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Concept

Increasing the Security of Supply by Optimising the Energy and Utility Supply in Static Field Accommodations
I hereby issue the

**Concept**

*Increasing the Security of Supply by Optimising the Energy and Utility Supply in Static Field Accommodations*

Ulrike Hauröder-Strüning
Director of BAIUDBw
Foreword

Bundeswehr missions are conducted worldwide under various framework conditions. It is apparent that the number of "smaller missions" is on the rise. These conditions require an operating system which is tailored to the respective individual case/mission in order to sustainably ensure the required utility and energy supply, thus simultaneously promoting the level of independence from the external energy and utility supply.

In order to fulfill its functional tasks, today's static accommodation\(^1\) requires a safe and secure high-quality energy and utility supply - which ideally is networked, uses regenerative energies and, consequently, reduces the logistic support requirements and the risk to friendly and allied forces and, thus, the dependence on external providers.

Up to now, the energy supply of static accommodation has been based exclusively on the use of diesel fuels and the use of/connection to locally available supply systems. Frequently, the existing supply provided by the host nation is only partly available. Depending on the security situation, the energy and utility supply is thus mostly ensured by friendly forces and/or providers by means of supply trips/convoys, which involves a certain risk.

In this sense, an optimization of the energy and utility supply for static field accommodation is intended to improve the security of supply, thus contributing significantly to a successful performance of operational tasks.

\(^1\) Cf. Type B General Publication "Unterbringung im Einsatz" (Field Accommodation), Section 2.2.
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1. Fundamentals

Bundeswehr missions can only be ensured if a rapidly available and sustainable static field accommodation (Unterbringung im Einsatz - UiE) can be provided. The operation of this static accommodation depends decisively on the reliability of the utilities and the energy supply - in addition to military aspects. It must be designed in such a way as to ensure a limited independence from the external supply, while simultaneously reducing the logistic support requirements and the resulting risk to own and allied forces.

The level of self-sufficiency, on the one hand, and the support requirements, on the other hand, must be adapted continuously because they both change in the course of an operation. The security situation, transport routes/assets and the integration of multinational armed forces have a direct influence on the demand and the provisioning of energy and utilities for static accommodation and are significant factors of anticipatory planning.

Today, energy and utility supply are based on the demand/consumption for a static accommodation. Up to now, the measures to restrict and deliberately control the energy and utility supply have been very limited.

In addition, the entire effort for ensuring the energy and utility supply in a static accommodation is indeterminate. Means of transport, logistic support channels, steps to be taken for energy conversion and the energy required for maintaining the security of supply depend on numerous actors and cannot be influenced directly. Hostile operations against forward energy and utility supply chains may endanger mission accomplishment. The associated protection of the supply requires additional energy and utilities resources. Today, the energy and utilities additionally required for the operation of the forward transport and generation chains are not taken into account in the calculation of the demand. Therefore, measures for increasing the security of supply cannot be formulated at all or, at least, not effectively enough.

This concept is intended to describe and limit the energy and utility consumption along the entire supply chain\(^2\). In this context, the forward transport and generation chains for energy and utility supply are taken into account. This leads to a comprehensive assessment of the energy and utility supply of static accommodations and provides a basis for defining measures for limiting the energy and utility consumption.

\(^2\) Promotion of energy sources, transport, escorts, storage, operation of transshipment points.
This concept provides evaluation criteria and a basis for action to limit the energy and utility consumption in order to enable a situation-oriented analysis, assessment, modification and monitoring of the security of supply and the logistic support channels. It is aimed in particular at the operators\(^3\) of static accommodations.

In this context, contents and schedule of the concept are closely geared to the mission planning process\(^4\). This is intended to ensure an early implementation of measures with structured contents, which is closely oriented towards the already integrated core processes of mission planning. Thus, it is possible to recognize climatic and mission-specific influences at an early stage and to assess/consider them in the energy and utility supply structure.

