

全流发电技术在分布式地热电站中的应用

The Application of Total-Flow Screw Expander Generation Technology in Distributed
Geothermal Power Station

报告人：胡达

Reporter: Da Hu

2017年9月25日 中国.天津



江西华电电力有限责任公司
JIANGXI HUADIAN ELECTRICAL POWER CO.LTD,P.R.CHINA



郑州地美特新能源科技有限公司



0001010010001010010

00101010010010010

1101010010010010010



一、全流地热发电技术

Total-Flow Geothermal Power Generation Technology



※ 基本原理 Basic Principle

把热流体直接引入动力机，在液态和汽态共存情况下，把热能转换成为机械能，做功发电。

The hot fluid is directly introduced into the power machine, and in the coexistence of the liquid and the vapor, the heat energy is converted into mechanical energy, and power generation is done.

※ 技术设备 Technical Equipment

螺杆膨胀机。Screw Expander

※ 地热发电应用特点 Application Characteristics

1、系统简单，发电投资省、效率高。

The system is simple, the power generation investment is low and the efficiency is high.

2、解决地热结垢、腐蚀的运行痛点，可以无人值守。

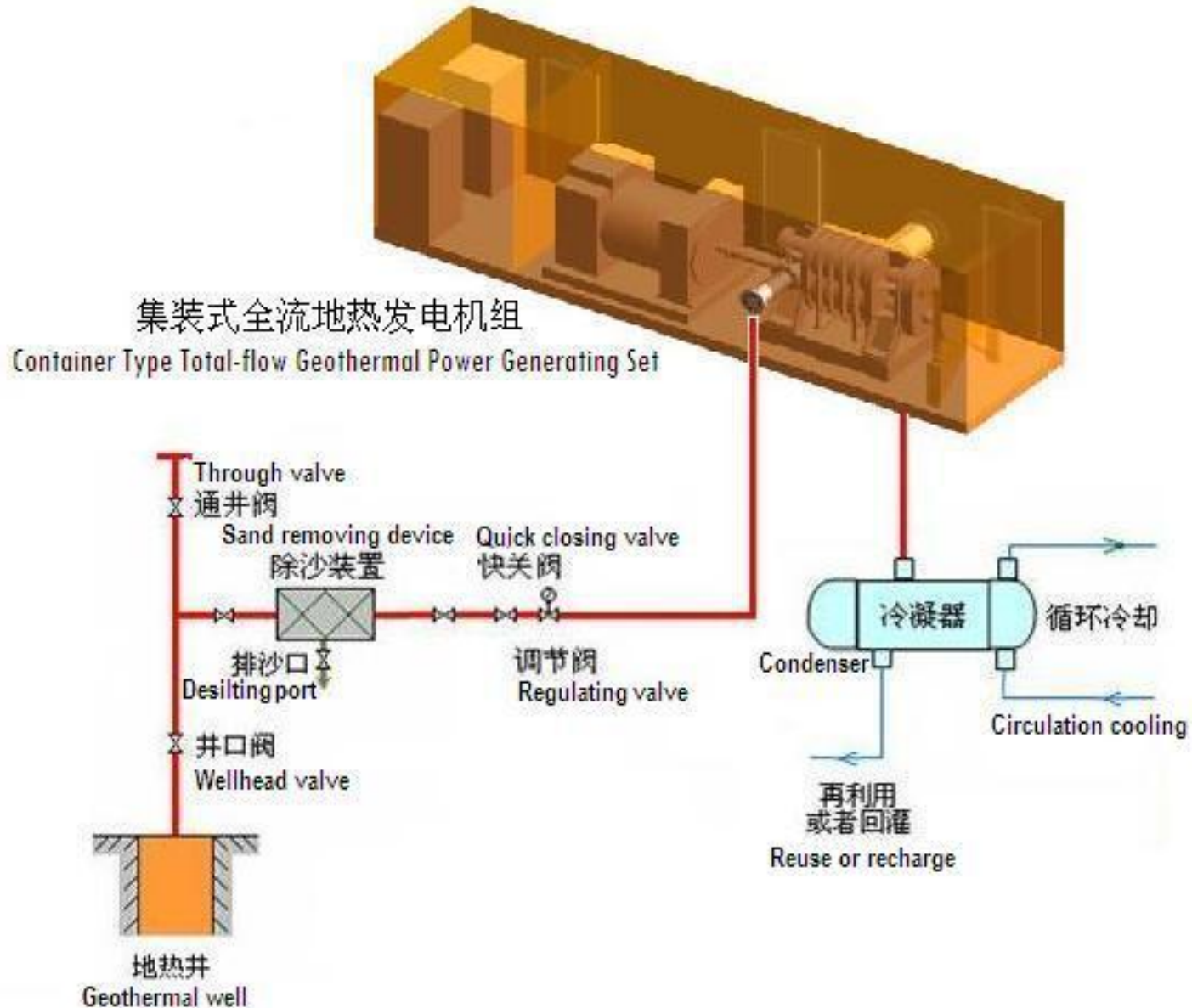
To solve the running point of fouling and corrosion of geothermal power, unattended.

