COMMERCIAL SUCCESS FROM SECOND-HAND POWER PLANTS AND COMPONENTS FROM THE EUROPEAN GENERATION CRISIS

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troveo
We trade power plants and components

A JOINT COOPERATION OF

VPC GMBH

AND

SPRINT! ENERGY CONSULTING GMBH

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Summary:

It’s all down to the changed energy market: the integration of energy from renewables in Europe is leading to the closure of plants of all ages and sizes. The plant operators are also faced with problems of dismantling and disposal or recycling of the existing power plant components. On the other hand, there are generation companies across the globe who could use quality controlled plants or components. The only missing factor is bringing the two stakeholders together in a serious manner and assisting in implementation of the project.

With a correct approach, this is a win-win situation. The used systems, which were designed and manufactured for a long service life and many hours of operation, can be integrated in existing systems or added to them. For the purchaser, there is an opportunity to acquire plant components for the precise (residual) life required at a highly competitive price. The seller receives a price which reflects the value still immanent in the components.

The continued use of second-hand plant components is, then, a sensible consequence of the current market and price developments in both an economic and ecological regard. The most promising scenario is marketing which includes support during the sales process for the relocation of entire plants or reuse of components by the purchaser.

Examples are presented to illustrate the following:

- How can the economically viable reuse of existing systems be effectively assessed?
- What cost savings can be achieved with second-hand plants and components?
- How does the deployment of used components affect downtimes after damage?
- What are the challenges presented by dismantling, overhaul and recommissioning?
- How do sellers and purchasers come together?

In conclusion, an estimation is made of the existing potential for this relatively new field of business, and of the prospects for international market developments in the field of trading with second-hand components.

Speaker's bio:

Hardy Hilliges has been responsible for business development at VPC for two years now. His work focuses on the expansion of international business and the changing requirements for providers of engineering services against the background of new energy generation and storage methods.

He started his professional career with a global telecommunications company and a management consultancy with international operations in major projects. There, he established contacts with the energy industry, initially developing them in the field of electro mobility with an automotive group. In that position, he dealt with the expansion of vehicle charging infrastructure and questions of strategic development.

Hardy Hilliges graduated as an engineer in media technology at a University of Applied Sciences.

Co-author's bio:

Andreas Stephan is a key executive consultant at SPRINT! Energy Consulting who has successfully led many high profile projects on behalf of our clients in several industries such as utilities and mining. Restructuring of business processes in the utilities market such as power, gas and water has been the focus of his activities. Market model design, analysis of investment opportunities and management of implementation projects related thereto have made Andreas one of the most important contacts in the company. Andreas has hands-on project experience in developing countries, too.

For the last 5 years, Andreas has focused on the power generation sector and specialised in the detailed assessment of thermal power stations and marketing of existing plants or their main components.

Andreas Stephan is a graduate geoscientist with a Diploma (equivalent to an M.Sc.) in Geophysics from the University of Cologne, Germany. Furthermore, Andreas has obtained the degree of Master of Business Administration at NIMBAS Utrecht, The Netherlands, and at the University of Bradford, United Kingdom.

Agenda:

1. What is going on? – Energiewende and emerging economies
2. What would be a solution and can it work? – An example
3. What drives relocations? – Money changes everything
4. What is the investment challenge? – Convincing investors and financing institutions
5. What is the trading challenge – Combining Networking with a technical match
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1. What is going on? – Energiewende and emerging economies

The transition to sustainable energy sources – in German referred to as "Energiewende", which literally translates as "energy turnaround" – is supposed to pave the way into a safe, environmentally compatible and economically prosperous future. Many countries in Western Europe have therefore made the decision to fundamentally change their energy supply systems and move from fossil fuels to renewable sources of energy. The finite nature of fossil energy resources, the health and safety of the population and environmental aspects of air pollution prevention are the main drivers behind these ambitious objectives.

According to plans by the German government, for instance, energy from renewable sources is to cover 40 to 45 percent of the energy demand by 2025, and at least 80 percent by 2050. Many European governments have adopted similar objectives.

These politically desired changes in energy generation have brought about a visible and noticeable development, especially in Western Europe. While the number of wind turbines and photovoltaic installations increases on the one hand, fossil fuelled power plants are taken out of service on the other hand because their continued operation is not economically efficient by the standards applicable here.

According to current data surveyed by the German regulator Bundesnetzagentur, conventional power plants with a generating capacity of approximately 4,000 GW are planned to be decommissioned in the years 2017 through 2019 alone; at the same time, there are an unknown number of gas-fired power plants which have been mothballed for the time being, because their owners have not yet made a decision or have not yet obtained approval for their final closure.

And all this is happening while thermal power plants still continue to be an important bridge technology to compensate for the heavy fluctuations in power supply from renewable sources and to ensure grid stability, at least as long as there are much too few large-scale energy storage facilities that are economically viable in operation.

Conventional power plants were designed for a service life of several decades. Now, some of them are already being taken off line after only a few years of service. Modern technology which achieves high efficiencies, is in a perfect maintenance condition and satisfies the high European emission standards is suddenly becoming superfluous. For operators of conventional power plants this means that either they keep their power plants running and put up with only minor or even negative revenues, or take them off line.

As a consequence, as shown in Figure 1.1, gas-fired steam turbine (ST) power plants of the capacity class up to approx. 400 MW which were originally commissioned in the nineteen-seventies, but also gas turbine (GT) plants and combined cycle gas turbine (CCGT) plants of the 300 – 800 MW capacity class dating from the second half of the nineteen-eighties to very recent years are being decommissioned and offered for sale. In the case of gas-turbine and combined cycle gas turbine units designed as industrial power plants and combined heat and power (CHP) plants with a capacity of up to about 120 MW, the plants up for sale are typically less than 20 years old.

