

Atdorf pumped storage plant – three weeks of public discussion – a milestone in the permit application procedure

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1. Introduction

1.1. Background of the project and content of the paper

The Schluchseewerk AG company headquartered in Laufenburg, a joint venture of Energie Baden-Württemberg (EnBW) and RWE AG, which are the third and second largest utility companies in Germany, plans to construct the Atdorf pumped storage plant (PSP) in the Southern Black Forest. With a capacity of 1,400 MW it will be one of the most powerful pumped storage plants in Europe. Since 2012, EnBW is the part of the joint venture that pursues this specific investment project.

In late 2010, ILF Consulting Engineers Austria GmbH (ILF) and AF-Consult (AFC) were awarded the contract to perform the overall design services for this hydropower project. In addition, in 2011 the consortium formed by ILF and AFC was commissioned also to prepare the permit application design. In 2013 ILF was additionally awarded a contract to revise and complete the environmental planning documents needed for the *Planfeststellungsverfahren*¹.



Fig. 1 – View towards the lower reservoir of the Atdorf PSP

The technical project and the required design and permit application procedures were introduced at HYDRO 2013 in Innsbruck (Austria) (Lit. 1). Since then, the project has evolved significantly and, with the successful conclusion of a three-week public discussion held in January 2017, has passed another very important milestone in the extremely complex and lengthy permit application procedure.

¹ *Planfeststellungsverfahren* or *PF procedure*: permit application procedure including environmental impact assessment and public consultation

The presentation at HYDRO 2017 and this paper will outline the developments and activities that have taken place since 2013 and will then focus on the permit application procedure including the three-week public discussion. Subsequently an outlook will be provided on future activities to be performed until the *Planfeststellungsbeschluss*² and the construction of the plant.

The project gives an example of the complexity of permit application procedures in central Europe, and of the great effort in terms of personnel, time and money, to pursue large-scale projects of this kind in the design phase and to obtain a positive final decision from the authority.

1.2. Location, design concepts and key technical data of Atdorf PSP

The project area is located in the south of the Black Forest in the German state of Baden-Wuerttemberg. The upper reservoir (Hornberg II reservoir) of the Atdorf PSP is located in the immediate vicinity of the Hornberg I reservoir, which is the upper reservoir of the existing Wehr PSP of Schluchsewerk AG. The lower reservoir (Hasel reservoir) is located north-west of the city of Bad Säckingen, close to the Rhine river. In Fig. 2 the location of the project site is outlined in red.

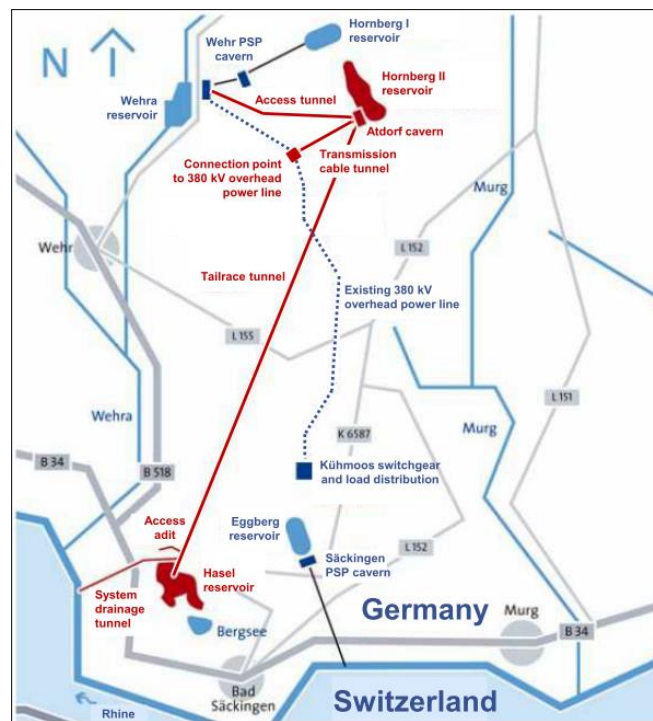


Fig. 2 – Overview of the project area of Atdorf PSP

The main components and the key technical data of the Atdorf pumped storage plant (PSP) can be summarized as follows:

