
Business Models Enabling Industrial Boiler Energy Efficiency Improvement and Pollution Reduction

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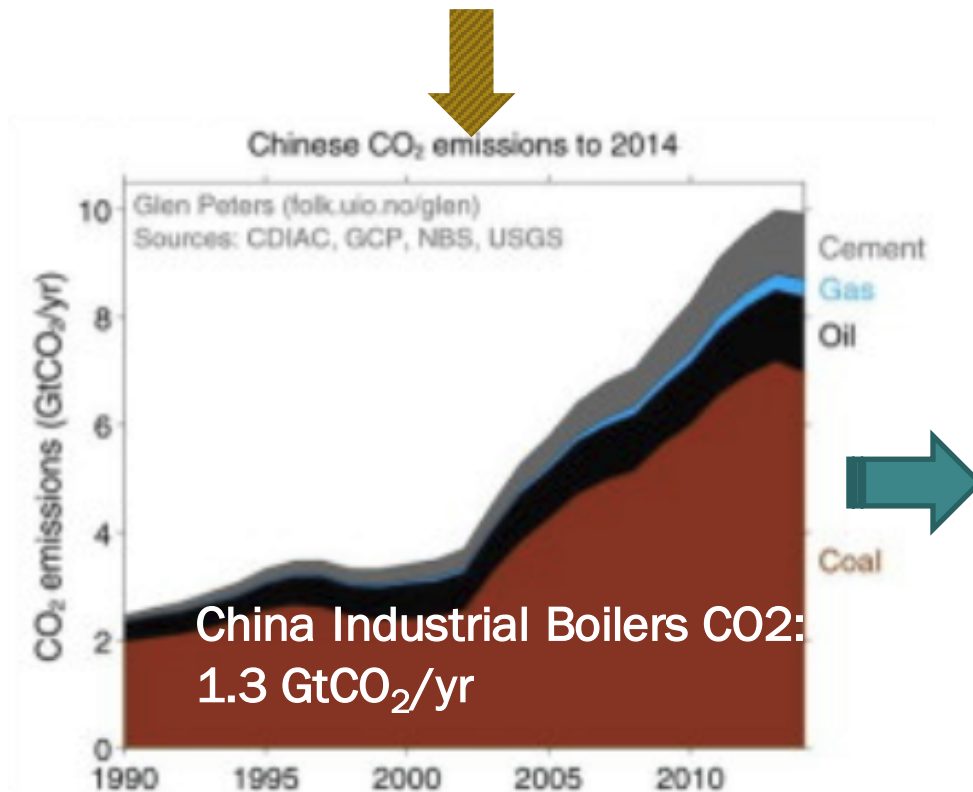
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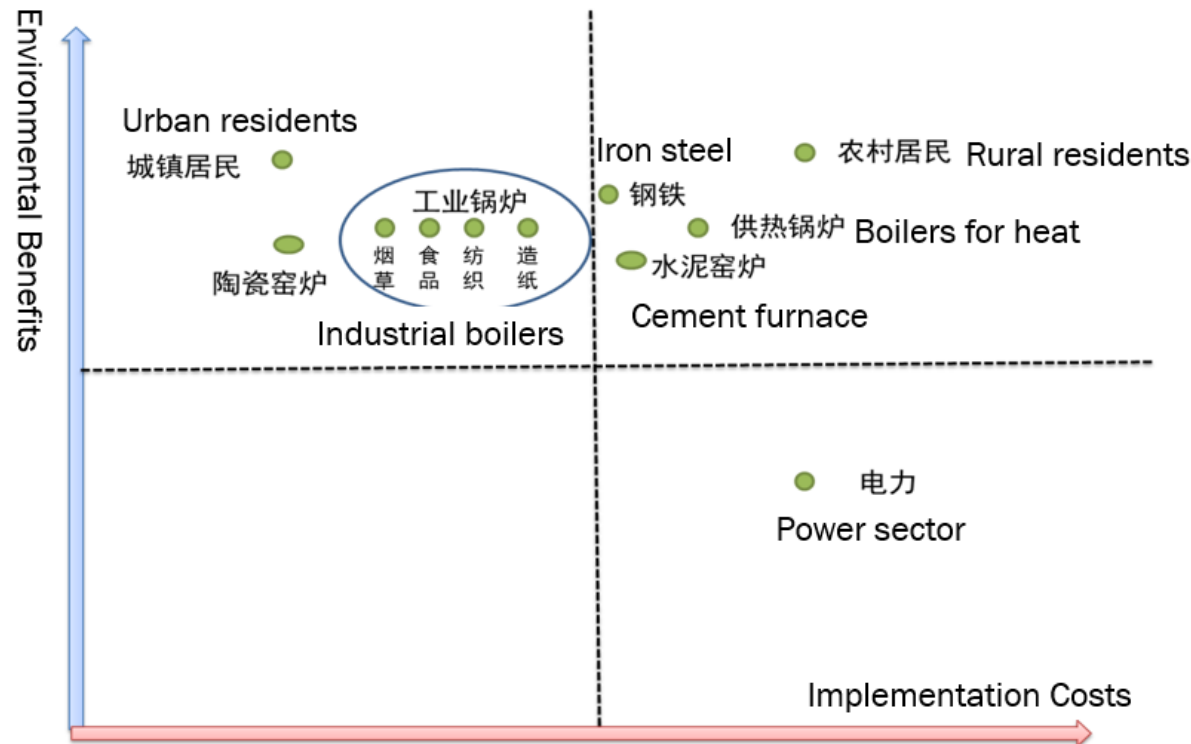
Why industrial coal-fired boilers in China?