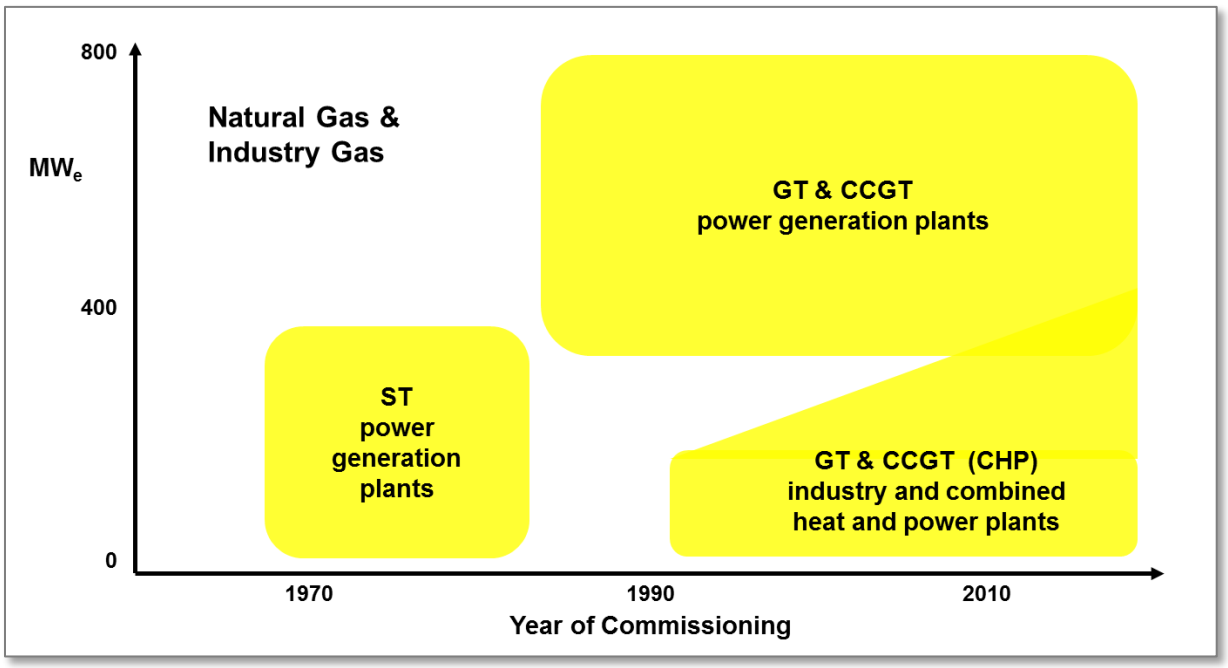


Figure 1.1: Capacity and age clusters of used gas-fired power plants for sale

As regards hard coal fired power plants, the situation is different, as is shown in Figure 1.2. Many of the generating units which have typically already been closed down or are to be closed down very soon have a capacity of less than 400 MW and date from the nineteen-sixties to eighties. However, it should also be mentioned that many of these power plants were retrofitted, with flue gas cleaning systems for instance, or had major components such as turbines and generators replaced. However, as the addition of renewable generating capacity is set to intensify, it is just a matter of time until the large generating units of as much as 800 MW capacity which were built since the middle of the nineteen-eighties will be put up for sale, too Coal-fired industrial power plants of the capacity class of 100 MW and less, in contrast, are offered in all age groups from 5 to 50 years, and there is significantly more choice in this segment.

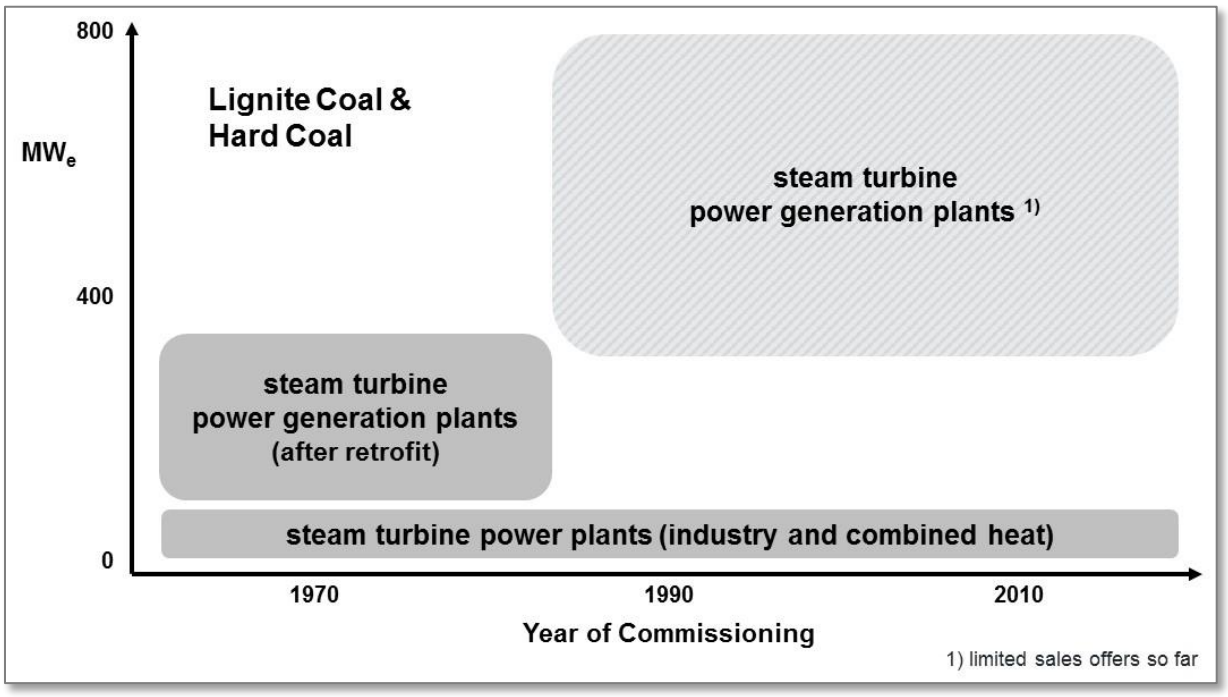


Figure 1.2: Capacity and age clusters of used coal-fired power plants for sale

2. What would be a solution and can it work? – An example

The marketing of relatively new power plants and equipment from Europe is just now emerging as a new field of business: In the past, it was hardly necessary in Europe to market used power plants. The plants were operated until the end of their useful service life and then they were scrapped. As a consequence, until now there have been only a very few examples of successful marketing of power plants from Europe and re-erection at a different location. However, favourable experience has indeed been gained with the relocation of power plants in other parts of the world, for instance with plants that were relocated from North America.