Quality and quantity of the security of supply are assessed by using the following reference variables: Demand for/consumption of raw water/primary energy. These reference variables enable a holistic energetic and utility-related calculation of the supply requirements/consumption of a static accommodation to be carried out. In accordance with the concept, a restriction of these variables will increase the security of supply.

If the forward national and multinational supply chains are integrated into the requirements planning,\(^5\) this will improve the joint security of the energy and utility supply. Thus, this concept is not only the basis for increasing the security of supply of national forces, but also for improving the security of supply of allied forces\(^6\) – for example within the framework of multinational operations.

\(^3\) Depending on the operational scenario: Federal Office of Bundeswehr Infrastructure, Environmental Protection and Services (BAIUDPw), German Joint Support Service Headquarters (KdoSKB).


\(^5\) Demand for primary energy and raw water.

\(^6\) The energy supply for static accommodations can be provided by own and multinational forces, the host nation and service providers.
1.1 General

This concept is subordinate to the Konzeption der Bundeswehr (KdB) (Bundeswehr Concept) and the following conceptual documents:

- Teilkonzeption Führung von Einsätzen der Bundeswehr (Subconcept on the Conduct of Bundeswehr Operations),
- Teilkonzeption Logistik der Bw (Subconcept on Bundeswehr Logistics)

It specifies the fundamental principles for planning and operating static field accommodation with regard to the security of supply.

1.2 Objective

The objective of this concept is to increase the security of the energy and utility supply for static field accommodation. This is achieved through the analysis, assessment, influencing and monitoring of the entire energy and utility supply chain.

In order to achieve this objective, it is intended to limit the consumption of primary energy and raw water in a static accommodation. This shall take the consumption of the entire energy and utility supply process into account.

1.3 Terms and Definitions

The following Chapter explains the relevant key terms and their meaning/usage.

1.3.1 Static Field Accommodation

Static field accommodation is the mainly central field accommodation which is not only provided for a short term and which is tailored to the mission and area organization required for the operational forces to be accommodated. It may be provided within a field facility or in a different way. 

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7 General Publication B-100/9 "Unterbringung im Einsatz" (Field Accommodation), Section 2.2, page 7.
The establishment and operation of the static field accommodation require a close cooperation between the Bundeswehr Joint Forces Operations Command (EinsFüKdoBw) as requesting agency at the operational level and the supplying areas of the Joint Support Service (Streitkräftebasis - SKB) and "Infrastructure, Environmental Protection & Services" (Infrastruktur, Umweltschutz und Dienstleistungen - IUD), cf. Table 1.

### 1.3.2 Security of supply

The extent of the security of supply in a static accommodation is defined as the capability of ensuring the temporary operation of a field facility without external energy and utility supply.

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8 General Publication B-100/9 "Unterbringung im Einsatz" (Field Accommodation), Section 4.4, page 17.
to effective and efficient standards, thus providing a significant prerequisite for mission accomplishment.

This capability also includes the immediate, reliable utility and energy supply for static accommodation. This capability, which shall be provided within the framework of a sustainable energy and utility supply, also includes the safety, security and load capacity of forward logistic, transport and energy generation chains (cf. Figure 1). Depending on the situation, the transport routes must be secured by military protection.9

This effort imposes burdens on the energy and utility supply chain of own forces and of multinational partner nations which may be responsible for the supply of German field accommodations.10 Therefore, it is necessary to record and consider not only the direct national requirements, but also the energy and utilities requirements of the entire forward supply infrastructure11 in order to optimize the supply of a static accommodation.

The energy supply chain depicted in Figure 1 gives an example of the individual steps required to transform the energy source/the energy until it can be used by the requesting agency. Any influence exerted on this supply structure will change the security of supply of a static accommodation. Possible measures to ensure the energy supply shall be planned and examined for their holistic effect, taking into account the entire energy supply chain.