3、集装箱式机组结构，设备紧凑，安装投运方便，可“一井一机”

The structure of the container type unit is compact, the installation and operation are convenient, and “one well one machine” is adopted

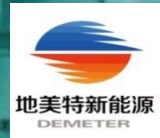


一、全流地热发电技术 Total-Flow Geothermal Power Generation Technology





一、全流地热发电技术 Total-Flow Geothermal Power Generation Technology



全流地热发电技术的核心：“螺杆膨胀机”技术

The Core of Total-Flow Power Generation Technology: Screw Expander

胡亮光 教授（1954年留学“莫斯科动力学院”）

Professor **Hu Lianguang**, studied at Moscow Power Institute in 1954.

技术研究30年，产业化示范15年。

30 years of technical research, 15 years of industrialization demonstration





一、全流地热发电技术 Total-Flow Geothermal Power Generation Technology



United Nations "Blue Sky Award"



Certificate of Independent Intellectual Property Rights



EU 3C Certification



National Key New Product Certificate



2012



2013



2014



2015

China Top 100 List of Energy Conservation and Emission Reduction



一、全流地热发电技术 Total-Flow Geothermal Power Generation Technology





一、全流地热发电技术 Total-Flow Geothermal Power Generation Technology



1MW集装箱式地热发电机组示意图

Diagram of 1MW Container Type Geothermal Power Generation Unit



一、全流地热发电技术 Total-Flow Geothermal Power Generation Technology



2009年3月20日北京中国国际节能减排与新能源技术博览会上，习近平总书记、时任胡锦涛总书记亲临“螺杆膨胀发电机组”展台并给予积极鼓励。

March 20, 2009, in Beijing, China's international energy saving and emission reduction and new energy exposition, Xi Jinping, general secretary, when he was Secretary General Hu Jintao in person "screw expanding generator unit" booth, and give positive encouragement



一、全流地热发电技术 Total-Flow Geothermal Power Generation Technology



科技日报

SCIENCE AND TECHNOLOGY DAILY

庚寅年二月初五 总第 8457 期 今日 4 版 国内统一刊号 CN11-0078 代号 1-97

2010 年 3 月

20

星期六

<http://www.stdaily.com>

科技日报2010年3月20日刊登
“西藏建设新型地热发电项目”

Science and Technology Daily
published in March 20, 2010, "Tibet
construction of new geothermal
power generation project."



这是西藏羊八井地热电站地热井喷(3月19日摄)。

3月19日,西藏羊八井1000千瓦新型地热发电项目开工。这个项目首次在西藏采用双螺杆膨胀动力机等先进地热发电技术,使得西藏的地热资源利用更加科学。据悉,羊八井1000千瓦新型地热发电项目估算投资为1300万元,施工总工期5个月。

