CODE2

Cogeneration Observatory and Dissemination Europe

D2.1 CHP Awareness Case Study
GERMANY

November 2012

Chapter 1: Introduction

The decision for Germany as the pilot country of the northern region was made due to the dynamics of CHP awareness and market expansion in the last years and the expected continuation. Actually Denmark and Finland with 50% and 39% have achieved significantly higher CHP shares of electricity generation than Germany (15%), but these results are based on most favorable conditions. For Germany an enormous CHP electricity potential of 351 TWh/y has been reported to the commission, which would allow an increase of the CHP electricity by 400%[1].

Germany is also assessed as particularly interesting as a pilot country because of the significant role of the growing recognition of cogeneration. Additionally with the current development of small-and micro-CHP markets important technical innovations are taking place which appear essential for the further development of the European cogeneration potential.

CHP in Germany is practiced in the industry since the beginning of industrialisation; however, autoproduction was replaced here in part during the expansion of nuclear energy starting in the 60s. For the production of low-temperature heat cogeneration was used until the late 1980s almost exclusively in the context of district heating systems in large and medium cities, usually operated by local public utilities. District heating is currently offered in approximately a quarter of 12,000 cities. It has a share of 14% of the total heating energy consumption. It was not until about 1990 that increasingly smaller CHP systems based on combustion engines in swimming pools, office buildings, hospitals, and in small private networks were installed. In district heating schemes and industry, increasingly gas turbines and combined cycle plants were used. Starting from 1996, in Germany the World´s first mass-produced micro-CHP systems were brought into the market.

By substantial improvements of the first CHP Act, 2009 and 2012 the conditions for further expansion of CHP were laid. The declared goal is expanding the CHP share of electricity generation by 2020 to 25%.

Overall, since 2002 by the CHP Act through 2009 26,906 plants were promoted.[2] Their net electricity generation totaled 71,891 GWh /y, the net heat generated 152,950 GWh /y and the installed CHP capacity 40,736 MWel. Significant increases were recorded in the municipal (+6.3 TWh / y) and industrial CHP plants (+4.2 TWh). On the other hand the production of non-municipal CHP public utilities sector decreased by 3.7 TWh. The introduction of a CHP bonus in

[1] The factor depends on the base number. In the reference year of the potential study it was calculated with 58 TWH whereas a new statistics for 2010 with a revised methodology including CHP electricity from condensation power plants and Bioenergy calls 90 TWh/y of CHP electricity.

[2] Zwischenüberprüfung des Kraft-Wärme-Kopplungsgesetzes, Bericht der Bundesregierung an das Parlament, 11/2011.

the Renewable Energy (Power) Act 2004 led to a significant increase of CHP electricity from bioenergy from 0 to 5.9 TWh/y.

In total the CHP share in power production increased in the period from 2002 to 2010 by 13.9% to 15.4% (89.9 TWh /y).

Table 1: Assessment of the current CHP awareness situation in the most important social groups.
Based on discussions with experts of associations and companies, 2012.

Group	CHP Awareness situation
General public	For the ordinary citizen CHP was and is mostly still a "far-away- technology" out of his field of vision. Just with the introduction of micro-CHP cogeneration comes increasingly into the scope of the general population. As far as known by citizens good image as a decentralised, citizen close, green technology.
Media	In the energy and environmental media meanwhile well known. Good image: decentralised, environmentally friendly, citizen close. The daily papers are mentioning CHP still little. Problem: issues are linguistically difficult to process for ordinary journalists.
Policy	Against the background of the "Energy Transformation" good CHP image, high priority for all parties in the parliament. Increasing support for cogeneration in the federal Länder.
Energy industry	Increasingly high priority for cogeneration, mostly good image, particularly in the younger staff. Protagonists of centralised power generation are in the defensive. Opponents of the CHP silenced more and more.
Industry	CHP is well known in principle, but there is a lack of technical, economic and legal know-how to implement it despite good business case.
Other potential user groups (commercial, hotels, …)	CHP is still little known.
Energy consultants	CHP is known in principle, but often detailed know-how is missing.
Energy agencies	CHP is well known and promoted by the 32 German regional and local energy and climate agencies.
Planners	CHP is known in principle, but often detailed know-how is missing.
Installation companies	CHP is known in principle, but often detailed know-how is missing. Since 2010 distance learning courses for the installation of micro CHP are offered (see below).