Power plant technology can well be conceived of as one of the supreme engineering disciplines: The plants and their components were designed and manufactured for a long service life. If plants are closed down prematurely, the service life is not exhausted by far. For the plant owner, this may be a losing game, because the investment was made in expectation of a long service life.

On the other hand, new construction of plants in regions facing a steep increase in energy demand is extremely expensive. The investment needed for a completely new plant often cannot be afforded.

In such a situation, purchasing an existing plant, followed by dismantling and re-erection of the plant in a region with appropriate demand, appears to be a natural solution.

That this can be achieved technically has been shown by the power plant owner Korea Midland Power Co. (KOMIPO) from South Korea, for instance: From 2009 to 2012 they relocated a 15-year old, efficient 500 MW CCGT unit within their own country to a location about 180 km away. For this purpose the existing unit had to be carefully disconnected from

the common-use facilities without disrupting normal operation. The disassembled plant was packed into 7,500 separate modules for shipment. Furthermore, the gas generators were upgraded, and heat extraction for district heating was added; these two measures together increased the efficiency of the unit from 51.6 percent to 82.8 percent. In 2013, this achievement was recognized with the Marmaduke Award for excellence in power plant problem-solving, as was reported online in POWER magazine.

All technical components, starting from coal handling and feeding machinery and coal belts, important elements of the water-steam cycle and up to the flue gas cleaning systems are potential candidates for power plant relocation (see Figure 2.1). When it comes to examining the marketability of a coal-fired generating unit, we differentiate between about 10 to 15 main components; In coal-fired power plants with capacities of less than 60 MW it is even worthwhile to examine a relocation of the steam generator.

In gas-fired plants, however, coal treatment and feeding and most of the flue gas treatment systems are not existent (see Figure 2.2).