- Largest coal-consuming single industrial system
- 18% of China's total coal use
- 33% of total soot emissions
- 27% of total SO₂ emissions
- Air pollution caused mainly by scattered small boilers



Country	Total CO ₂ emissions from Energy Use (Gt CO ₂ /yr). 2012
Australia	0.42
UK	0.49
Canada	0.55
Germany	0.79
Japan	1.26
India	1.83
U.S. 2025 reduction goal	1.85~1.99

Environmental Benefits vs. Implementation Costs for Reducing Coal Use in Different Sectors in China



来源：国家发改委能源所

Possible Solutions

- Fuel switch
- Retrofit
- Replace small boilers

Targeted Customers & Services

Third-party provides services to industrial (and other) customers in the service area

Customers purchase steam/hot water from the provider, similar to their purchase of electricity

System can implement CHP, providing steam, cooling, heating, and electricity, maximizing opportunities

Distributed Boiler Service Centers

- Use of distributed energy
- Higher resource utilization
- Cost effective using efficient tech
- Effective and lower cost in controlling/monitoring emissions
- Can become flexible peaker unit

Business Model and Rate Design

Through PPP, SPA

The system (boiler + local distribution network) developed by industrial park in a partnership with a boiler manufacturer, special purpose company, or specialized energy service company

Rate design: a volume rate and a fixed charge like electricity service

Enterprises Collectively Forming a Joint Partnership

Targeted Customers & Services

Multiple willing companies form a joint partnership facilitated by the industry park

Collectively build a service center to provide heat and steam to serve partnering companies (and other customers)