Architects	CHP solutions are mostly known only superficially. Focus on solar thermal, heat pumps and pellets.
Academic world	Only a minority of universities and technical colleges deals with CHP; good knowledge only in a few institutes.
Environmental NGOs	Good image: decentralised, environmentally friendly, citizen close.
Banks; Leasing	no major problems for CHP financing are reported; special credit programs with favourable terms are offered from the state KFW bank

Chapter 2: Awareness of CHP in Germany

2.1. Policy level

In Germany, awareness and importance of cogeneration in the energy and environmental policies have seen a remarkable development in the last 5 to 10 years. While cogeneration in many parts of the established electricity industry and in politics had been disregarded largely and partly even deliberately ignored and discriminated against, it is now recognised by all parties in Parliament and throughout the energy industry as an important element of the planed "energy transformation".

What led to the positive development of the image of cogeneration in the political perception? Overall, in Germany the realisation has grown that resource scarcity and climate change are forcing a restructuring of the energy supply system. Energy-saving and replacing fossil fuels with renewable energy have considerably climbed up in the last 10 to 20 years on the political agenda. This process of understanding and developing an awareness of the problem occurred in mutual interaction between science, politics, media, NGOs and the public.

Regarding the question what could be done to solve the problems, the general perception focused mainly on the substitution of fossil fuels with renewable energy sources. This was mainly due to the early introduction in 1991 of the state support of electricity production from renewable energy sources which led to a massive expansion in particular of electricity from wind power and solar energy. They also constituted for many people an interesting opportunity for investment by building their own photovoltaic systems or financial participation in particular wind and solar farms, but also in bioenergy projects. For these reasons, renewable energies became an increasing important issue being enforced by treating accordingly strong in the media.

There was also a growing importance of energy saving measures at the level of individual consumption of electricity, fuel and heat. Awareness on these issues increased on the one hand

by rising prices for these energies, on the other hand by politically launched information measures such as consumer information and mandatory product labelling.

2011 after the Fukushima nuclear catastrophe it became a broad consensus in politics and society to end the production of nuclear power. Additionally in recent years has turned out that in the population there was a strong resistance against the construction of new coal-based power plants. This background increased the awareness and the value for the option CHP. In the energy and environmental policy debate it is regarded as a low cost decentralised and environmentally friendly alternative to nuclear and coal fired power production.

2.2. General public and main involved groups

The now attained positive image of the CHP at the political level has to be distinguished from the awareness in the general public. As far as known, no published investigations have been made concerning this. However, based on the experience of the author and additionally taking into consideration several experts opinions, which are all consensual, it can be stated that in the population the combined heat and power generation is still known by a minority of the citizens. Just in the last few years with a growing number of daily press reports and manufacturers advertisements on the upcoming new micro CHP devices, the awareness of Cogeneration seems to rise perceptibly. According to the published result of a poll[3] made by the LPG supplier Primagas in January 2012, already 32% of the citizens know about the new technology for electricity and heat generation in private homes (men 46%, women 19%), with a remarkable peak of 56% beeing reported to have been found in smaller towns up to 20.000 inhabitants.

In comparison to renewable energy, cogeneration as an important option for reducing energy costs and climate protection is still relatively little known in the population. The preconditions for increasing awareness, however, have now improved significantly.

2.3 Previous PR activities for CHP

The roles of different associations

B.KWK

With the aim to gain a reasonable role of CHP in the energy debate, 2001 the German CHP Association B.KWK (www.bkwk.de) was founded. Its tasks were to bundle and represent the interests of the entire CHP across all branches, technologies and input fuels and to communicate the chances associated with its major expansion to politics, media, industry and the public. B.KWK is regularly offering general information on CHP for all applications in workshops, seminars and on stands in some relevant fairs (Enertec, Hannovermesse, Renexpo). Since 2006 they also organise each year a CHP conference in cooperation with the State