新华社记者 觉果摄



一、全流地热发电技术 Total-Flow Geothermal Power Generation Technology



2012年在西藏羊易1MW集装箱式示范机组

1MW container type geothermal power generation unit in Yangyi of Tibet in 2012

西藏. 拉萨. 当雄县. 羊易热田





在中低温地热田的发电项目比较

Comparison of Power Generation Projects in **Medium Low-Temp** Geothermal Field

(1) 地热田基础数据 **Geothermal Field Data**

地热井口出水温度：100℃以上 Geothermal wellhead temperature: above 100℃

地热井口出水干度：0% 以上 Geothermal wellhead dryness: over 0%

(2) 发电技术指标 **Qualification of Power Generation**

全流发电技术：发电2.5kW/吨流体以上 Total-Flow: Above 2.5kW/t fluid

ORC发电技术：发电1.5kW/吨流体以上 ORC : Above 1.5kW/t fluid

闪蒸发电技术：发电1.5kW/吨流体以上 Steam Turbine: Above 1.5kW/t fluid

(3) 发电设备投资指标 **Investment of Power Generation Equipment**

全流发电技术：100% Total-Flow: 100%

ORC发电技术：120% 以上 ORC : 120% Above

闪蒸发电技术：110%以上 Steam Turbine: 110% Above



地热发电项目运行维护分析

Operation and Maintenance Analysis of Geothermal Power Generation Project

(1) 年运行小时数 Run Hours Per Year (No other considerations)

全流发电技术: 6000-8000小时 Total-Flow: 6000-8000 hrs

ORC发电技术: 5000-7000小时 ORC : 5000-7000 hrs

闪蒸发电技术: 4000-7000小时 Steam Turbine: 4000-7000 hrs

(2) 运行维护费用 Operation and Maintenance Cost

全流发电技术: 100% Total-Flow: 100%

ORC发电技术: 160-250% ORC : 160-250%

闪蒸发电技术: 130-180% Steam Turbine: 130-180%

(3) 环保和运维痛点 Environmental Protection and Runing Pain Point

全流发电技术: 回灌 Total-Flow: Recharge

ORC发电技术: 回灌、结垢腐蚀、泄漏工质 (每年0.6t/MW装机)

ORC: Recharge, Scaling and Corrosion, Leakage of organic refrigerants (0.6t/MW.Year)

闪蒸发电技术: 回灌、结垢腐蚀 Steam Turbine: Recharge, Scaling and Corrosion



全流地热发电项目的特点

Characteristics of Total-Flow Geothermal Power Generation Project

(1) 净发电功率提高 10-20%

Net generation power increased by 10-20%

(2) 发电设备投资降低 5-20%

Investment in power generation equipment decreased by 5-20%

(3) 运维费用减少 20-40%

Operation and maintenance costs reduced by 20-40%

(4) “一井一机”，简单快装，减少地热分离、管网等设备投资运维

“One well, one unit”, simple and fast installation, reducing geothermal separation, pipe network and other equipment investment operation and maintenance



0001010010001010010



二、分布式地热电站中的应用

Application in Distributed Geothermal
Power Station



二、分布式地热电站中的应用 Application in Distributed Geothermal Power Station



2016年“中国光彩事业德宏行”项目

In 2016, “China’s Guangcai Career, Dehong”

云南瑞丽100MW地热发电项目

Yunnan Ruili 100MW Geothermal Power Generation Project

1、规模 **Scale**

预计投资30亿元人民币

Estimated that the investment will be RMB 3 billion yuan.

设计规模100MW

Design scale 100MW

2、部分地热资源情况 **Estimating Geothermal Resources**

地热井深300-2000米

The geothermal well is 300-2000 meters deep.

地热流体井底温度120-200℃

The geothermal fluid temperature at the bottom of the well is 120 – 200 °C.



二、分布式地热电站中的应用 Application in Distributed Geothermal Power Station



3、一期地热发电资源情况 Phase I Geothermal Resources

地址：云南德宏自治州瑞丽市勐卯镇贺闷村

Address: Hemen Village, Mengmao Town, Ruili City, Dehong Autonomous Prefecture, Yunnan Province in P.R.China

