

## 北京首航艾启威节能技术股份有限公司

# 关于与 EDF（中国）投资有限公司签署超临界二氧化碳布雷顿循环技术与太阳能光热电站技术合作框架协议的公告

本公司及董事会全体成员保证信息披露内容的真实、准确和完整，没有虚假记载、误导性陈述或重大遗漏。

### 一、协议签署概况

1、北京首航艾启威节能技术股份有限公司（以下简称“公司”或“首航节能”）与 EDF（中国）投资有限公司（以下简称“法国电力”）于 2017 年 12 月 28 日签订《超临界二氧化碳布雷顿循环技术与太阳能光热电站技术合作框架协议》（以下简称“合作框架协议”）。

2、该《合作框架协议》不构成关联交易，也不构成《上市公司重大资产重组管理办法》规定的重大资产重组。

3、该《合作框架协议》为双方合作的战略性文件，目前尚未涉及具体项目投资金额和其它程序，因此本协议目前无需提交董事会和股东大会审议。

4、该《合作框架协议》所述投资项目需根据公司审批程序按照证监会和交易所相关规定予以披露。

### 二、协议的主要内容

#### 1. 合作基础

首航节能是以清洁能源和节能环保为主要业务的高新技术型企业，业务涉及光热利用系统、电站空冷系统、余热利用系统、水资源利用系统的研发、设计、制造、销售、安装、管理、调试、培训及电站总承包等服务。在光热领域，首航节能敦煌 10MWe 塔式熔融盐电站已经建成及并网发电，敦煌 100MWe 塔式熔融盐电站正在建设之中，德令哈 50MWe 槽式发电站太阳岛正在调试之中。首航节能积极推进太阳能光热发电技术与超临界二氧化碳布雷顿循环发电技术结合，并针对相关设备开始了设计研发。

法国电力是全球知名的低碳能源领导者，业务涵盖能源生产、传输及消费。法国电力在发电侧装机容量达到 140GWe，同时也是全球最大的核电运营商，积

累了大量的电站投资、建设和运营的经验。光热领域，法电积极参与全球光热商业项目投标（如 Noor III, DEWA IV, Noor Midelt 等项目），并针对熔融盐塔式光热电站、高温光热发电和超临界二氧化碳布雷顿循环等技术开展了大量研发工作，涉及实验研究、设备初设、系统设计及优化、数值模拟仿真、先进技术评估等。

首航节能与法国电力的合作，可以结合双方在光热和超临界二氧化碳布雷顿循环领域的技术和经验积累，共同推动双方的技术进步和在相关领域的发展。

### **1. Collaboration context**

Shouhang IHW is a high-tech enterprise, the industries that Shouhang IHW is involved include concentrated solar power (CSP) generation, air cooling system, waste heat recovery, desalination system, industrial waste water zero emission system, EPC and project investment. In the domain of CSP, Shouhang IHW has one 10MWe CSP Tower with molten salt under operation in Dunhuang, and another 100MWe CSP Tower with molten salt and 50MW parabolic trough plant are under construction in Dunhuang and Delingha. Shouhang IHW is interested in developing supercritical CO<sub>2</sub> Brayton cycle coupled with CSP, and some preliminary research has been started in Shouhang IHW regarding equipment design and system integration.

EDF is a global leader in low-carbon energy. EDF covers every main sector of expertise, from generation to transmission and consumption. On power generation side, EDF has a 140 GWe installed power capacity in total, and is the biggest nuclear operator in the world. In CSP industry, EDF participates in the commercial project bidding in emerging countries (Noor III, DEWA IV, Noor Midelt, etc.), and carries out various R&D works which cover molten salt tower technology, high-temperature solar receiver and supercritical CO<sub>2</sub> Brayton cycle. The R&D projects include campaign studies, equipment predesign, cycle design and optimization, numerical simulation, innovative technology assessment, etc.

The collaboration between Shouhang and EDF, which combines the competence and expertise from both sides on CSP and supercritical CO<sub>2</sub> Brayton cycle, is able to promote the related technology development and the competitiveness in related industry both for Shouhang IHW and EDF.

## 2. 合作内容

基于法国电力和首航节能对于光热发电技术及创新热发电技术的共同兴趣，双方有意向就以下两个课题展开科研项目合作：

### 1) 超临界二氧化碳布雷顿循环发电技术

超临界二氧化碳布雷顿循环，相对于水蒸汽朗肯循环，具有效率高、结构简单以及设备紧凑等优点。结合首航节能在设备设计制造和系统集成的经验，以及法国电力在超临界二氧化碳布雷顿循环的技术积累和电站运营经验，建立一个以光热为热源的示范实验循环，在此循环的基础展开相关技术研发工作。