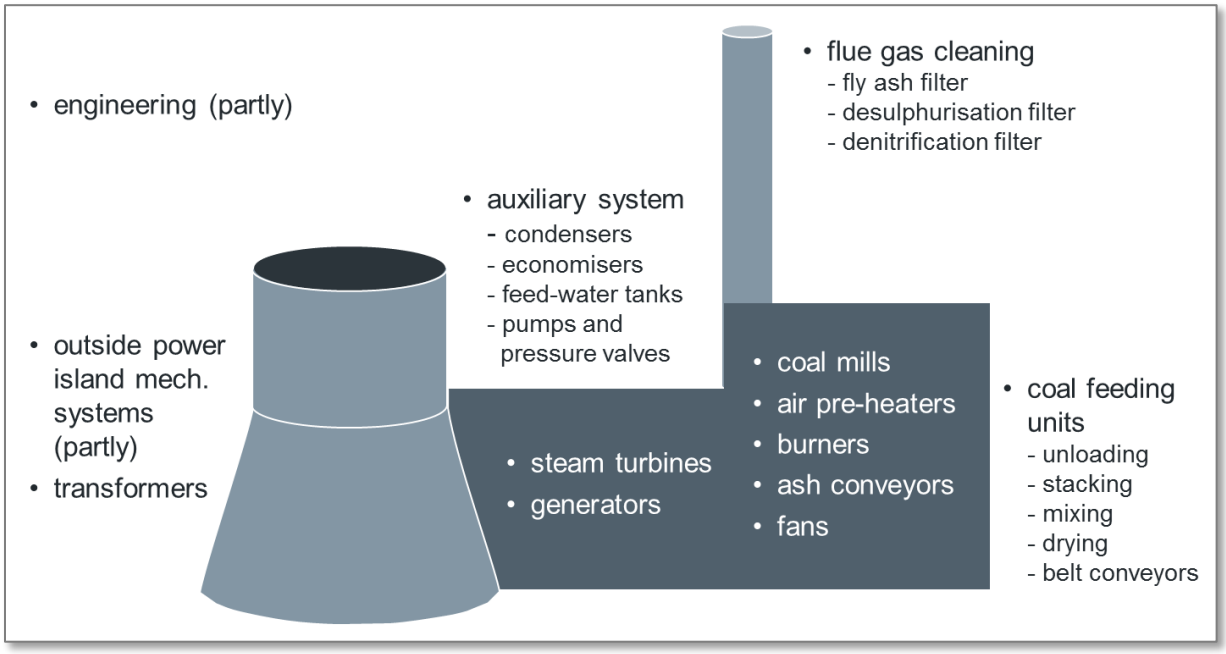


Figure 2.1: Re-usable components of second-hand coal-fired power plants

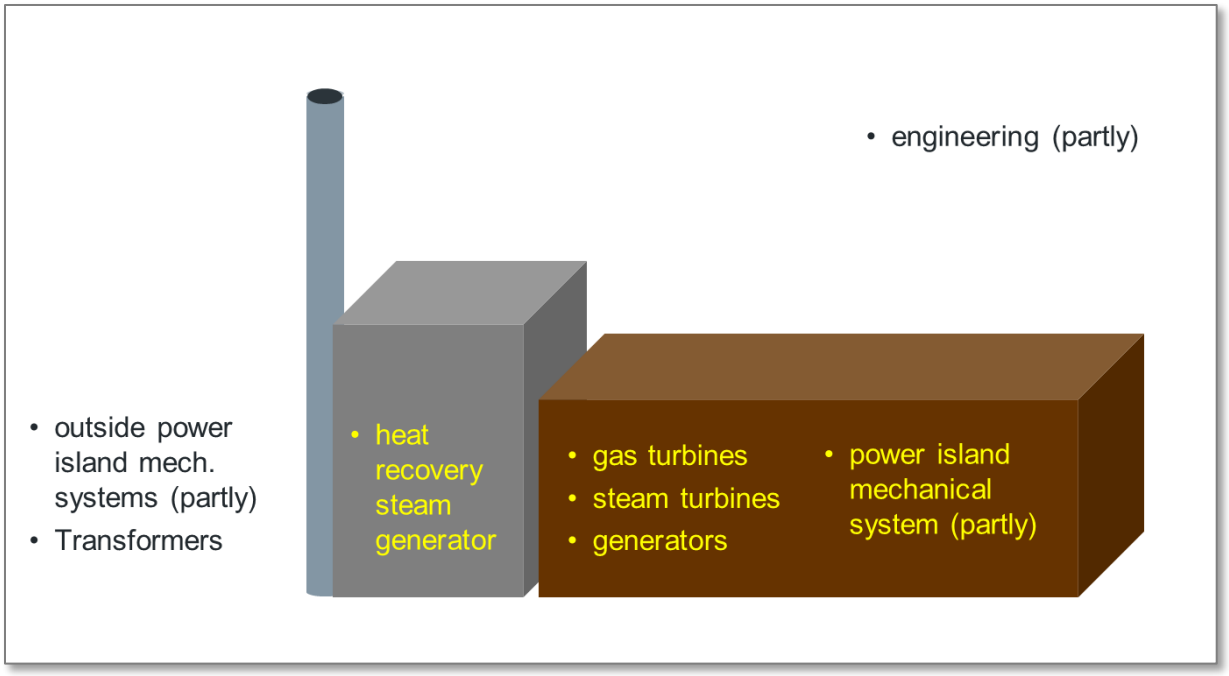


Figure 2.2: Re-usable components of second-hand combined-cycle gas turbine power plants

Figure 2.3 illustrates that, according to our studies, in ideal cases and depending on the type of power plant, components with a value of between about 35% and 50% of the overall investment of a new-build project can be reused. Plant components whose relocation is not economically efficient, for instance buildings, chimneys, cooling towers, cables and pipework are not suitable for reuse; instrumentation and control systems are not reusable either, at least where older plants are concerned. Also the money spent on construction and commissioning cannot be recovered. However, an investor can save up to 40 percent of the cost involved in engineering if he uses an existing plant.

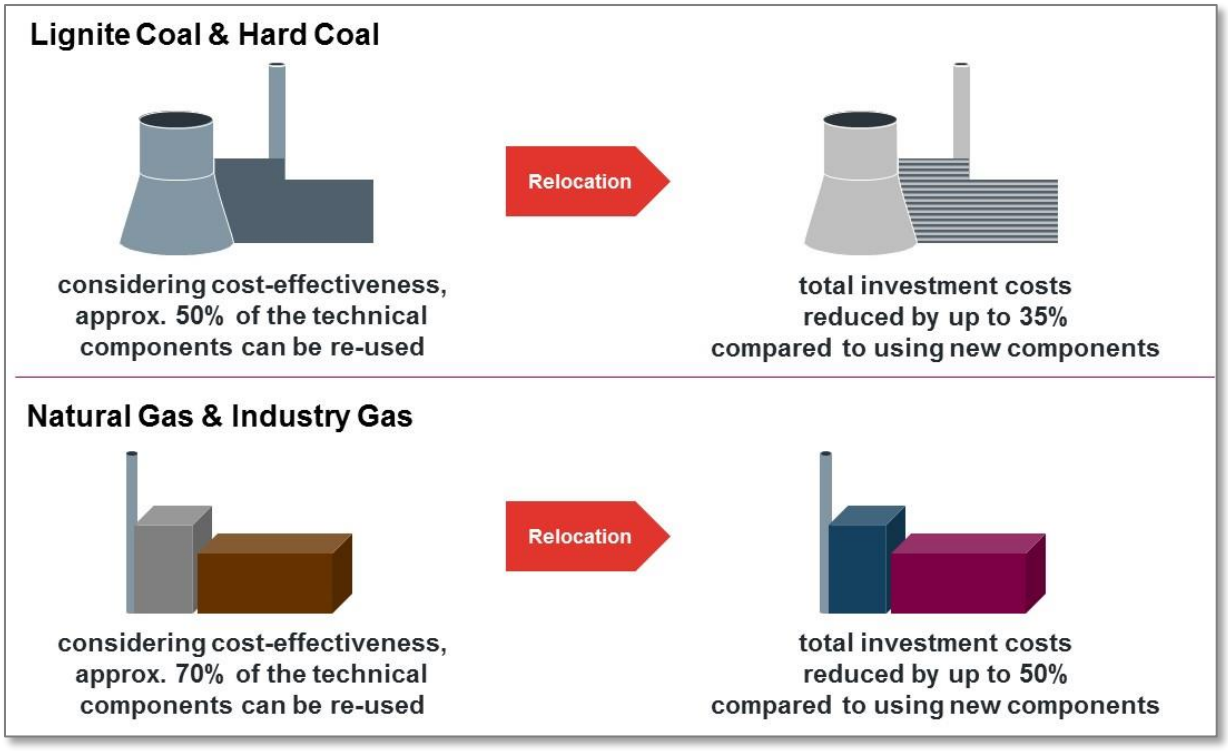


Figure 2.3: Potential savings of investment costs when using second-hand units

3. What drives relocations? – Money changes everything

Also in Europe, relatively young power plants or generating units that have been subjected to costly retrofitting and modernization are becoming unprofitable as the energy transition proceeds. Consequently, even plants and components that have been operated for considerably less than 10 years are up for sale.

On the other hand, industrialization in many emerging economies is progressing at breathtaking speed. Apart from the growth in world population, we also face a trend towards increasing urbanization and man's urge for mobility. As a result of these trends, energy demand is rising rapidly in these countries and new generating capacity has to be added rapidly. Quite often, it is not possible to fully cover this capacity demand within the given short time frames by building renewables-based plants.

So the challenge is now to rethink energy production both in terms of project economy and of a global approach, and bring together the players from the different regional markets. In other words: sellers and buyers must find each other.