9 Protection of convoys, operation and protection of transshipment points.
10 For example, in case of limited availability of resources: Raw water and energy sources.
11 Multinational forces, Host Nation, United Nations, service providers, third party services.
The following subsection defines the individual types of energy shown in Figure 1.

1.3.2.1 Primary energy from fuels

In accordance with this concept, primary energy (PE) from fuels is defined as a type of energy which originally exists in nature in the form of fossil sources of energy (e.g. crude oil, coal and natural gas) and renewable resources (e.g. wood, biodiesel produced from rape/corn). Hereinafter, the energy from fuels will be referred to as primary energy.

Renewable/regenerative combustible primary energy sources:

- Rape diesel,
- Biodiesel,
- Wood, wood chips

have the same primary energy balance as fossil primary energy sources due to a comparable energy supply chain. Therefore, the energy effort required for the operation of the two supply chains is assessed/determined equally by the primary energy factor.

1.3.2.2 Primary Energy Factor

The primary energy content of an energy source (e.g. diesel, biodiesel) is determined by using a primary energy factor. This factor shows the ratio between the amount of the fossil and renewable primary energy quantity used and the amount of the delivered final energy; it depends on the design of the energy supply chain in theatre (cf. Figure 1).

The primary energy factor (PEF) derived therefrom is a tool for the quantitative determination of the primary energy content of fossil and renewable sources of energy. The primary energy factor shall be determined for every static accommodation. If this factor is known, the useful energy consumed at the end of the energy supply chain (electrical power, heating, air conditioning) can be traced back to the primary energy contents.

Example:

12 Production, processing, transport, transshipment and storage, protection, generation.
In a static accommodation, 2 kWh of final electrical energy are taken from a power supply network. Based on the primary energy factor determined beforehand (3.2), the primary energy quantity consumed can be calculated as follows:

\[
2 \text{ kWh} \times 3.2 = 6.4 \text{ kWh}
\]

This calculated primary energy quantity describes the entire energy effort of the forward energy supply chains. In addition, it shall be used as a reference variable for controlling the energy demand/consumption for a static field accommodation.

Due to mission-specific framework conditions, which will be explained in Section 2.2, it is not always possible to determine the primary energy factors. In these cases, the primary energy factors specified in Annex 2 shall be used.

### 1.3.2.3 Secondary energy

Secondary energy is defined as a type of energy which is generated by converting, refining or processing primary energy. The secondary energy sources include the following: Petroleum products (diesel, kerosene, gasoline), long-distance heat and power/heat generated in block-type thermal power stations.

### 1.3.2.4 Final energy

Final energy is the portion of primary energy which remains after the energy conversion and transmission losses and passes through the connection to the building of the energy consumer. If electrical power provided by regenerative energy sources is fed into the supply network, this will reduce the primary energy demand/consumption of a site. Consequently the available energy quantity will remain constant, but the demand for/consumption of combustible primary energy sources will be reduced due to the portion of regenerative energies.

### 1.3.2.5 Useful energy

Useful energy includes, but is not limited to, the heat emitted by a radiator, electrical energy for workplace illumination or cooling energy transferred to a building. In this context, the
useful energy content may be higher than the energy content of the final energy, for example, if environmental heat/environmental cold is used.\textsuperscript{13}

\subsection*{1.3.3 Reference variables}

Purposefully assessing and influencing the energy/utility supply chain requires data, figures and measurands which are suitable for describing the condition and future development of the supply chain with sufficient accuracy. This concept examines the energy supply chain as shown in Figure 1 and the water supply chain as shown in Figure 2.

The efficiency of these supply chains can be described by the following reference variables: Primary energy demand/consumption\textsuperscript{14} for energy supply and raw water demand/consumption\textsuperscript{15} for water supply. A change in these reference variables will exert a direct influence on the security of supply of the field accommodation.