- Head approx. 600 m
- Flow rate (turbine operation / pump operation) approx. 270 / 200 m³/s
- Installed capacity: 1,400 MW, working capacity: approx. 13 GWh
- Live storage: 9 million m³ per reservoir
 - Upper reservoir with bituminous concrete surface sealing and ring dam as rockfill dam, including two intake towers
 - Lower reservoir with main dam constructed as roller-compacted concrete (RCC) dam and two other dam structures constructed as rockfill dams, partially with bituminous concrete sealing, lower reservoir includes an outlet structure and a filling/emptying pipeline to the Rhine river.
- Two 710-m-long vertical pressure shafts with inner diameters ranging from 4.8 m to 5.0 m and a 8.5-km-long tailrace tunnel with an inner diameter ranging from 8.5 m to 10.2 m;

² Final decision by the approval authority

- Tailwater surge facility consisting of a vertical shaft and several surge chambers
- Powerhouse cavern and transformer cavern with access and logistics tunnels
- Six machine units
 - machine type: single-stage reversible Francis pump turbine
 - operating capacity of turbine mode: approx. 60 to 1,400 MW
 - operating capacity of pump mode: approx. 160 to 1,400 MW

The implementation of this power plant would lead to an increase in the pumped storage capacity of almost 25% in Germany. This underlines the importance of this project from the energy policy and grid security point of view.

The operating requirements to be met by the Atdorf PSP, especially with regard to flexibility, availability and reliability, are very stringent. On the one hand, the plant shall be designed for grid control (primary control, secondary control, minutes reserve) and, on the other hand, for energy storage. The operating modes comprise pump operation, turbine operation and reactive power provision.

These requirements are not just to be met by the mechanical equipment, but especially by the hydraulic system (headrace and tailrace tunnel system) in order to prevent operational constraints and to ensure a plant availability and reliability of up to 100%.

1.3. Change in framework conditions of energy economics (2008-2017)

When Schluchseewerk AG started the development of the Atdorf scheme in 2008, the energy world in Germany looked totally different from what it looks like now in 2017, and it looks totally different from what it will probably look like in the 2030s, when the Atdorf plant is designated to begin commercial operation. This fact makes clear that continuous checks of the future framework conditions are necessary during the project development to see if a scheme is suitable for future conditions.

Back in 2009 the power industry was still dominated by large scale nuclear power plants (NPP) or fossil power plants (CFPP) and minor feed-in of renewables in the German power grid. Existing PSPs used the nighttime to pump, when there was a surplus supply of energy from NPPs or CFPPs. Electricity prices also followed this logic, with low prices during the night and peak prices around noon, providing a sufficient price spread for the operation of PSPs. Furthermore it was also clear that the development of volatile feed-in of renewables will increase the demand of power storage facilities. All in all, a good setting to start the Atdorf project.

In 2017 the situation is quite different. The German “*Energiewende*” followed by a massive development of solar and wind power facilities has a major impact on the power market. The peak demand at noon can be covered, to a great extent, on sunny days with solar power which enjoys priority feed-in with guaranteed prices. On the other hand, this has caused falling prices for energy around midday – the price spread between night and day has minimized and nowadays the economic pressure on existing PSPs is very high. In the current market setting a development of a new plant would not be profitable. This is one of the reasons why several PSP projects in Germany are currently on hold.