Apart from general environmental benefits such as conservation of resources, reusing second-hand power plants benefits both parties:

The purchaser gets a plant which meets the European quality, safety and environmental standards. Older power plants which are now to be decommissioned, have been modernized repeatedly. Most of the plants are state of the art. Using a second-hand plant, the purchaser can save up to 40 percent of the engineering costs involved in new-build projects. For a comparably **low price**, the purchaser gets mature technology that has demonstrated its operational capabilities for years. In countries having direct access to coal or gas as fuels

while lacking trained specialists, a robust, second-hand plant may often be a better choice than a brand new plant.

Especially plants from Europe satisfy the highest requirements in terms of quality, safety and environmental compatibility. Furthermore, when re-using existing power plants, purchasers can benefit from shorter engineering and delivery periods for power plant construction or for technically complex components.

Benefits for buyers:

- Significantly lower investment costs
- Modern and ultra-modern technology meeting European standards as regards safety and emissions
- Plants designed and manufactured for reliability, durability and many operating hours can be integrated well into existing systems
- Quick availability of the plants to meet basic energy supply requirements in other regions of the world facing increasing energy demand
- Opportunity to purchase plant components with the exact residual service life needed at bargain prices
- Securing electricity supply in emerging economies until sufficient renewables-based generating capacity can be built up
- Use of readily available parts – for instance after cases of damage – in order to keep the plant on line
- Prior to decommissioning of the existing plant, the buyer can have his own staff trained and familiarized with the plant in real-life operation.

But also the sellers of the power plant units can benefit. In most cases, the revenues from the sale of used components are significantly higher than the scrap value. This applies all the more, the more comprehensive and coherent the reusable components are. In an ideal case, the power plant can be marketed almost “as an integral whole”. However, it is a basic precondition for successful marketing that the purchasers be allowed sufficient time, because as investors they need time for their own approval and decision-making processes. Therefore, owners of existing power plants should think about marketing their used plants well before the date scheduled for decommissioning.

Benefits for sellers:

- No disposal and dismantling of operational plants at seller’s own cost
- Sales prices significantly above scrap prices
- Stocks of materials needed for maintenance/operation of the plant can also be sold
- During decommissioning, seller’s own staff can be involved in training of purchaser’s staff

However, probably the most powerful value lever for power plant owners in the decommissioning of plants is the sale of re-usable components. Where power plant owners after decommissioning – or even better before decommissioning – make the decision to sell their unit or its components on the market, it is possible to significantly increase the chances of the intended sales or achieve additional revenue by focused international marketing.

4. What is the investment challenge? – Convincing investors and financing institutions

One of the biggest challenges is finding and convincing buyers.

Especially when it comes to power plant new-build projects or overall plant improvement projects, the use of second-hand components should be considered at an early stage; once the technical planning and engineering has begun, it is usually too late to include existing components.

Awareness of the availability of second-hand plants might even trigger the investment decision as such.

The solution to this challenge is in the marketing approach: identify capacity demand in the region of potential purchasers at an early stage and contact potential investors directly.

In addition to the cost benefit, it will in any case be necessary to provide the potential purchaser with assurances concerning the permitting procedure, the right to import second-hand plant and equipment, financing and warranties/sureties, the latter both for commissioning and for the initial years of operation.

In order to achieve this, the potential purchaser should be professionally advised by the marketer. This may be supported by feasibility studies or by identifying and attracting suitable capital providers and financing institutions. Warranties/sureties can be procured in the market, although it would be better if the marketer in his role as a planning and civil engineer also performed certain services in relocation and reconstruction at his own risk and thus himself covered this risk for the purchaser.

Where replacement of an existing system or component is concerned, for instance because a component cannot be repaired any more or is to be replaced for efficiency or environmental reasons, it is especially the technical suitability of a component that counts. To verify suitability, a detailed description of the existing plant part is required, i.e. apart from the mounting situation also the technical parameters must be known. The more precise and clear the needed information prior to commencement of marketing is, the more successful will the match be.

5. What is the trading challenge – Combining networking with a technical match

As illustrated in Figure 5.1, three preconditions must be satisfied for successful marketing:

a) The components to be reused must be immediately reusable, or be reusable after a maintenance service or overhaul at least.

b) Time and the right means to find and approach potential purchasers.

c) Advisory services for the purchaser, starting as early on in the planning process as possible, and continuing up to the commissioning of the new plant involving second-hand equipment, if appropriate.