\subsection*{1.3.4 Specific site-specific primary energy demand/consumption (Spezifischer flächenbezogener Primärenergiebedarf/-verbrauch - SFP)}

The SFP is a measurement unit for the demand for/consumption of combustible primary energy sources per square meter (m\textsuperscript{2}) of usable area\textsuperscript{16} of a static accommodation during a specified period.

The measurement unit $\frac{kWh_{PE}}{m^2 \cdot period \ of \ time}$\textsuperscript{17}

$kWh_{PE} = \text{Demand for primary energy (in accordance with the definition provided in paragraph 1.3.2.1)}$

shall be used in this context.

The specific site-specific primary energy demand/consumption (SFP) is a characteristic value for the efficiency of the exploitation of energy, taking account of the entire energy supply

\begin{flushleft}
\textsuperscript{13} E.g. by a counterclockwise Carnot cycle.
\textsuperscript{14} Cf. paragraph 1.3.4.
\textsuperscript{15} Cf. paragraph 1.3.5.1.
\textsuperscript{16} The usable area describes the enclosed and illuminated, cooled, air-conditioned or heated areas of a static accommodation.
\textsuperscript{17} The specified period depends on duration of the operation. A period of 1 year shall not be exceeded.
\end{flushleft}
chain, and a reference value for planning and controlling the energy demand of a static accommodation.

1.3.5 Utilities

In this concept, the focus of the utilities of a field facility is placed on water supply. Depending on its origin and its quality, water can be subdivided - for example - into raw water, wastewater, filtrate/permeate\(^{18}\), non-potable water.

1.3.5.1 Raw water

Untreated water taken from a water source for further use/treatment is designated as raw water (RW)\(^{19}\).

The measurement unit for the use of raw water in a static accommodation is the specific raw water demand per person and per day. The following measurement unit shall be used:

\[
\frac{\text{Liter}_{\text{RW}}}{\text{Person} \cdot \text{Tag}}
\]

The water supply chain (cf. Figure 2) consists of several steps. The treatment and transport of water entail a high water loss\(^{20}\) and a high energy input along the water supply chain.

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\(^{18}\) Purified water which has passed through a solid matter.

\(^{19}\) Examples: Water from open bodies of water, groundwater, seawater.

\(^{20}\) Leaking pipelines, ruptured pipes, leaking storage facilities, water flow that was not used for reverse osmosis (concentrate).
numerous regions, there are only restricted natural water resources so that raw water is only available to a limited degree and must possibly be transported over long distances. This requires a high energy input, which imposes burdens on the security of the energy supply.

A reference quantity for measuring and controlling the water supply in a static accommodation is the specific raw water consumption. This variable can be used to characterize and control the efficiency of the water use.

1.3.5.2 Filtrate/permeate

After the water treatment, the purified water which is generated for further use, for example as drinking water, is designated as filtrate/permeate. If the water is treated by means of a multi-layer filtration, the filtered water is designated as filtrate. If the water is treated by reverse osmosis/ultrafiltration/nanofiltration, the water flow passing through the membrane is designated as permeate. The filtrate/permeate must undergo further treatment before it can be used as drinking water. Depending on the treatment technology, the production of filtrate/permeate is connected with high water losses.

1.3.5.3 Waste water

Water which has been polluted by use or changed its characteristics or composition is designated as waste water. Waste water can be subdivided into grey water (slightly polluted waste water), black water (domestic waste water containing feces) and rain water. Depending on the framework conditions in theatre, it could be beneficial to partially use the accumulating waste water in order to limit the raw water demand. Particularly the use of rain water and the treatment of grey water for reuse as non-potable water can reduce the raw water demand considerably. In addition, the transport routes for water supply can be shortened significantly because the waste water may be reused on site, if required, after proper treatment (for example in washing machines, dishwashers, car wash facilities).