[3] http://www.presseportal.de/pm/29273/2187494/jeder-dritte-kennt-mikro-blockheizkraftwerke-mit-bild

government of Rhineland Palatinate and the "Transferstelle für Rationelle und Regenerative Energienutzung" at the Fachhochschule Bingen. An important issue for the development of cogeneration facilities in the industry is the development of contracting services through specialised companies and energy utilities. Since 2008, CHP manufacturers and ESCOs present themselves each year in the world's largest industrial fair in Hannover on a joint stand under the umbrella of the B.KWK and the contracting association ZVEI ESCO Forum. For heat contracting companies seminars on cogeneration are offered regularly by the Association for heat supply (www.energiecontracting.de). In 2005 for the first time, the B.KWK organised a joint stand on micro-CHP on the important trade fair for heating installations (ISH, Frankfurt /M). In a much-publicised press conference, the message was conveyed that the micro-CHP will in a few years replace the condensing boiler as the most efficient heating systems for single family houses. The effect of the action was that for the first time major newspapers reported extensively on micro-CHP and attention to this new technology in installation companies and energy consumers rose sharply. This increased, beyond the micro CHP issue, the general interest in CHP as a key efficiency technology, with additionally a positive impact on the political status of the CHP.

Berlin Energy Agency

2008 the Berlin Energy Agency has initiated the project "KWK Modellstadt Berlin, running up to 2011. In this initiative for the first time in Germany some important energy companies and the government of a federal Land of Berlin have been assembled to cooperate in informing the public on CHP and its advantages for protecting the environment and saving resources, simultaneously being a powerful signal to all decision makers in energy industry as well as general industry and all other decision makers that CHP is an essential element of a sustainability strategy. The initiative launched a broad information campaign for CHP and it advantages, thereby using uncommon pictures addressing not in the first line the technical intellect - see www.kwk-modellstadt-berlin.de. The initiative developed the first teaching material focusing on CHP in an interdisciplinary approach in Germany and distributed them to all secondary schools in Berlin.

AGFW

The exchange of experience on technical, economic and legal issues concerning the

development of the district heating in Germany is technically supported by the DH association AGFW (www.agfw.de). PR activities were in the past limited to the supply company level. For the first time on a federal level, in October 2009 AGFW in cooperation with the German Association of combined heat and power (B.KWK) launched an image campaign for district heating. The aim was to encourage the district heating companies for increased PR work per district under a single brand using a common website (www.fernwaerme-info.com) and the following logo[4].

VIK: Industrial energy users

VIK (www.vik.de), the Association for Industrial Energy Management, provides information and advice including CHP in industry use for more than 20 years by an affiliated consulting company (EnB GmbH). The Federal Association of combined heat and power (B.KWK) started in 2010 with the financial support of the Federal Ministry for the Environment, an information campaign for industrial cogeneration under the title "New opportunities with industrial cogeneration: producing efficiently - economising sustainably" (www.bkwk.de / industry). Both, special brochures are offered and branches tailored workshops.

Gas sector

(Fördergemeinschaft Blockheizkraftwerke)

Other heating market (covered by small and micro-CHP)

The expansion of the market for CHP beyond district heating and industrial use to individual buildings by introduction of small-and micro-CHP plants was mainly driven by the gas industry, who founded in 1991 an initiative for supporting small scale CHP (Fördergemeinschaft Blockheizkraftwerke). Its task was the distribution of brochures, press releases, as well as lobbying for improving the policy framework for CHP.

ASUE

By the ASUE (www.asue.de), an organisation of the gas industry, who promotes technological innovation, in the following years, were launched intensive information activities about micro-CHP under the term "power-generating heating" (www.stromerzeugende-heizung.de). This term was designed to allow an immediate intuitive understanding of the new technology.

Education

[4] The subtitle "rein ins Haus" means both "clean into the house" and "go into the house".

2010 the Craft Association of Plumbing Heating Air North Rhine-Westphalia launched Germany's first distance learning course for Micro CHP technology. Unlike simple boilers these devices require comprehensive planning, exact sizing and special abilities of the installer during installation and the subsequent tuning and optimising the system. The learning course for "SHK-Kraftwerker" can be used by all guild specialised companies HVAC association organisations in Germany. The course consists of three course letters in 10 weeks and 2 days of attendance at the Centre for Environment and Energy of the Chamber of Düsseldorf in Oberhausen with subsequent testing. Entering the course cost 450 €. (Details see http://shk-nrw.de/weiterbildung_fernlehrgaenge.php?id=107). It is reported that the offer is being well received. By mid-2012 more than 200 participants have passed the exam. However, this is not more than a first foot in the door. Related to the existing 49,650 installation companies in Germany with 271,000 employees it´s still vanishingly few.