With a scheduled start of commercial operation in the 2030s, the much more interesting question for a project such as Atdorf is what the energy system and the energy market will look like then and in the following decades and whether demand and prices will justify a major investment such as the Atdorf PSP. Considerations in this area are driven by the following assumptions:

- The Paris Treaty with the goal of a decarbonated economy will be observed.
- The German “*Energiekonzept*” launched by the German government aiming at 80% less CO₂ in 2050 than in 1990 will be implemented.
- Massive further development and feed-in of volatile renewables such as wind and solar power in Germany will be realized.
- NPPs will be out of the market in Germany by 2022
- Many fewer fossil baseload power plants will be in the market to meet the goals of the Paris Treaty and the German “*Energiekonzept*”.

The large amount of volatile renewables combined with a small percentage of baseload fossil power leads to a great demand for power storage on an hourly, daily, weekly and seasonal basis. The question is: How can the storage demand be met and which technologies will succeed for which application?

PSPs such as Atdorf are suitable for storage on an hourly and daily basis. Pricewise several hours of low or zero price periods during the day could alternate with periods of higher prices during the evening and night, providing a

storage facility such as Atdorf with sufficient income. In comparison to the “old energy world” of 2007 the pumping hours will shift from nighttime to daytime.

Another important question is whether other storage technologies will be more economic than PSPs and might therefore stifle new PSP developments. Especially batteries could become serious competition for PSPs, since their development will probably be promoted by the car industry in the next 10 to 20 years, with a large scalability yet to come. Other storage technologies such as power to gas are more suitable for longtime storage and do not compete with PSPs.

Looking at all these aspects together with the need to look far into the future makes it clear that all predictions and estimates contain great uncertainty. Risks and opportunities balance each other!

1.4. Recapitulation of initial permit procedure stages 2008-2014

In 2008, plans were publicly announced to develop the Atdorf PSP. In 2010, the project passed the first major milestone in the permitting process: The regional planning authority issued the *Raumordnungsbeschluss*, the end result of a spatial planning procedure that serves to determine the general feasibility of the project and the effective integration of the project into the surrounding environment.

As all large-scale construction projects in Germany require a two-stage permit application procedure, the second stage, the *Planfeststellungsverfahren* being the actual permit application procedure, was initiated in June 2012 through the submission of a huge number of application documents for review by the competent authorities. As reported at Hydro 2013 (Lit. 1), the permit application for the Atdorf PSP required extremely detailed and extensive environmental planning and suffered from a lack of project-specific legal framework and guidelines. Consequently, a unique course of action for the permit application procedure was agreed with the authority at an early stage. The authority was integrated in the design process early on, with close coordination of authority, Schluchseewerk AG, designers and experts. This was done by holding intensive, regular meetings (at least on a monthly basis) and by agreeing on a review of all application documents by the authorities in two cycles.

Usually a client prepares all the application documents together with designers and experts and then submits them in a package directly to the approval authority for a formal check for completeness. For the Atdorf PSP a different procedure was chosen. In a first cycle, the authority received all parts of the application for an informal preliminary check. In the process, the documentation was divided into several parts and submitted progressively from mid-2011 until mid-2014. The several thousand comments received from the authority were examined, discussed with the authority and either integrated into the documents or rejected stating a reason for rejection. From mid-2012 until late 2014, the documents that passed this initial quality check were submitted progressively for the second cycle, the formally intended completeness check.

2. Permit application procedure since 2015

In parallel to the authority coordination process and checking of the application documents, numerous coordination meetings were held with communities affected and action plans were further developed, especially with regard to environmental compensation measures such as the preparation of a concept to increase the residual flow for surface water bodies and to contribute to the recharge of groundwater.

In the second cycle of review, the legally required *Vollständigkeitsprüfung* or “completeness check” which was completed by summer 2015, the authority made only minor comments. All comments were discussed and processed in the same way as in the first cycle. The findings of the completeness check were incorporated into the application documents, so that by the end of 2015, the completed permit application documents could officially be made available to the responsible authority (District Administration Office of Waldshut). After the feedback received from the authority in January 2016, some minor formal changes were incorporated before copying the permit application documents in the spring of 2016. In total, 88 copies of the permit application documents had to be made, with one set of the permit application comprising 124 folders, 19,000 pages and 1,100 maps and drawings.