1.3.5.4 Non-potable water

Water which is used for technical applications is referred to as industrial/non-potable water. This water can be used, for example, for vehicle cleaning or toilet flushing. By using non-potable water, it is possible to reduce the raw water and primary energy demand/consumption of a static accommodation because the production, transport and treatment of raw water is connected with a high consumption of energy and raw water.
1.4 Differentiation

This concept is a practical instruction for controlling the energy and utility supply. It has a binding character.

The concept does not specify the mission requirements for:

- Physical/protective security of facilities and the protection of installations and facilities;
- Vehicles/aircraft;
- Statutory protective tasks.

In addition, this concept does not apply to the mobile field accommodation of forces.\(^{21}\)

\(^{21}\) Cf. General Publication B-100/9 "Unterbringung im Einsatz" (Field Accommodation), Section 2.1, page 6.
2. Requirements and Framework Conditions

2.1 Legal Requirements

The tasks to be performed in order to increase the security of supply and the measures taken on operations abroad with regard to energy and utility supply shall be subject to national and international law. This includes, above all, the production, the treatment and disposal of water and energy supply.

On operations abroad, the international, European and constitutional legal requirements and the operational regulations for the respective mission shall be observed. In addition, the national law of the host nation shall also apply. Status of Forces Agreements (SOFA) and other intergovernmental agreements may specify deviations from the law of the respective host nation.

Particularly with regard to the utility supply of static accommodations, this concept is based on compliance with the following norms and standards unless concrete exemptions are specified on a case-by-case basis:

- Trinkwasserverordnung, Bundesministerium für Gesundheit, Bundesministerium für Verbraucherschutz, Ernährung und Landwirtschaft (German Drinking Water Regulation, Federal Ministry of Health, Federal Ministry of Food, Agriculture and Consumer Protection), as of 21 May 2001;
- STANAG 2136 (Requirements for water potability during field operations and in emergency situations), NATO Standardization Agency, as of 21 March 2014;
- STANAG 2885 (Emergency supply of water in operations), North Atlantic Treaty Organization, as of 13 January 2010;
- DIN 2001-2, Trinkwasserversorgung aus Kleinanlagen und nicht ortsfesten Anlagen. Teil 2: Nicht ortsfeste Anlagen (Drinking water supply from small units and non-stationary plants - Part 2: Non-stationary units);
- DIN EN 806-2 Technische Regeln für Trinkwasserinstallationen - Betrieb und Wartung (Specifications for installations inside buildings conveying water for human consumption - Part 2: Design);
• DIN 1988-200, Technische Regeln für Trinkwasser-Installationen Teil 200: Installation Typ A (geschlossenes System) – Planung, Bauteile, Apparate, Werkstoffe; Technische Regeln des DVGW (Codes of practice for drinking water installations - Part 200: Installation Type A (closed system) - Planning, components, apparatus, materials; DVGW code of practice);

• WHO Guidelines for Drinking Water Quality.

With regard to energy supply, the following norms and standards shall be observed:

• Special Publication C1-1810/0-6076 "Grundsätzliche Militärische Infrastrukturforderung für eine Einsatzliegenschaft“ (Basic Military Infrastructure Requirement for a Field Facility);

• STANAG 1135, Interchangeability of fuels; lubricants and associated products used by the armed forces of the North Atlantic Treaty Nations;

• STANAG 2528, Allied Joint Doctrine for Force Protection, North Atlantic Treaty Organization, as of 2 April 2015;

• STANAG 2532, Allied Joint Doctrine for the Deployment of Forces, North Atlantic Treaty Organization, as of 6 June 2008;

• STANAG 2406, Land Forces Logistic Doctrine, North Atlantic Treaty Organization, as of 4 February 2010.

With regard to support services, the following regulations shall be observed in particular:

• A2-1200/0-0-3 GeoInfo-Unterstützung im und für den Einsatz (GeoInfo support for and during operations), ZGeoBw (Bundeswehr Geoinformation Center) III 2 (1), as of 16 February 2017;

• C2-1200/0-0-2 Fähigkeitsbasierte Kräfte dispositiv für die GeoInfo-Unterstützung der Bundeswehr in den Einsätzen (Capability-based force postures for GeoInfo support of the Bundeswehr on operations), ZGeoBw (Bundeswehr Geoinformation Center) III 2 (1), as of 09 February 2016.