The partnership can form own operation team or outsource the operation

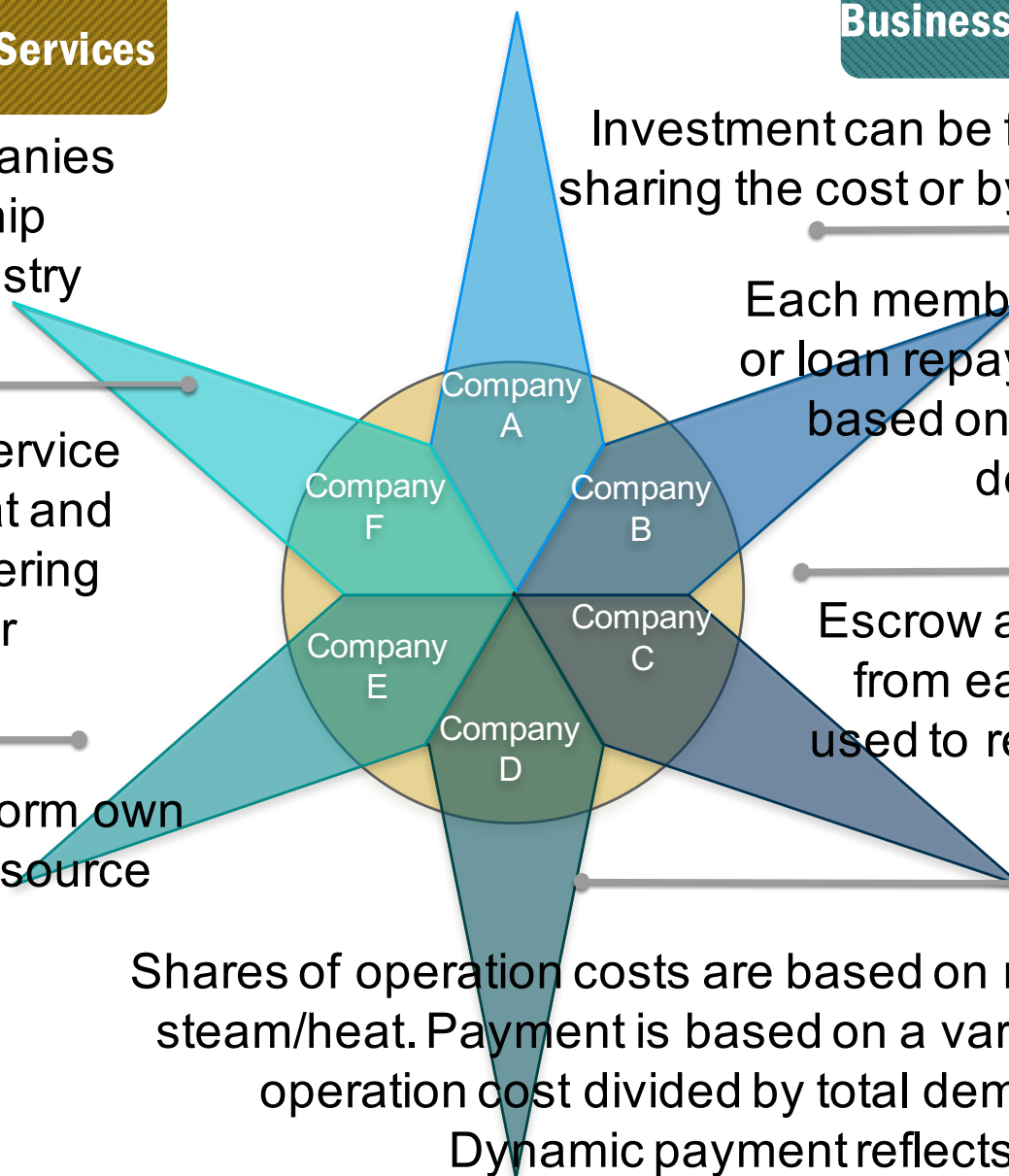
Business Model and Rate Design

Investment can be financed by members sharing the cost or by third-party financing

Each member's invested amount or loan repayment amount will be based on the percentage of its demand in steam/heat

Escrow account with deposits from each member could be used to reduce risks of default

Shares of operation costs are based on member's demand in steam/heat. Payment is based on a varying unit price (=total operation cost divided by total demand for steam/heat).
Dynamic payment reflects production changes



- **Outsourcing boiler operation:** operation and maintenance outsourced to a boiler manufacturer or specialized service company; fee paid by the facility is lower than its original operational expenses
- **Boiler Tune-up Service Contract** customers own and operate own boilers; boilers are tuned-up regularly for optimal performance; fees charged based on service frequency and levels of service
- **Boiler Performance Monitoring and Management Service Contract:** boilers are installed with online monitoring systems; boiler operation and performance data are collected, tracked, and analyzed; improvement recommendations are provided to facilities with fees
- **Boiler Retrofit Contract:** retrofits implemented by ESCO; the savings from technical retrofits are shared or service fee charged to the customer; performance of technical retrofits are guaranteed by ESCO; third-party or the customer is responsible for financing

Boiler Tune-up Guide

National Emission Standards for Hazardous Air Pollutants for Area Sources:
Industrial, Commercial, and Institutional Boilers

40 CFR Part 63 Subpart JJJJJJ

The purpose of this Guide is to provide the boiler owner the knowledge base to appropriately direct boiler tune-up activities to comply with the requirements of the Boiler Area Source Rule. This will allow the boiler owner to clearly define the scope of work the tuning technician will be tasked to accomplish.