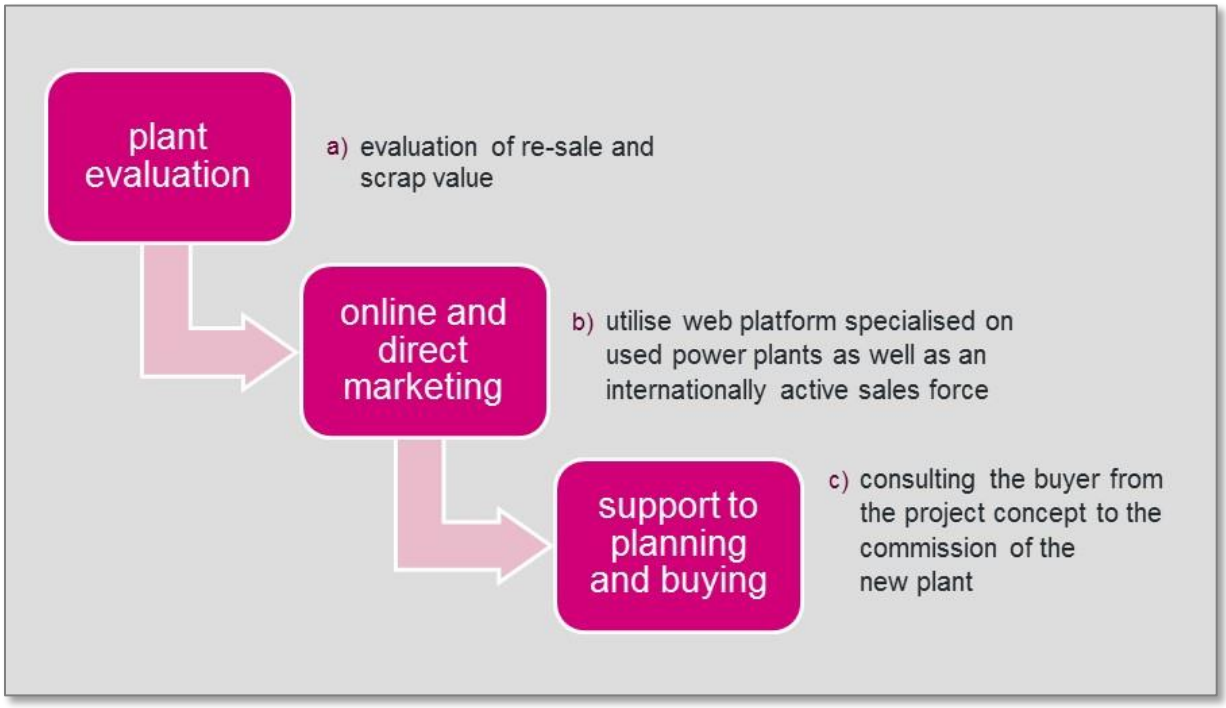


Figure 5.1: Preconditions for marketing success

a) The evaluation (estimation of sale and scrap value) is a basic prerequisite of the process of covering against risks in the process as a whole.

The evaluation model for power plants should be standardized to the greatest extent possible, in order to produce a sound and reliable assessment with minimum time effort. Typically, it should not take longer than 8 weeks from the date of an on-site inspection until the results of the site inspection and evaluation can be shown in a presentation and discussed.

In the context of the evaluation, about 20 plant systems and main components, with a total of approx. 150 constituent parts, are basically considered to be re-usable and are evaluated in this respect.

Data and results are recorded and documented according to a defined structure. The components and parts are classified as “immediately reusable” or “reusable following overhaul”; components that are not classified in either of these categories are deemed to be

not reusable. The estimated degree of reusability is rated in percent, depending on the necessary overhaul/repair effort and expense, and comments are added where appropriate. The assessment report includes a summary and tabular overviews of all recorded and examined components and parts. Figure 5.2 shows an example of such a tabular overview.

Overview

Coal ans Ash Handling System

	availale	not available	re-usability: immedeately	re-usability: after overhaul	re-usability: not re-usable	estimated international demand
Distributors	☑	☐	☐	☑	☐	see comments
Coal mills	☑	☐	☑	☐	☐	very high
Pulverised coil ignition supply system	☐	☐	☐	☐	☑	medium
Ash conyeing system	☑	☐	☐	☑	☐	low
Fly ash disposal system	☐	☑	☐	☐	☐	

Figure 5.2: Example of evaluated reusability

A market analysis is crucial to the success of the transaction. The following example presents an overview of the parameters that can be used to evaluate the process in order to increase the chance of sale. From this, a recommendation for a target group-specific marketing strategy should be derived. This strategy could, for instance, differentiate between marketing for sale of individual components and marketing for sale of the plant as a whole to a public utility or a large industrial enterprise with captive generation capacity.

Once the reusable components are known, the evaluation should also include:

- assessment as regards sale of the plant as a whole or sale of selected, usable components only
- assessment of necessary repair effort and expense, if any
- assessment of buyer's market
- assessment of chance of sale
- assessment of sales revenue above scrap value
- recommended actions

Figure 5.3 illustrates the example of an overall plant whose marketing potential was assessed as good. Here, groups of potential buyers and promising regions for relocation have been identified in a simplified, generic manner. World-wide experience with second-hand equipment and the sales network in this field permit a traffic light assessment of the chance of marketing success, from low (red) to high (green).