2.2 Framework conditions

Every Bundeswehr mission abroad is conducted under different operational and climatic framework conditions, which will change in the course of the operation. Relevant framework conditions and influencing factors may include the following:
- Requirements derived from the mandate (e.g. personnel ceilings);
- Security posture in the area of deployment;
- Availability of services of Host Nation Support and/or multinational partners.\textsuperscript{22}

Given this great variety of influencing factors, there is in principle a necessity for a concrete case-by-case decision with regard to the planning, implementation and assurance of the respective energy and utility supply for static field accommodations.

3. **Principles of energy and utility supply**

3.1 **Energy and utility supply**

The capability to provide field accommodation is one of the core capabilities of the Bundeswehr.\textsuperscript{23} This also includes the energy and water supply for the field accommodation.

The energy/utility supply of a static accommodation requires the use of different forms of energy (electrical energy/heating and/or cooling energy). Depending on the climatic conditions in the theatre and other mission-specific framework conditions,\textsuperscript{24} suitable energy generation chains shall be defined and taken into account in the plant technology employed.

![Figure 3: Energy supply chain. Presentation of transformation steps, taking account of the energy efficiency (example)](image)

Along the energy supply chain, several "transformation steps" are required in order to convert the energy generated into useful energy. These transformation steps lead to energy losses, thus reducing the efficiency of the energy supply (cf. Figure 3).

A reliable supply of water also requires an efficient supply chain which provides the water quality suitable for the respective use.

\textsuperscript{22} Connection to electrical power/water, delivery of fuel.
\textsuperscript{23} Cf. "Vorläufiges Konzept Unterbringung im Einsatz als bundeswehrgemeinsame Aufgabe" (Preliminary Concept for the Provisioning of Field accommodation as a Bundeswehr-wide task), page 7.
\textsuperscript{24} Cf. paragraph 2.2.
The supply chain consists of different water treatment steps. Each of these steps leads to a water loss (cf. Figure 4) and requires the use of energy (electrical power/heating/cooling energy).

The losses in efficiency which are incurred during the provisioning of utilities and energy exert a direct influence on the security of supply of a static accommodation. Generally, the energy and utility supply shall pursue the following objectives:

- Principle of economic consumption of energy and utilities;
- Use of energy-efficient procedures, facilities and materials for the energy and utility supply;
- Increase of the security of supply.

These principles shall always be taken into account when planning and conducting operations.

### 3.2 Security of supply of a static accommodation

In a static accommodation, an optimized primary energy and utility demand will reduce the operational effort. This makes it possible to reduce the number of supply transports as well, which will also reduce the risk for the supply/escort forces required for the transport.

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25 Production, transport, filtration, storage, distribution, recycling, disposal.
26 Cf. paragraph 3.1.
The reference variables described in paragraph 1.3.3 can be used to characterize the consumption. A deliberate limitation or even reduction of the demand/consumption defined by the reference variables will thus lead to a sustainable increase of the security of supply - and thus directly to an improvement of the sustainability of the field facility - while all capabilities required are maintained.

4. Tasks/performance of tasks during mission planning

4.1 Integrating tasks into the mission planning process in order to increase the security of supply

The Bundeswehr Joint Forces Operations Command (EinsFüKdoBw) as requesting agency at the operational level shall integrate the supplying areas of "Infrastructure, Environmental Protection & Services" (IUD) and the Joint Support Service (SKB) at an early stage into the planning process.