Financing Pledged by Service Contract

On-Bill Financing

Leasing Financing

Finance Backed by Service Interruption Insurance

Financing pledged by service contract and secured by scheduled payment of service fee

Attach financing to the service bill. If default, steam/heat services can be turned off until payment continues. Benefits: (a) loan converted to bill payment not a debt; (b) treated as operation cost, offsetting taxable revenue; (c) attached with service payment, reducing default risks, (d) Loan term can be as long as contract duration

Lease contract signed between the customer and boiler manufacturer/service provider that owns the boiler. Customer pays leasing fee as scheduled. At the end, customer can either return the equipment or pay the remaining value to own the boiler

Service reliability is a concern in a new service model. Insurance can help reduce the performance risk. Special purpose insurance such as service interruption insurance allows insurer to pay the loss from service interruption due to fuel shortage or equipment malfunction

- Industrial boilers – most small - are one of the key sources of greenhouse gas emissions and local pollution in China
- Options can be adopted include switching coal to other fuels, retrofitting existing boiler systems to improve efficiency, and developing distributed energy centers to replace scattered boilers
- New business models are needed to implement viable strategies to address boiler challenge and accelerate efficiency improvement, fuel switching, and the adoption of CHP and distributed energy



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Questions? thank you

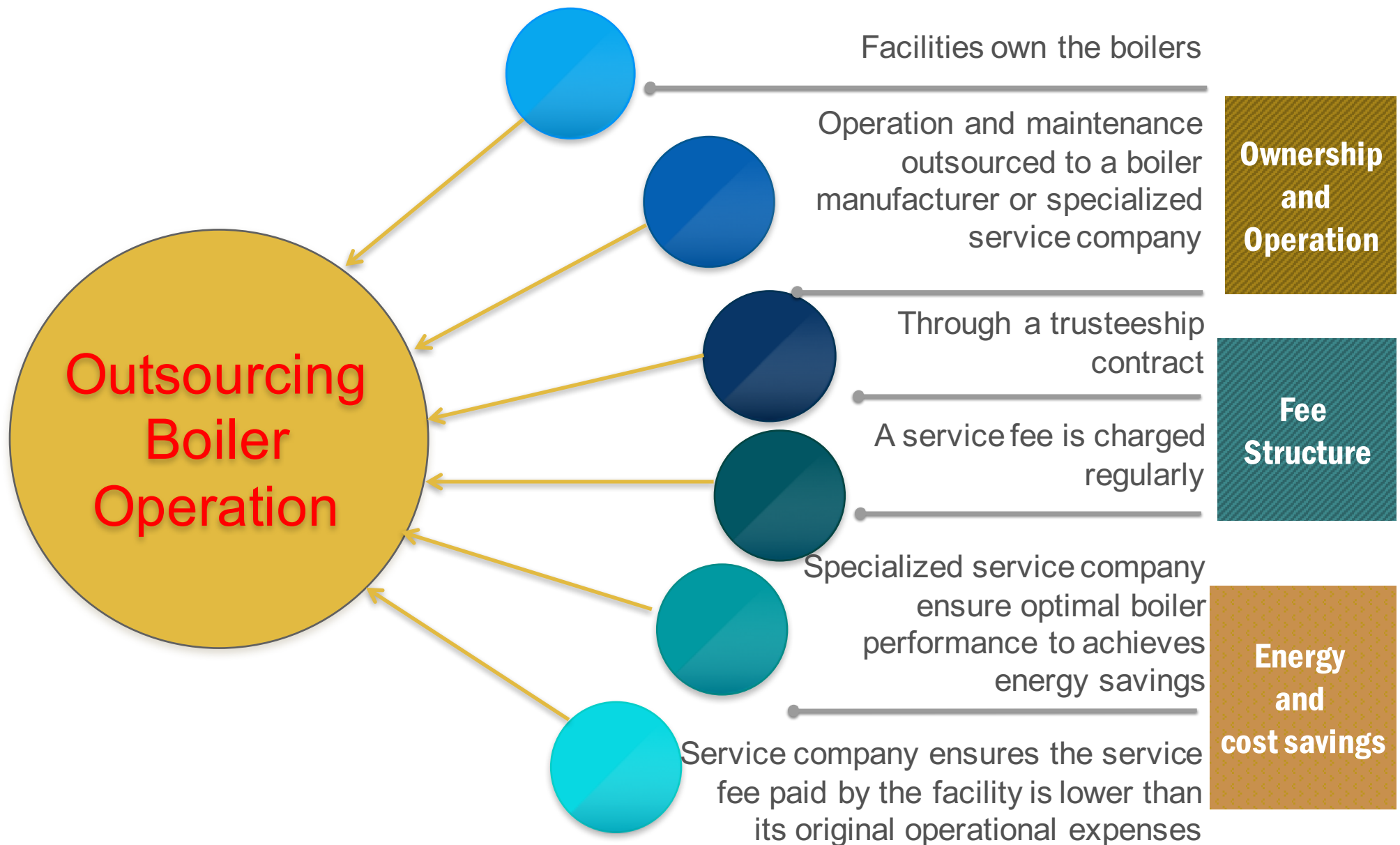
contact information

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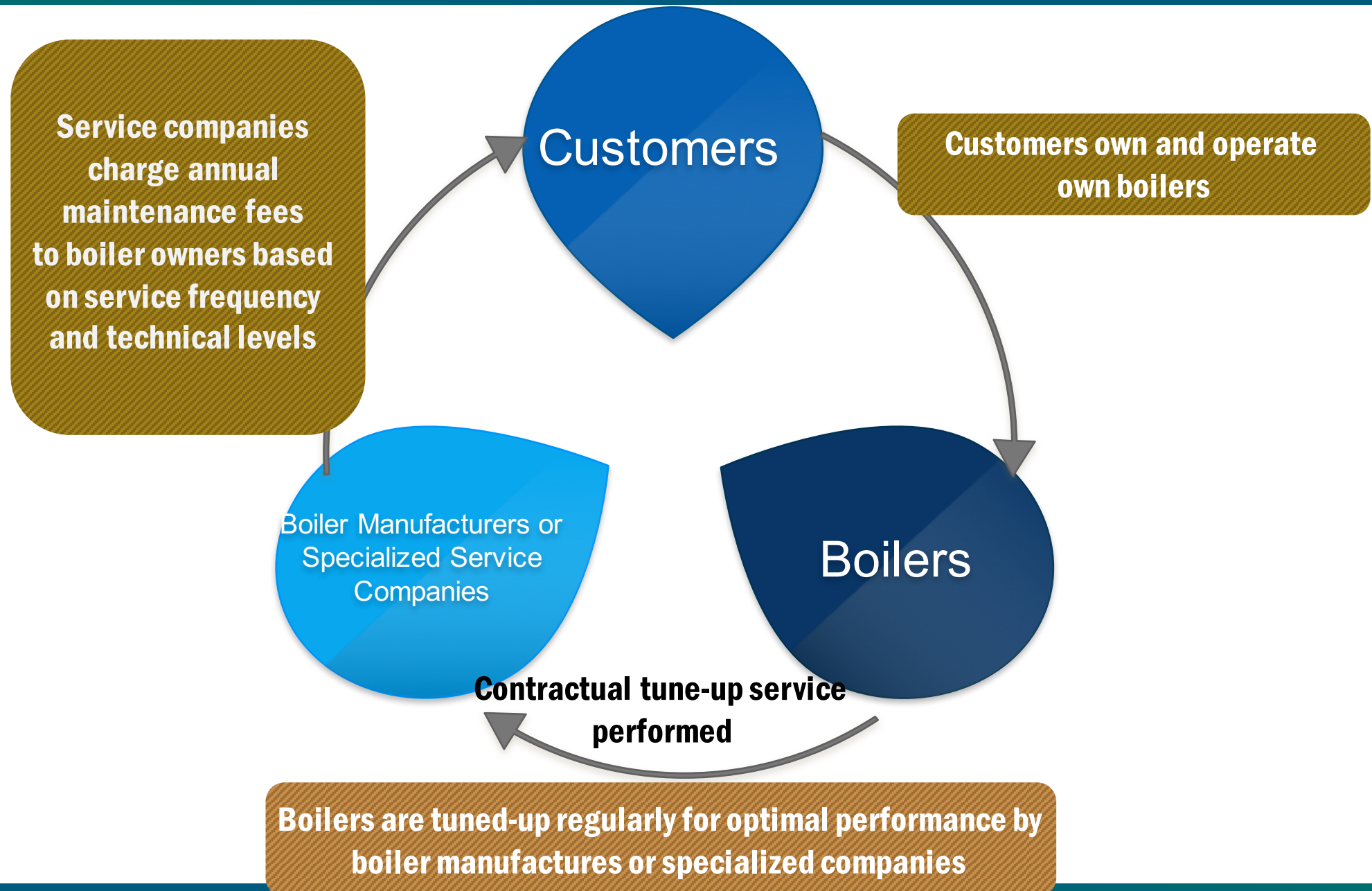
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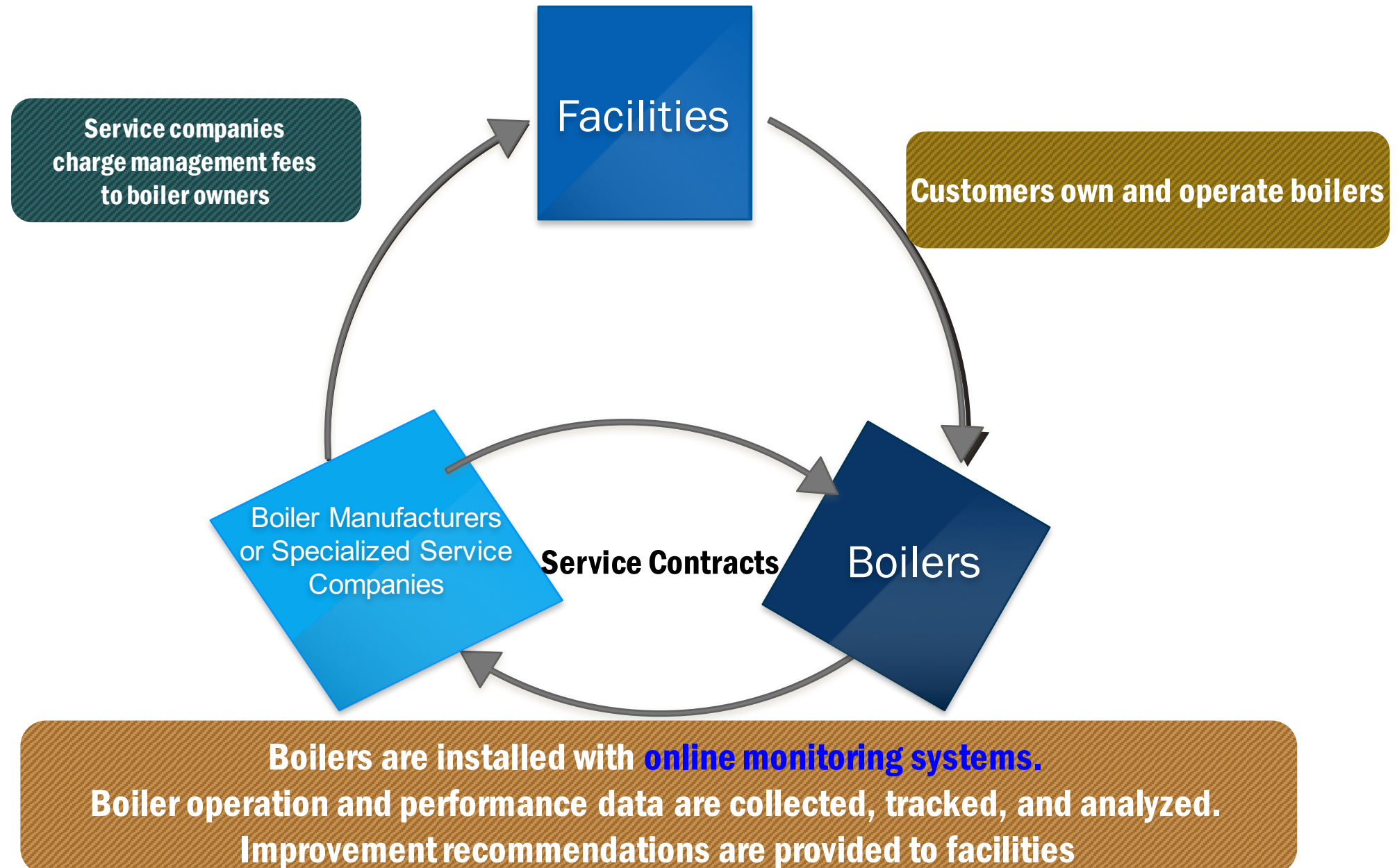
Model 3: Outsourcing Boiler Operation