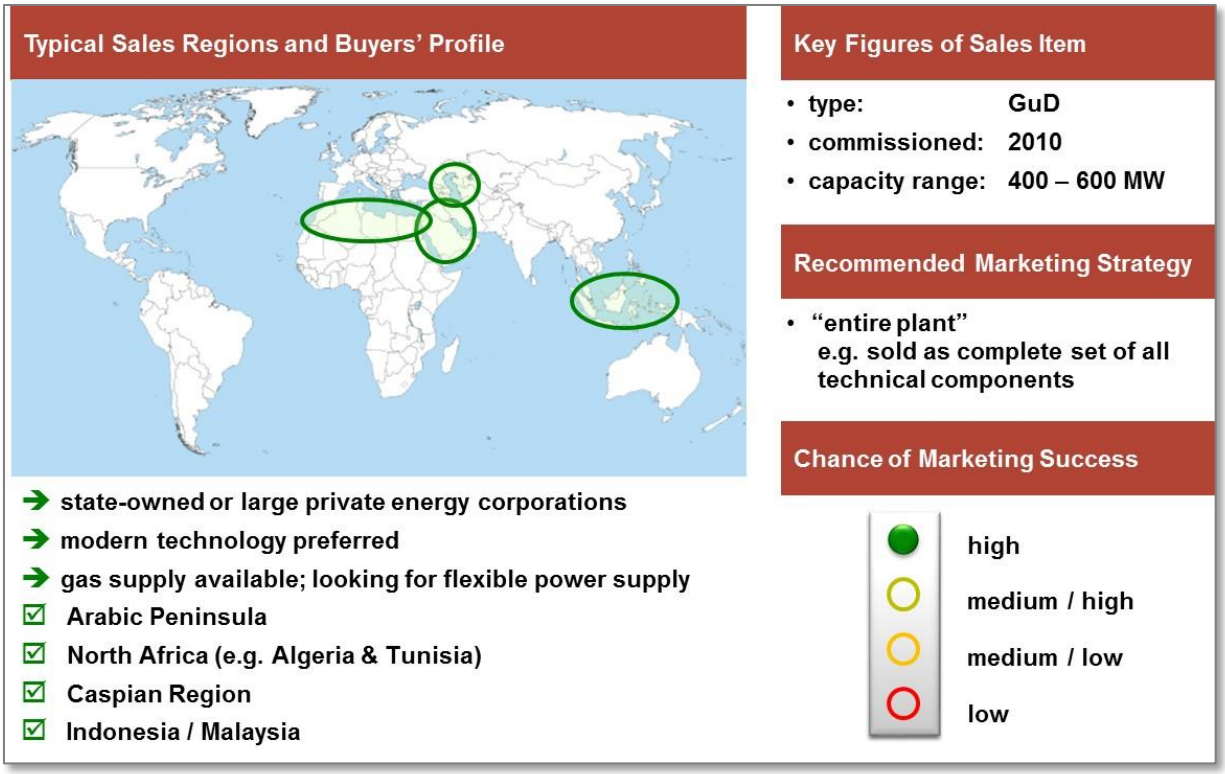


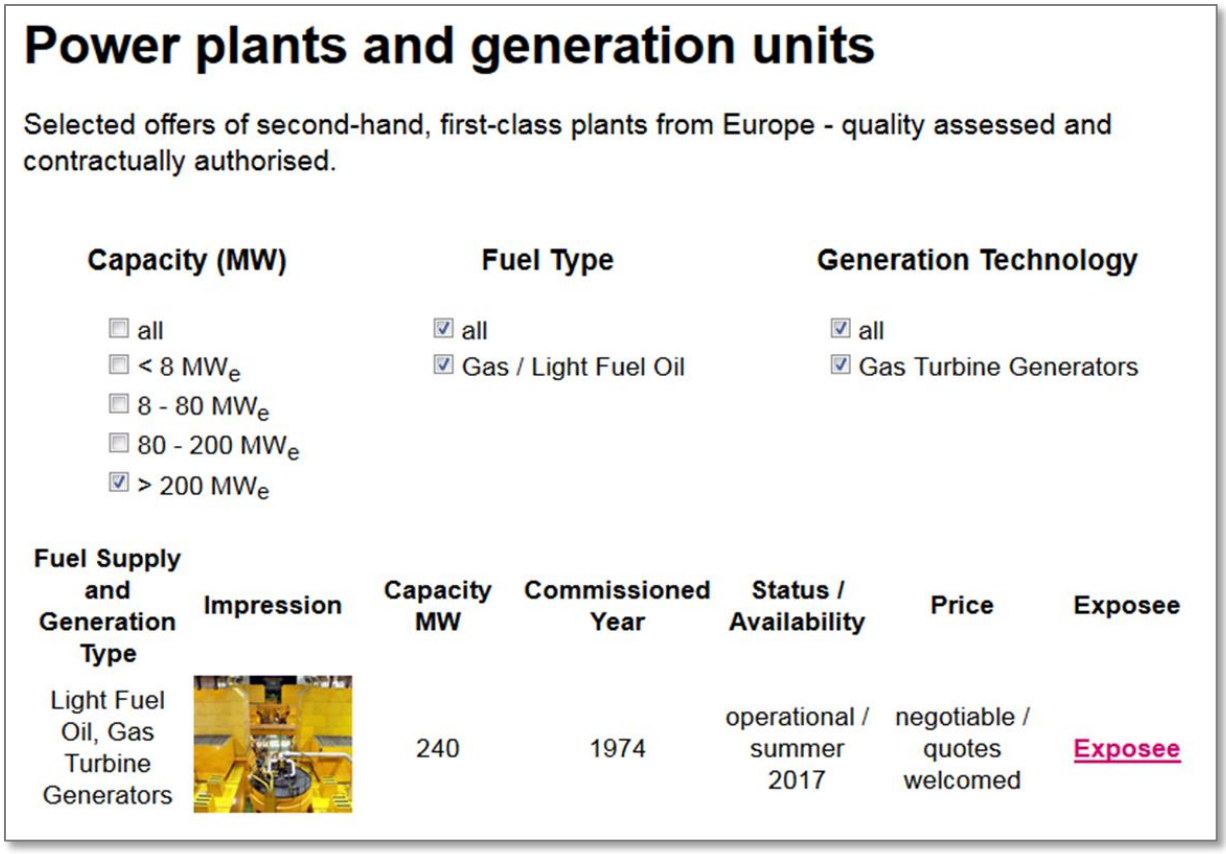
Figure 5.3: Summary of marketing potential assessment

b) Time and appropriate means

Planning the sale in good time is crucial: On the one hand, the potential new owner will have to go through planning and permitting processes and will have to secure funding before the purchase transaction can take place. Even if a buyer is found who is immediately interested in buying the plant, this may well take one or two years if the plant is bought for reuse in a new-build project. Sellers will need some patience until dismantling work can begin at the old plant site.

On the other hand, plant owners tend to address the issue of marketing their plant only after the plant has already been closed down. Selling a decommissioned power plant, however, is more difficult than a plant that is still in service. Launching the marketing process before the plant is shut down considerably improves the chances of finding potential buyers.

Another success factor is marketing, which is structured in two steps in order to ensure that as many potential buyers as possible are reached. The internet is used as a far-reaching medium to provide a platform for quick information on both plants that are up for sale and plant purchase requests (see Figure 5.4). It is important that the information here is presented both from a technical viewpoint and from a managerial viewpoint.



Power plants and generation units

Selected offers of second-hand, first-class plants from Europe - quality assessed and contractually authorised.

Capacity (MW)

- ☐ all
- ☐ < 8 MW_e
- ☐ 8 - 80 MW_e
- ☐ 80 - 200 MW_e
- ☑ > 200 MW_e

Fuel Type

- ☑ all
- ☑ Gas / Light Fuel Oil

Generation Technology

- ☑ all
- ☑ Gas Turbine Generators

Fuel Supply and Generation Type	Impression	Capacity MW	Commissioned Year	Status / Availability	Price	Exposee
Light Fuel Oil, Gas Turbine Generators		240	1974	operational / summer 2017	negotiable / quotes welcomed	Exposee

Figure 5.4: Example of a used gas-fuelled power plant from the online database of the troveo trading platform (with exposé download option)

Finally, it will be necessary to provide flanking support for the sales process, because the power plants often lack resources for such activities, as their staff is tied up in daily business. The support provided should address the need to create a legally sound framework for the sales transaction.

c) Services for buyers

Reuse of second-hand plants can help to achieve significant cost savings. Furthermore, in the case of damage to existing plants, use of second-hand components can help to avoid long downtimes, because delivery periods for new plant components may be quite long.