With the Project Group for Field Accommodation (Projektgruppe Unterbringung im Einsatz - ProjGrp UiE), a suitable organizational element has been established for this purpose. In this Project Group, the Bundeswehr Joint Forces Operations Command (EinsFüKdoBw), the Federal Office of Bundeswehr Infrastructure, Environmental Protection and Services (BAIUDBw), the German Joint Support Service Headquarters (KdoSKB), the Bundeswehr Logistics Command (LogKdoBw) and the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) cooperate before and during the operation. They define the parameters required for a static accommodation and make recommendations to the Federal Ministry of Defense (BMVg).27

Being of utmost importance, the rapid implementation of the planning, establishment and operation of a static accommodation has priority. In accordance with the mission planning process28, measures for optimising the operation of the field facility are initially regarded as secondary. During the first three phases, the measures of the mission planning process are thus restricted to the following:

- Estimating/determining the primary energy and utility demand for a fixed accommodation;

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- Formulating a primary energy and utility demand for Phase D (Operation);
- Developing possibilities for reducing the primary energy and utility demand.

Figure 5 shows the ideal integration of measures for limiting the primary energy and raw water demand into the mission planning process.

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<td>Zeit</td>
<td>Time</td>
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</table>

The measures depicted in Figure 5 for the Phases A to D shall be planned and implemented by the Project Group for Field Accommodation (ProjGrp UiE). Phases A, B, C are described in more detail in General Publication B-100/9 "Unterbringung im Einsatz" (Field Accommodation).
Phase D (Operation) has been implemented as an additional project phase which is necessary in order to record and sustainably limit the energy and utility consumption. During this phase, technical, organizational and logistic measures for limiting the consumption can be implemented purposefully.29

4.2 Phases and tasks of the mission planning process

Each mission shall be planned and conducted for each individual case, taking account of the different external influences (location/time/security situation/actors). In this context, the phases of the mission planning process, which are depicted in the Figure, show an ideal process. During the implementation of the Phases A to D, there may be deviations from the depicted process, depending on the situation.

4.2.1 Phase A (Analysis phase)

During this phase of the mission planning process, the Joint Forces Operations Command (EinsFüKdoBw) shall derive options for action from the strategic guidelines specified by the Federal Ministry of Defense (BMVg). The Joint Forces Operations Command (EinsFüKdoBw) shall submit an operational planning result to the Federal Ministry of Defense (BMVg). This planning result provides the basis for the first estimate of the primary energy and utility demand, which will be provided by the Federal Office of Bundeswehr Infrastructure, Environmental Protection and Services (BAIUDBw) and/or the German Joint Support Service Headquarters (KdoSKB), depending on the responsibility assigned in the field facility. The method for estimating the primary energy demand is described and clarified by an example in Annex 1 "Calculation of PEF and SFP". For further information, refer to the following documents:

- DIN V 18599-1 Energetische Bewertung von Gebäuden (Energy efficiency of buildings);
- DIN 4701-10 Energetische Bewertung heiz- und raumlufttechnischer Anlagen (Energy efficiency of heating and ventilation systems in buildings);

29 Cf. paragraph 5.4.
• Grundlagenpapier: Primärenergiefaktoren (Policy paper: Primary energy factors).\textsuperscript{30}

The energy demand of the static accommodation shall be determined, taking into account the primary energy demand. This can be done based on the personnel strength\textsuperscript{31} or on specific values\textsuperscript{32}.

The estimation of the demand is only possible if the Project Group for Field Accommodation (ProjGrp UiE)\textsuperscript{33} has identified the possible options for the energy and utility supply of the field accommodation and submitted a proposal for an initial solution and a follow-on solution, if required.

In this phase, the Project Group for Field Accommodation (ProjGrp UiE) shall submit a report which summarizes a situation picture of the energy and utility supply of a static accommodation.

In the following, this "Bericht zur Energie- und Medienversorgung" (Report on Energy and Utility Supply)\textsuperscript{34} shall be used as a basis for Planning Phase B. It shall include the following information:

• Reconnaissance results concerning energy and utility supply;

• Estimate of the primary energy and raw water demand for the static accommodation;

• Geospatial factors that are relevant for the energy supply, as for example:
  ○ Existing supply infrastructure;
  ○ Special climatic conditions (rainy season, dry periods);
  ○ Availability of raw materials.