Chapter 3: Conclusions: Importance of Awareness in CHP success in Germany

Today, the full range of diverse applications in the heating market with different temporal patterns of consumption, temperature requirements, and requirements for flexibility and control capability can be covered by CHP. The recent successes in both the market and at the political level have been achieved only by an increase in awareness of CHP. But the technical options of cogeneration and their economic and environmental advantages are currently still not wide spread in all potential user groups. Additionally CHP requires for all involved stakeholders more knowledge and prudence, as the generation of only heat in boilers or only electricity at power stations.

So one attribute of CHP lies in its relative complexity in terms of technology, planning / design, approval and funding issues as well as in their specific resulting high standards of planning and information transfer. The know-how capabilities in these areas in the energy industry as well as in the general industry are still low. They might be the limiting factor for an expansion of CHP. In addition, any planner and consultant, who cannot inform on CHP and work with it because of his low own information status might actually constitute a "living obstacle", because he will rather tend to advice against CHP installations and recommend conventional solutions. On the other hand, every expert for heat installations in the whole heating market, who has become familiar with CHP, will also be, more or less, a multiplier. So according to the opinions gathered in many discussions with experts, the lack of specific skills might be one of the most important barriers to CHP which has to be overcome.

A steadily increasing number of providers of energy systems and services is discovering CHP as a new economic business area because of the range of applications and favourable support

mechanisms But the initiatives in industry and commercial to accelerate this development yet remain low. A systematic acceleration of training CHP related skills as well as the promotion of information could booster the growth of CHP and strengthen in a very cost effective way the existing financial support measures

Best practice case studies

The importance of awareness of CHP for the realisation of specific projects is also evident in the case studies in the case studies which follow. These have been chosen as best practise for Germany and the influence of awareness can be seen in all of them. There are:

Both the hospital and the hotel projects arose from the participation in an association led information event where the owner or a relevant person of the organisation hear of the cogeneration option for the first time. These events were decisive in the process of bringing the projects to fruition. In the case of the brewery CHP was known already in principle within the organisation. In this case a new renewable energy act which, in connection with the objectives to reduce CO2 emissions, was the trigger for a closer examination of a CHP solution. The existing experience and awareness of the organisation led it naturally to consider CHP in its new project plans in area unconnected to traditional fossil fuel.

In all cases the cost saving which the CHP project offered as a result of the German support scheme was an important project driver.

It is interesting that urban planning did play a role, in any of these cases.

Annexes: Two Case study factsheets on Warsteiner Brauerei and Krankenhaus Hubertus

Case study factsheet
Northern region, Germany

Warsteiner Brauerei

Food and beverage

Main CHP plant indicators

Electrical capacity (total)	MW_{el}	2,3 MW
Heat capacity (total)	MW_{th}	2,3 MW
Technology	Motor engine	
No. of units	2	
Manufacturer	AGO AG & MWM	
Type of Fuel	Natural gas	
Electricity: yearly generation	GWh	15
Heat: yearly generation	GWh	15
Year of construction	2009	
Total investment costs	EUR	3.000.000
Financing	Own founds	
State support	---	
Location and contact details	Germany, 59581 Warstein WARSTEINER BRAUEREI Haus Cramer Peter Himmelsbach, Phone: +49 (2902) 881453, himmelsbachp@warsteiner.com http://www.warsteiner.de	

Picture

General description of the case

The cooling water from the 2 natural gas driven engines, which is heated as a part of the combustion process, supplies the heat for an energy storage system through the primary heat exchanger. From there, the water is pumped to several secondary energy circles in the brew house. For optimized delivery, as well as to minimize acquisition costs, it was necessary to integrate 3 preliminary, already existing old water tanks from the defunct plant as new storage tanks. The electricity, which is generated by this process, is utilised completely by the brewery itself. The most important factor of the project is that the total amount of heat obtained from the combustion process can be used by the brewery, the main aim within the calculations for the cogeneration plant.

For this project Warsteiner was awarded the Energy Master 2010 Award: http://business-masters.econique.com/486.html?L=0.

Success factors

- Reduction of CO_2 emissions by 5.200 t/year.
- Reduction of expenses for energy.