In April and May 2016, the printed permit application documents were officially made available for a public review period of six weeks to the 21 communities considered to be affected by the project. In addition, all documentation was made available on the website of the District Administration Office of Waldshut, where it is still available.

In the course of presenting the documents to the public, 1,380 written statements were received and further divided into some 11,000 individual arguments and questions. Of these, about 70 were official statements from municipalities, authorities and other official entities (“*Träger öffentlicher Belange*”), with the remainder being objections from citizens who felt affected by the project in some way.

By the end of November 2016, every single objection had been investigated and answered, with the documentation totalling more than 16,000 pages, so that the responses could be made publically available on the website of the responsible Administrative District Office, where statements and responses are still available.

The next stage in the permitting process is a formal public hearing (“*Erörterungstermin*”), which is the only legally required participation stage under German planning law. As outlined in (Lit. 1) and above, extensive additional information and consultation events, including an extensive Round Table process in 2011, were held in connection with the Atdorf PSP. Nevertheless, the formal public hearing is a central milestone in the permitting process. Issues such as site selection, layout and other optimisations of the project were already discussed in earlier participation events, especially the Round Table 2011. However, all these topics were revisited in the formal public hearing.

The three-week public discussion which was held from 9 to 27 January 2017 in Wehr (Germany) marked the preliminary completion date of the design phase. For this event, a triple sports hall was converted into a modern conference venue, providing all the required technical equipment and seating for an audience of some 300 people.

The public discussion chaired and moderated by the regulatory authority focused on the following topics:

- Legal basis for permitting project implementation and operation
- Comparison of alternatives
- Necessity of the scheme from an energy policy perspective
- Land use issues – plots of land owned by private persons/by public agencies to be used for technical facilities and as (ecological) compensation areas
- Impact on human beings (focus on construction effects such as noise, dust, vibrations)
- Protection of and impact on water (spring water, surface water, groundwater)
- Soil (storage space, muck disposal sites)
- Interference with other projects such as the design and implementation of the A98 motorway
- Environmental aspects/Natura 2000/species protection

Representatives of the authority making the final decision (District Administration Office of Waldshut) and designers and experts of the applicant (Schluchseewerk AG) attended the three-week discussion. A total of 90 experts testified on the project developers’ side. Depending on the topics addressed, representatives of authorities responsible for public concerns, of the communities, of the citizens’ initiative, of environmental organisations and residents affected and/or interested were present. The scale and significance of the project became evident for example due to the fact that the majors of several affected municipalities were present for most of the 17 days of the proceedings.

Public interest in the hearing was limited, with around 5–20 private citizens present at most times. Two topics generated significantly more interest, namely the impact of the project on waters (springs, rivers and groundwater) and the use of land both for project installations (around 135 hectares) and especially for environmental compensation measures (1.151 hectares). The regulatory authority had anticipated public interest in these topics and scheduled discussion about these topics for two Saturdays, which were each attended by about 100–150 persons. On one of these days, the citizens’ initiative against the project organised a demonstration (see Fig. 3).



Fig. 3 – Demonstration during public discussion



Fig. 4 – Public discussion

The applicant found the three-week discussion thoroughly positive, even if there is still a need for dialogue and/or follow-up initiatives. Commitments and coordination meetings were scheduled for a total of 170 follow-up issues to be discussed with various stakeholders (private persons, authorities, communities, etc.), plans for compensation measures were to be prepared in more detail and/or additional surveys were to be conducted.