Thus, in both cases mentioned, operating periods can be achieved or extended at reasonable expense, which would not be viable with new components.

From the buyer's point of view, the following requirements are important in this context:

- Support for investment projects and plans
  - Pre-feasibility studies
  - Feasibility studies related to markets and technology
  - Commercial feasibility studies including business cases
  - Consulting on warranties, guarantees and financing

    - Assistance in approval and permitting procedures
    - Support for investment decisions
    - Support during project planning

- Support for investment and construction projects, also in the capacity of an EPC contractor
    - Support and implementation of tendering procedures
    - Organization and monitoring of dismantling and transport
    - Supervision of construction and field erection
    - Integration of components into existing plants/systems, including engineering
    - Commissioning and provision of warranty, if requested

- Operation & maintenance management

6. What's the Conclusion? – Used is the new "NEW"

Due to the energy transition in Europe, securing profitable power plant operation has become more of a challenge than ever before. This is one of the reasons why more and more plants of all age groups and sizes are decommissioned – plants which could be used elsewhere.

One task in the power generation market is to act globally and within networks. This means not only focussing on knowledge transfer and use of best available techniques but also bringing sellers and buyers together and supporting the sale and purchase process and the tasks of physical and technical plant relocation up to commissioning.

This approach benefits both of the parties to the deal and allows generating capacity to be built rapidly. In newly industrializing countries, sufficient energy supply is a fundamental prerequisite of economic growth. A capable and strong economy can in turn be conducive to timely investments in the energy sector that are necessary for the transition to renewable sources of energy and thereby facilitate a global energy transition.

In conclusion, experience has shown the following factors to be important for the success of the marketing model:

- Detailed and accurate knowledge of the condition of the plant and the plant parameters
- Timely and foresighted marketing of plants in order to avoid loss in value
- Use of opportunities of both direct marketing and marketing via the internet
- Knowledge of the energy market and planned capacity additions
- Timely identification of potential markets and purchasers
- Involvement of purchasers in a very early stage of capacity expansion plans and investment projects
- Covering risks in the sales and purchase transactions by facilitating financing and warranties

7. troveo – Who's behind it?

troveo is an independent marketer of second-hand power plants and components. In addition, troveo consistently supports the sales process from the assessment of the plants or selected items to relocation and commissioning of such plants or their components.

troveo combines the skills and expertise of SPRINT! Energy Consulting and VPC in a joint venture (see Figure 6.1).

VPC is an engineering company for power plants. With its expertise, VPC covers the entire life cycle of power plants including engineering, construction, commissioning, operations management, maintenance, decommissioning and dismantling know-how. The technical expertise is supplemented by consulting and project management services. VPC – that is more than 750 staff at locations in Germany, Serbia, Turkey and India.

SPRINT! Energy Consulting is an advisory company for companies active in the energy sector, with a focus on detailed assessments of thermal power stations and marketing of existing plants or their main components. SPRINT! has a network of internationally experienced sales staff in the fields of power plant construction as well as marketing and sales.

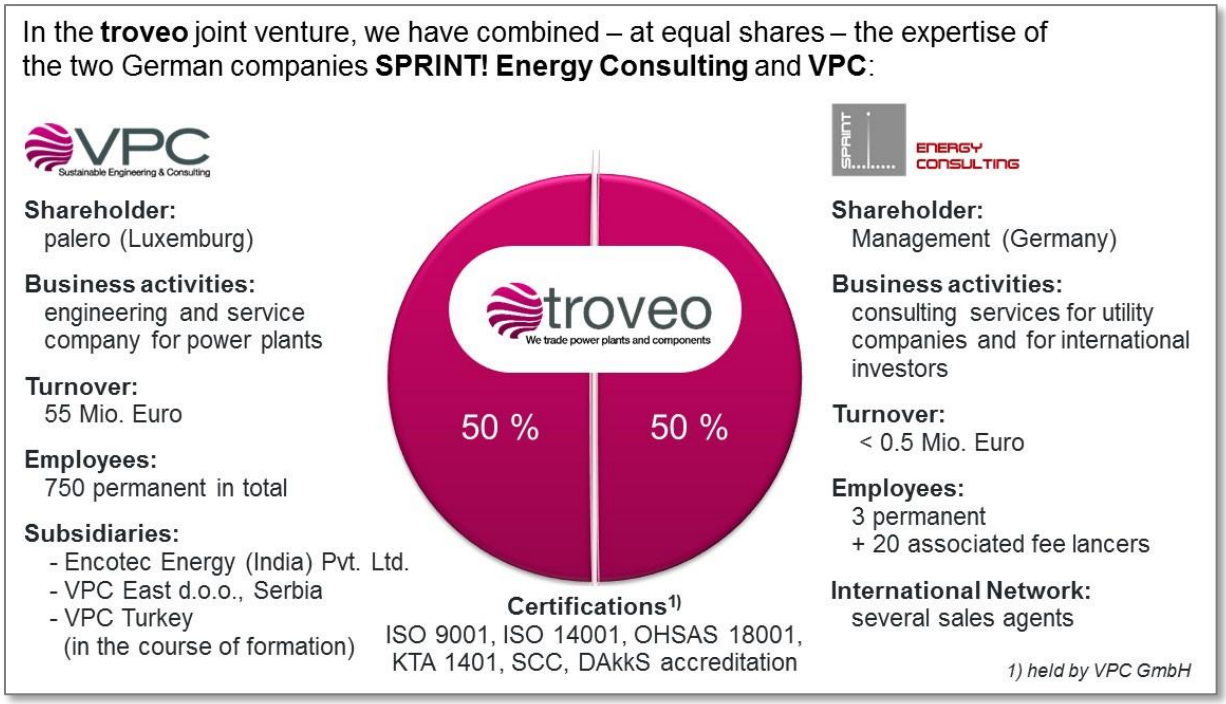


Figure 6.1: The troveo joint venture partner companies