地热井深：300-700米

Geothermal well depth: 300 – 700 meters

地热井口参数：压力0.28-0.4MPa

Geothermal wellhead parameters: Pressure 0.28-0.40 MPaA

温度136°C，干度为0，地热水状态。

Temperature 136°C, Dryness value 0, Water status



二、分布式地热电站中的应用 Application in Distributed Geothermal Power Station



4、发电技术方案 Power Generation Technology Scheme

利用“螺杆膨胀机”全流发电技术，将地热井口的热水直接引入集装发电机组发电，排水出口45℃左右。该系统运行稳定、安全可靠，占地小，维护方便。

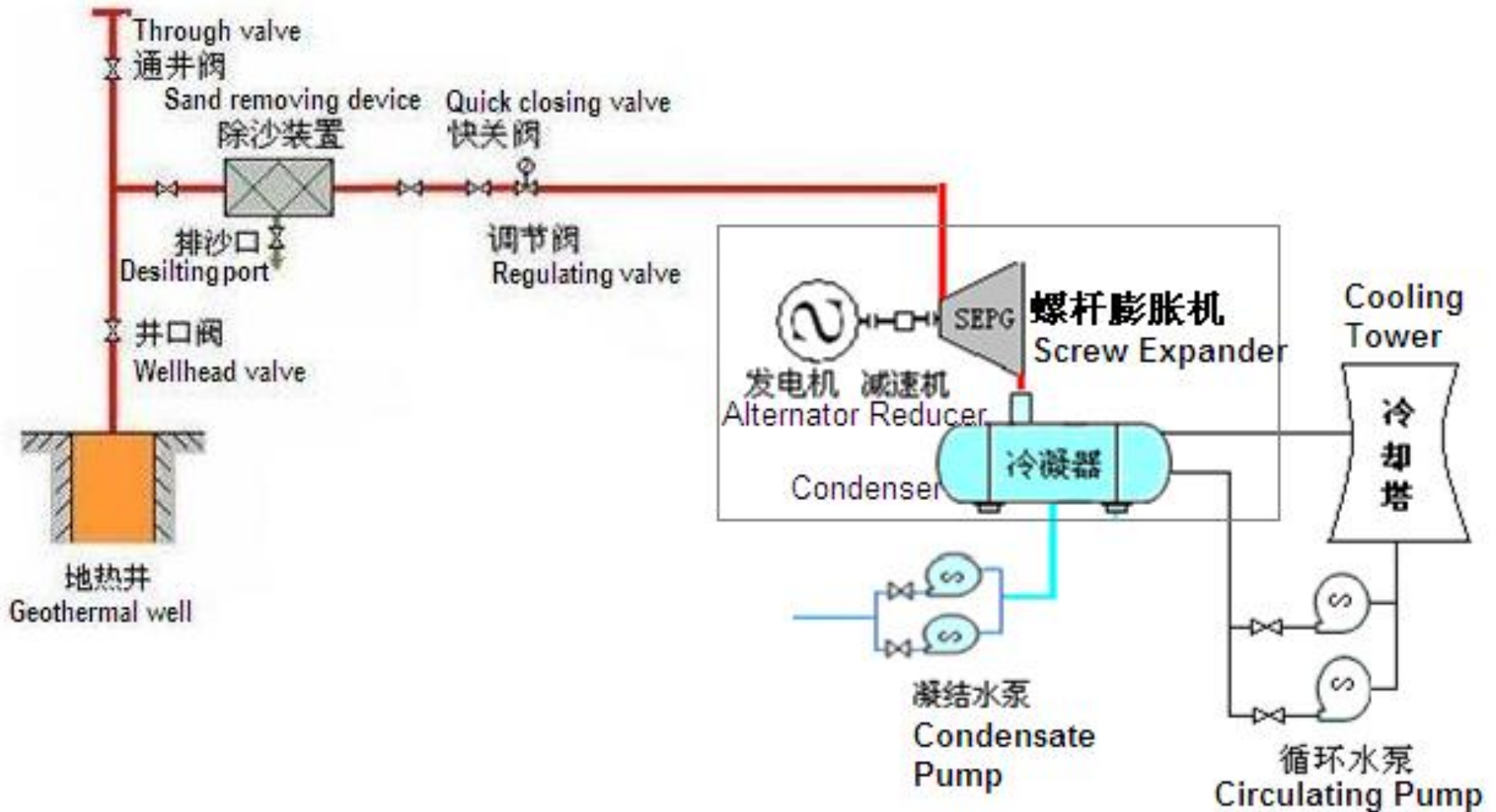
Using the total-flow power generation technology of screw expander, the hot water of the geothermal wellhead is directly introduced into the container type generating unit to generate electricity, and the drain outlet is about 45 °C. The system is stable, safe and reliable, with small occupation and convenient maintenance.



