platforms

- Open innovation platform for the whole industry chain
- A network service platform for eco-system optimization

3 Focuses

- Efficient, high quality and comfort lighting sources for various applications
- Smart lighting systems and service
- “More than Illuminations”



- Healthy lighting, intelligent lighting, agricultural lighting, UV LED

Standardization Plan in National R&D Program (2016-2020)

Tasks	Subtasks	Number of standards
Semiconductor lighting and biological mechanisms and systems integration techniques and applications for health care and agriculture	High quality, full spectrum inorganic semiconductor lighting materials, devices, lamps and lanterns industrialization manufacturing technology	2
	Key technology and production demonstration of high efficiency large area OLED lighting	/
	Third-generation semiconductor materials and semiconductor lighting	/
	New form multi-function intelligent lighting and visible light communication critical technology and system integration	4
	The study of biological mechanism for healthy illumination	>5
	Research and development of the mechanism of health and medical care	4
	Research and application demonstration of LED key technologies for facility agriculture production	>5
	Research and application demonstration of LED key technologies for poultry and aquaculture	>3

- Explore a way **to incorporate technological achievements into standards**, serve the industry 's technology and market demand
- Exchange and cooperate with domestic and foreign **organizations and enterprises** , coordinate and improve development of industrial standard
- Explore an approach to **make alliance standards into national standards or international standards** , improve collaboration capabilities of alliance standards platform
- In the light and lighting scope, **build bridges between China industry and ISO/TC274**, support the development of standardization

Thanks for Your Attention!