### 2) 太阳能热发电技术

首航节能依托运营中的 10MWe 塔式熔融盐光热电站以及建设中的 50MWe 槽式导热油和 100MWe 塔式熔融盐光热电站，积累了丰富的设计、建设和运营经验；法国电力拥有丰富的电站投资、建设和运营经验，目前正积极关注全球光热发电市场，并结合塔式熔融盐光热发电技术，在全球范围内积极竞标，同时开展了大量的相关研发工作。结合双方在光热发电领域的积累，在首航节能 10MWe 塔式熔融盐电站的基础上，针对塔式熔融盐光热发电技术、高温光热吸热器（如粒子吸热器、空气吸热器等）等相关技术研发展开合作，有利于更好地解决目前遇到的技术问题，推动双方在光热领域的共同发展。

## 2. Collaboration content

Based on the common interest on CSP technology and supercritical CO<sub>2</sub> Brayton cycle, Shouhang IHW and EDF will collaborate on three topics:

### 1) Supercritical CO<sub>2</sub> Brayton cycle technology

Supercritical CO<sub>2</sub> Brayton cycle, compared to conventional Rankine steam cycle, has the advantage of higher efficiency, simpler layout and more compact equipment. Shouhang IHW has rich experience on equipment design and system integration, and EDF has been working on supercritical

CO2 Brayton cycle since 2010 and has well-established experience on construction and operation of power plant. Combining the competences of both sides, building a demonstration solar-heated supercritical CO2 Brayton cycle and conducting research works on this demonstration loop will be beneficial for Shouhang IHW to get a leading position on this technology and for EDF to better assess the feasibility of this technology.

## 2) CSP technology

Shouhang IHW, based on its 10MWe molten salt tower CSP plant in operation and its 50MWe Parabolic Trough ,100MWe molten salt tower CSP under construction, builds rich experience on design, construction and operation of CSP plant. EDF, which has well-established expertise on investment, construction and operation of power plant, is focusing on CSP industry and is bidding for international CSP projects with molten salt tower technology. In the meanwhile, EDF R&D carries out a lot CSP-related researched works. Combining the expertise of both sides on molten salt tower CSP technology, Shouhang IHW and EDF could collaborate on research and development of molten salt tower CSP technologies and high-temperature solar receiver (e.g. air receiver, particle receiver, etc.), in order to solve related problems and to improve the competitiveness of both sides in CSP industry.

## 3. 合作管理

3.1 双方围绕着合作课题每两个月开展项目工作会议，讨论阶段性项目工作，技术研究进展等，并共同商讨开发未来合作项目与计划，本项目合作有效期为五年。

3.2 针对上述合作内容，双方承诺在本协议生效后两个月内签署正式项目合作协议，明确合作项目的各方责任和义务。

## 3. Collaboration management

3.1 A collaboration steering committee is organized, to meet every

two months to discuss the progress of any collaboration project and any new research progresses as well as any opportunities for further collaborations. The term of validity is 5 years.

3.2 Based on the above collaboration contents, both party promised to sign an officially detailed collaboration agreement/contract within 2 months of the signing of this Agreement, in order to define the rights and obligations of both parties.

#### **4. 费用**

4.1 该项目为技术合作，双方各自承担工作范围内的费用，暂不涉及费用往来。

#### **4. Financing**

4.1 This project is designed as a technical collaboration. Each party shall bear its own cost and expenses in its work scope. No financial exchange is involved between both parties.

### **三、协议对上市公司的影响**

该协议短期不会对公司的生产经营、当期收入和利润产生重大影响。

超临界二氧化碳布雷顿循环系统是一种高级电力循环系统，其采用二氧化碳作为工作介质、在封闭的布雷顿热力循环中做功，热电转换效率高于以蒸汽作为工作介质的传统蒸汽轮机。超临界 CO2 透平体积小、重量轻、可以不用水、可显著降低成本，适合荒漠缺水地区的应用，是太阳能光热发电未来重要的技术方向之一。

长期来看，《合作框架协议》的顺利执行，为公司与法国电力共同推动双方光热发电业务发展奠定了基础；为公司加快光热发电新技术的开发并推动未来光热发电项目成本更低、适用范围更广有积极的意义。

### **四、风险提示**

1、该协议为合作框架协议，如在此框架约束下双方进一步推进其它方面的合作或者双方的合作出现中止、终止等情况，按照相关规定需进一步披露或者履行相应审批程序的，公司会按照相关规定予以履行和披露。

2、临界二氧化碳布雷顿循环系统研发难度高，存在双方研发无法取得重大

突破的可能，请广大投资者关注风险。

3、本协议的履行对公司本年度经营业绩无重大影响。

### 五、备查文件

1、北京首航艾启威节能技术股份有限公司与 EDF（中国）投资有限公司签署的《超临界二氧化碳布雷顿循环技术与太阳能光热电站技术合作框架协议》。  
特此公告。

北京首航艾启威节能技术股份有限公司

董事会

2017年12月29日