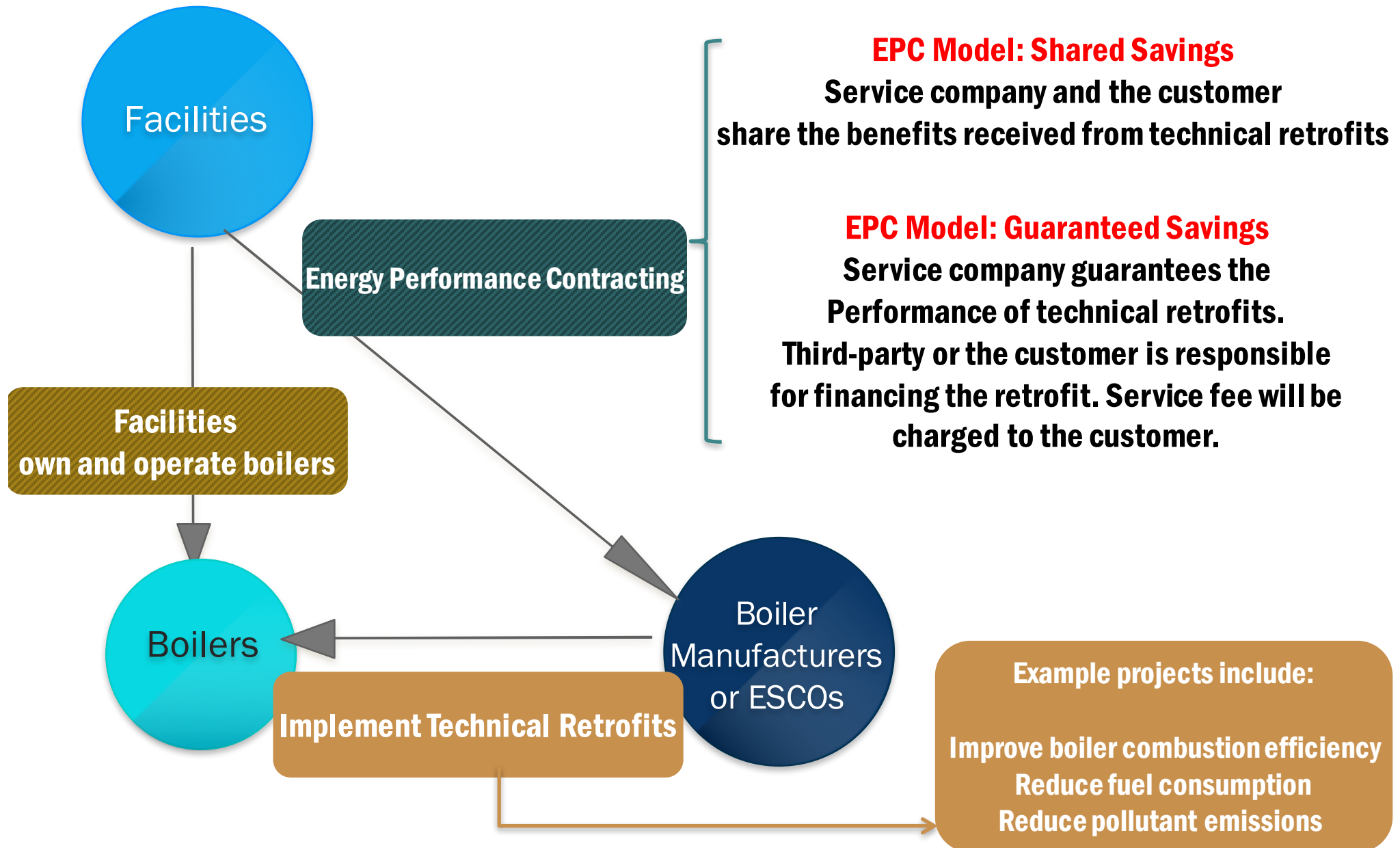
Model 4: Boiler Tune-up Service Contract



Model 5: Boiler Performance Monitoring and Management Service Contract



Model 6: Boiler Retrofit Performance Contract



Model 7: Franchising