二、分布式地热电站中的应用 Application in Distributed Geothermal Power Station



5、发电系统图 Generation System Diagram





二、分布式地热电站中的应用 Application in Distributed Geothermal Power Station





二、分布式地热电站中的应用 Application in Distributed Geothermal Power Station



6、装机方案 Installation Plan

以“一井一机”方式装机4套300kW集装箱机组

With “One well,one unit”, 4 sets of 300kW container power generation units are installed.

技术选择:	全流地热水发电方案
Technical Choice:	Total-Flow Geothermal Power Generation
装机规模:	1.2 MW
Installed Scale:	4 × 300 kW
排汽去处:	回灌或再利用
Exhaust Place:	Recharge or Reuse



二、分布式地热电站中的应用 Application in Distributed Geothermal Power Station





二、分布式地热电站中的应用 Application in Distributed Geothermal Power Station



云南德宏集装箱式全流地热发电机组运行数据图

Operation data Picture of Dehong Container Type Total-Flow Geothermal Power Generation Unit



二、分布式地热电站中的应用 Application in Distributed Geothermal Power Station



7、技术参数 Technical Parameter

项目Item	参数Parameter	单位Unit
井口压力 Wellhead Pressure	0.28	MPa.A
井口温度 Wellhead Temperature	136	°C
进口压力 Inlet Pressure	0.09-0.12	MPa.A
进口温度 Inlet Temperature	97-105	°C
地热流量 Geothermal Flow	70-100	t/h
排汽压力 Outlet Pressure	0.006-0.010	MPa.A
排汽温度 Outlet Temperature	39-45	°C
额定功率 Power Rating	210-300	kW



二、分布式地热电站中的应用 Application in Distributed Geothermal Power Station



5、运营指标 Operation Index

指标 Index	Data	备注 Remark
发电功率 Generation Power	4 × 300 kW	
净发电功率 Net Generation Power	4 × 210 kW	自耗电功率约4 × 90kW
年供电量 Annual Power Supply	5.88 GW.h	按年运行时间7000小时计算
年节约标准煤 Annual st. coal saving	2,058 t	节约标煤指标0.350kg/kWh
年减少CO ₂ 排放 Annual reduce CO ₂ emmissions	4,889 t	减少CO ₂ 排放指标0.8316kg/ kWh



0001010010001010010
0010010010001010010



三、全流地热发电产业 的发展前景

Development Prospects of Total-Flow
Geothermal Power Generation Industry



1、投资成本优势

Investment Cost Advantage

发电系统简单，可实现“一井一机”装机模式；每千瓦投资比常规地热发电降低20%。

The power generation system is simple and can realize "one well, one unit" model, and the investment per kilowatt is 20% lower than that of conventional geothermal power generation.



2、分布式地热电站模式

Distributed Geothermal Power Station

全流地热发电技术很容易实现分布式地热电站模式，可激发出地热发电的巨大潜力。中国现有上千个90℃以上地热井就具备分布发电能力，若未来装机10万台1MW全流地热发电机组，地热发电装机规模将达到1亿千瓦。

Total-flow geothermal power generation technology is easy to implement distributed geothermal power station model, which can stimulate the enormous potential of geothermal power generation. China has nearly 1000 geothermal wells over 90°C. It has the ability to distribute power generation. If the installed capacity of 100 thousand 1MW geothermal generators will be installed in the future, the installed capacity of geothermal power generation will reach 100 million kilowatts.



3、巨大市场空间 Huge Market Space

集装箱式全流地热发电技术的发展，将伴生出“分享”式地热发电新型商业模式；同时，地热发电的开发商将发生较大变化，将由原先的抗风险能力强的大型企业，逐步扩大成为众多企业皆有参与的清洁电能经营者，为社会创造出许多新商机，具有巨大的市场发展空间。

The development of container total-flow geothermal power generation technology, will be associated with "share" new geothermal power generation business model; at the same time, geothermal power developers will be changed by large enterprises of the original anti-risk ability, many enterprises have gradually expanded to become clean energy operators force participation, create many new opportunities for the society, has a huge market space for development.

感谢您的支持！

为地球的“天”更蓝，我们
留给子孙后代的“资源”更多！

**Thank you for your participation and
support! For the sky bluer,we leave more
resources to future gennerations!**

- ◆ Mobile: +86-13879019171
- ◆ E-mail: jxhdhuda@163.com
- ◆ <http://jxhdep.com>