Main barriers

- Interaction of individual hydraulic engine heat circles.
- Rapid changes in the returning temperature.

Recommendations

- Cogeneration plants provide economic benefits for the company as well as reducing CO_2 emissions.
- All factors related to the proposed plant should be calculated carefully.

Intelligent Energy Europe

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CODE2 – Awareness - Best practice case

Warsteiner brewery

1. Which role did awareness play for the realization of the project?
   CHP in the company in principle has long been known. The reason for a specific dealing with the option CHP gave the amendment of the Renewable Energy Act 2004, which supports the use of biogas in a CHP plant was interesting. A student was commissioned in 2006 to study in the context of a diploma thesis different options from the point of emission reduction and cost savings.
2. Cost-benefit/economics
   a. Figures or assessment
      Payback period 3.3 years, important overall consideration of the involvement in the operation of the factory.
   b. How important were economics?
      Together with emissions the most important criterion.
3. Is there a specific business model which applies to the best practise case which makes CHP more attractive to the customer? (service model for installation and maintenance of the CHP)
   External CHP planning expertise has been utilized. The integration in the companies operation processes, however, was based on their own expertise.
4. What was the main project driver?
   Similarly, economy and emissions reduction.
5. What project experience exists within the group who implemented the project and is this widespread?
   a. awareness
      General knowledge of CHP was already there.
   b. know-how
      Detailed planning know-how the company had to learn with external help in a more than 4 year process up to the completion.
6. Was there external funding and was there any experience within the financial sector of CHP projects?
   Self-financing.
7. Identify the role which urban planning may have played in project success for the best practise examples, including links between local authorisation and projects, approval/promotion, complexity and speed.
   No relevance.

Case study factsheet
Northern REGION, Germany

Evangelisches Krankenhaus Hubertus, Berlin

Hospitals

Main CHP project indicators

Heat capacity (total)	kW	470
Electrical capacity (total)	kW	330
Technology	Motor engine	
No. of units	1	
Manufacturer	MENAG	
Type of Fuel	Natural gas	
Heat: yearly generation	MWh	3.077
Electricy: yearly generation	MWh	2.143
Year of construction	2004	
Total investment costs	EUR	280.000
Financing	Contracting	
State support	no	
Location and contact details	Berlin, Germany; Jens Kothe, HOCHTIEF Energy Management GmbH jens.kothe@hochtief.de	

Picture

General description of the case

The CHP plant was installed replacing an unneeded second emergency generator. It is operated by an energy service company who also has installed and financed the device. The CHP feeds the heat into the return of a jointly supplied auxiliary building. A heat network, to which, additionally to the buildings of the hospital, two retirement homes are connected, is used in summer as a buffer for the daytime heat generated from the CHP. An additional emergency cooler enables the generation of electricity even with reduced heat loss. The CHP is also involved in the current peak demand management.

Success factors

The CHP plant produces an annual average of 60% of electricity and 50% of the heat demand of the hospital. It contributes significantly to the reduction of energy costs and CO2 emissions by totally 50%.

Main barriers

Initial doubts about the CHP technology in terms of economy and sound insulation were removed by an independent expertise of the Berlin Energy Agency.

Conclusions

The CHP option should be proactively communicated to the hospitals. Particular emphasis should be drawn to the possibility of reducing energy costs.