3. Remaining challenges after the public hearing

3.1. Main results of the public hearing

Even though most issues and impacts connected with the project could be concluded in the public hearing, some topics were identified that need further examination and/or stakeholder discussion before the regulatory authority is satisfied that the final permit can be issued. These topics were identified during and after the public hearing, including in follow-up discussions mainly with environmental and water authorities. The main focus of the follow-up initiatives is placed on the below-listed topics:

1. Revising and updating environmental studies conducted in earlier stages of project preparation
2. Revising and clarifying compensation and coherence measures required as a result of limited availability of land
3. Verifying whether the economic existence of individual farmers is threatened by land use for the project and especially for the extensive environmental compensation measures
4. Checking the necessity of sealing the lower reservoir as impacts on local thermal springs caused by seepage are feared by some stakeholders

Issues 1 and 2 are explored in more detail below.

3.2. Revising and updating environmental studies

Extensive environmental studies were conducted in the period 2009-2014 as a basis for environmental assessment and planning of the Atdorf PSP. The study area covers more than 6,000 hectares and environmental surveying was done in an extremely thorough and detailed way, with separate assessments of hundreds of protected species, habitat types and biotopes, at a total cost significantly exceeding 10 million euros.

During the public discussions and in the statements of the environmental authorities, the age of the environmental surveys emerged as a major issue. There are no legal standards or definitions for the validity period of environmental surveys, mappings and assessments in Germany, but legal practice suggests a limit of around 5 years. The environmental authorities therefore demanded the surveys to be repeated. In discussions following the public hearing, a compromise could be reached with a detailed proposal for an “update check” of the environmental studies to be conducted over two years, at significant manpower input and cost.

This agreement causes a significant delay as the update checks for plants and biotope types, conducted in the spring and summer of 2017, will have to be followed by update checks for the many different groups of animal species (such as birds, bats, other mammals, but also butterflies and moths, beetles, dragonflies and many other species groups). As this second round of checks is dependent on the results of the 2017 biotopes check, it can only be conducted in 2018, starting in February with “early species” (e.g. owls and woodpeckers) and continuing into the summer. Detailed and restrictive methodological standards have to be followed for each group of species.

After the results from these update checks are available in the autumn of 2018, the environmental impact assessments, Natura 2000 assessments, protected species assessments and environmental compensation planning will have to be updated. Due to the extensive volume of the environmental studies (more than 90 folders or about 75% of the total application documents) this will take several months. Only then will a second round of consultation be initiated. The exercise of revising and updating the environmental studies therefore leads to a delay of the whole permitting process, at significant additional cost.

3.3. Revising and clarifying compensation and coherence measures

Due to the highly conservative approach used in environmental planning for the Atdorf PSP, the 135 hectares of permanent land use for the project (with an additional 55 hectares of temporary land use for ancillary construction space) will be compensated with a total of 1.151 hectares of compensation measures. Most compensation measures involve an ecological upgrading of both forest and agricultural (mostly pasture) lands. Near-natural management will focus on (re-)creating appropriate habitats for protected species and biotope types, while forestry and agricultural production will cease to be the primary focus of land use.

As the project is situated in a region of highly fragmented land ownership (gavelkind), the planned compensation measures are located on more than 3,000 plots owned by about 1,100 different private land owners, as well as local municipalities and the state. The location of the compensation measures faces significant constraints as they have to be close to the location of the impact (spatial and functional linkages have to be upheld). These requirements mean that the compensation measures cannot be located in “convenient” places; instead placement follows scientific and legal requirements.

Typically, the plots on which compensation measures will be located will not be bought by the company but will remain in the ownership of the current owner. The restrictions on land use, which will be formalised through land register entries, will be compensated financially. The land owner normally will have a right to choose whether he wants to implement and maintain the compensation measure according to the prescriptions in the permit against additional payments, or whether Schluchseewerk AG should manage the compensation measure.

Initially local communities and municipalities were keen for compensation measures to be implemented close to the project sites. This gradually changed as it became clear that the measures will be rigidly planned and current forestry and pasture practices will have to be significantly changed. Many land owners are very attached to their plots and have started to reject the planned measures. Consequently, about 50% have now raised objections to their land being used for compensation measures.