CODE2 – Awareness - Best practice case

Hubertus Hospital

1. Which role did awareness play for the realization of the project?
   In an information meeting of the Berlin Energy Agency in 1999 the technical director of the hospital was first time aware on the possibility of the energy and cost savings by producing the hospitals own electricity in a cogeneration plant. First, the idea of a realization in in-house discussions was met with skepticism, as this technology was not yet known at all. But the commercial director said he would agree to an implementation, if at least 10% energy cost savings would be achieved. This was confirmed in a preliminary external expertise. After commissioning, the hospital was awarded as the first object with the Award "Energy saving hospital" the environmental organization BUND.
2. Cost-benefit/economics;
   a. Figures or assessment
      Reduction in annual energy costs by 50%.
   b. How important were economics?
      Besides the primary economic criterion also ecological aspects have contributed to the motivation of the hospital.
3. Is there a specific business model which applies to the best practise case which makes CHP more attractive to the customer? (service model for installation and maintenance of the CHP)
   The CHP was established under an energy saving service contract, which aimed to reducing the entire power and heat consumption in the hospital. The contractor, HOCHTIEF Energy Management, has achieved a reduction in total energy costs by almost 50%. The investment and operating costs for all energy saving measures including CHP have been refinanced without grant by the hospital exclusively from the energy cost savings.
4. *What was the main project driver?*
   Reducing energy costs without capital expenditure of the hospital.
5. What project experience exists within the group who implemented the project and is this widespread?
   a. Awareness: *The hospital authorities became attentive by an information meeting on the possibility of cogeneration.*
   b. know-how: *The Energy services provider HOCHTIEF Energy Management operates about 30 CHP units in Germany with performances between 5 kW and 2 MW, thereof 4 in hospitals. So HT has appropriate technology experience with CHP.*
6. Was there external funding and was there any experience within the financial sector of CHP projects.
   State funds have been not requested. The local gas supplier granted an investment subsidy.
7. Identify the role which urban planning may have played in project success for the best practice examples, including links between local authorisation and projects, approval/promotion, complexity and speed.
   The Building Department and the Environmental Department of the responsible Berlin district of Steglitz-Zehlendorf have been involved early in the cogeneration project and have welcomed and supported it. There were no delays in the approval process.

Case study factsheet
Northern Region, Germany

Hotel “zur Brücke”

Gastronomy

Main CHP project indicators

Heat capacity (total)	kW	17 to 30
Electrical capacity (total)	kW	6 to 15,2
Technology	Motor engine	
No. of units	1	
Manufacturer	EC-Power	
Type of Fuel	Natural gas	
Heat: yearly generation	MWh	216
Electricity: yearly generation	MWh	109
Year of construction	2009	
Total investment costs	EUR	37,352
Financing	Own founds	
State support	Investment subsidy Other: Bonus per kWh	
Location	D-33428 Greffen , Germany, http://www.hotel-zur-bruecke.de/; contact: Installation company Brockbals GmbH, www.brockbals.de.	

Picture

General description of the case

In March 2009, in the small hotel additionally to a gas boiler a CHP plant with 15 kW of electric power was taken in operation after one week of installation time. Thanks to government support and 7,270 full operation hours per year, the system pays for itself in 3.5 years. The annual saving of CO2-Emissions is 76 tons and of primary energy 142 MWh (39%).

- Dimension: 1250 x x 750 1110 mm
- Weight: 700 kg
- Service Interval: 8500 hours of operation
- SPL : <49 dB (A)

Success factors

By a proactive installation company the hotel was approached and informed about the opportunities arising from the operation of a cogeneration plant. Significant influence over the investment decision was due to the investment subsidy from the mini-CHP funding 2009 of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the bonus payment for each kWh electricity produced (5,11 Cent/kWh), according to the revised CHP law 2009.

Main barriers

The first barrier was to convince the hotel owner from the CHP investment, as this technical solution was not yet known before. Although State support was an important proof of the seriousness, the bureaucratic fussiness of the support system turned out to be a problem. It was solved by undertaking the complete grant application by the installation company.

Conclusions

Success factors were: proactively customer approaching; independent information brochures are helpful; State support acts like a seal of approval; relieving the customer of bureaucratic tasks with permission and funding applications is helpful.

CODE2 – Awareness - Best practice case

Hotel zur Brücke

1. Which role did awareness play for the realization of the project?
   On an information event of the German Hotel and Restaurant Association DEGOGA the hotel owner became aware of the possibility of own electricity generation with a CHP device. A friend of the hotel owner had already good experience with a system installed by the installation company.
2. *Cost-benefit/economics*
   a. Figures or assessment
      5 years pay back time
   b. How important were economics?
      crucial
3. Is there a specific business model which applies to the best practise case which makes CHP more attractive to the customer? (service model for installation and maintenance of the CHP)
   no
4. What was the main project driver?
   Energy cost saving
5. What project experience exists within the group who implemented the project and is this widespread?
   a. awareness
      -
   b. know-how
      -
6. Was there external funding and was there any experience within the financial sector of CHP projects.
   Bank loans. CHP was known at the bank.
7. Identify the role which urban planning may have played in project success for the best practise examples, including links between local authorisation and projects, approval/promotion, complexity and speed.
   no relevance.