Consequently, the coming project phases will involve renegotiation with land owners as well as discussions about the scope of less disruptive measures with environmental authorities. As Schluchseewerk AG intends to avoid expropriation of property wherever possible, the search for alternative sites, especially for compensation measures, will also play an important role.

4. Outlook: the way forward for Atdorf PSP

The follow-up measures identified during the public discussions are planned to be completed by 2018 for the supplementary documents to be ready for final check by the authorities in early 2019 and a second public discussion to be held, if needed. The *Planfeststellungsbeschluss* (the final building and operating permit, which will be issued for a permit period of around 70 years) will presumably be obtained by 2020 at the earliest and will pave the way for the preliminary design works to get underway.

As both the local NIMBY (*Not In My Back Yard*) citizens’ association and environmental associations have announced plans to take legal action once the permit once it is issued, a further delay of several years is likely before the permit is cleared by the courts and can be implemented.

The preliminary construction measures are therefore scheduled to be carried out from the mid-2020s, with the start of major construction works anticipated for 2026–2028. With a construction period of some six years, the plant is assumed to be put into operation in 2032 at the earliest.

Initial plans at project inception in 2008 assumed construction to start in 2013 and regular operation to start by 2019. In the presentation held during HYDRO 2013, the date for operation start-up was still assumed to be in 2025. This shows how great an influence the permit application procedure has on large-scale projects such as the Atdorf PSP, causing very significant delays and cost increases.

The Atdorf PSP is a prime example of the difficulties for societies enjoying mature and extensive infrastructure to make difficult decisions on long-term interests. Schluchseewerk AG remains optimistic, however, that the regulatory

framework will ultimately recognise the need for additional storage capacity in the German and European electricity systems and that ways will be found to implement much-needed projects essential for the energy transition and the wider challenge of tackling climate change.

References:

1. **Fink, M., Fritzer, R. and Pehm, M.**, “Atdorf Pumped Storage Plant – Permitting Requirements for a Large-Scale Project in Germany”, Paper Hydro 2013

The Authors:

Reinhard Fritzer is a 1992 graduate of the Civil Engineering Faculty of Innsbruck University and began working in the Water & Environment Department of ILF Consulting Engineers in 1993. He has been and is involved in numerous hydropower and pumped storage projects as project engineer and project manager. Since 2015 he is the Head of Hydropower Department of ILF Consulting Engineers. He is the project manager and design engineer for the civil and hydraulic engineering structures of the Atdorf PSP.

Eva Manninger is a 2004 graduate of the Civil Engineering Faculty of the Technical University of Munich (TUM). After working as research assistant to the chair of Hydromechanics of the UniBW Munich, she accepted two assignments as project engineer/project manager in the field of hydraulic engineering in Germany. In 2011 she started working in the Water & Environment Department of ILF Consulting Engineers Austria GmbH as a project manager and is currently responsible for the Atdorf PSP as project coordinator.

Michael Fink is a 2006 graduate of the Department of Urban and Regional Planning of the University of Dortmund. He initially worked for the former Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), which is now part of the German Corporation for International Cooperation, in the field of sustainable hydropower. From 2008 to 2010 he was Programme and Business Director of the International Hydropower Association (IHA) and was closely involved in a range of Association projects, such as the Hydropower Sustainability Assessment Forum. In 2011 he joined Schluchseewerk AG and is responsible for the regulatory and environmental affairs of the Atdorf PSP.

Ulrich Gommel is a 1998 graduate of the Civil Engineering Department of the University of Stuttgart. He has worked on numerous projects in the energy sector and in the building industry, assuming the roles of site manager, project manager and contract manager in the project development as well as in project execution. He joined Energie Baden-Württemberg (EnBW) – shareholder of Schluchseewerk AG – in 2010 and has since been managing hydropower projects. In 2015, he joined the Atdorf project as deputy project director.