\textsuperscript{30} Bundesverband der Energie- und Wasserwirtschaft e.V (Association of the Energy and Water Industry), Berlin 22 April 2015; within the framework of this concept, special attention should be paid to the definition of the term "primary energy", cf. paragraph 1.3.2.1.

\textsuperscript{31} Spatial requirements and energy demand shall be determined in accordance with Special Publication C1-1810/0-6076 "Grundsätzliche Militärische Infrastrukturforderung für eine Einsatzliegenschaft" (Basic Military Infrastructure Requirement for a Field Facility);

\textsuperscript{32} Example: Mali: 1,250 kWh/m², AFG: 1,346 kWh/m², Kosovo: 471 kWh/m²; Iraq: 845 kWh/m²: [m²=usable area].

\textsuperscript{33} Cf. "Vorläufiges Konzept Unterbringung im Einsatz als bundeswehrgemeinsame Aufgabe" (Preliminary Concept for the Provisioning of Field accommodation as a Bundeswehr-wide task), page 23.

\textsuperscript{34} Cf. Annex 3.
After the Federal Ministry of Defense (BMVg) has issued the mission planning directive (Weisung zur Erstellung der Einsatzplanung), the Planning Phase (Phase B) of the mission planning process will begin.35

4.2.2 Phase B (Planning Phase)

In Phase B of the mission planning process, the Joint Forces Operations Command (EinsFüKdoBw) shall

- Plan and formulate the requirements of the performance processes,
- Derive the need for action and the support requirements,
- Finalise the operational capability requirements,
- Specify and formulate the demands on troop, capability and service providers.

In order to optimize the supply, it is - in this phase - essential that the supplying areas of "Infrastructure, Environmental Protection & Services" (IUD) and the Joint Support Service (SKB) can prepare the preparatory plans for ensuring energy and utility supply in coordination with the Joint Forces Operations Command (EinsFüKdoBw). These include:

- Early calculation of the military requirements and the necessary usable area;36
- Identification of large-scale users of energy and utilities;
- Assessment of the possible energy and water supply options (Host Nation Support, raw water sources);
- Assessment of the locally available infrastructure for energy and utility supply as well as utility disposal.

These measures can usually be conducted without reference to a concrete site. In the course of the planning phase, the Joint Forces Operations Command (EinsFüKdoBw) can further specify potential sites in order to enable the Federal Office of Bundeswehr Infrastructure, Environmental Protection and Services (BAIUDBw) and the German Joint Support Service Headquarters (KdoSKB) to prepare technical plans for the intended energy and utility supply.


36 Cf. paragraph 1.3.4.
Based on this, a further specification of the primary energy and raw water demand is possible.

In all mission planning phases, the primary energy/raw water demand can only be calculated after the Bundeswehr Geoinformation Center (Zentrum für Geoinformationswesen der Bundeswehr - ZGeoBw) has conducted a research study in order to determine climatic framework conditions.

In the "Bericht zur Energie- und Medienversorgung" (Report on Energy and Utility Supply), the findings gained shall be specified further by the following data:

- Schematic diagram\(^{37}\) of the forward energy and utility supply chains;
- Further specification of the primary energy/raw water demand based on the services/requirements specified by the Joint Forces Operations Command (EinsFüKdoBw);
- Determination of the primary energy factors of the locally available types of energy (electrical power, heat, diesel).\(^{38}\)

When the site of deployment is specified further, a benefit analysis\(^{39}\) shall be prepared and included in the "Bericht zur Energie- und Medienversorgung" (Report on Energy and Utility Supply). Subsequently, derivations from this benefit analysis shall be taken into account for the further mission planning and implemented by technical measures.

The collected information shall be documented by the Project Group for Field Accommodation (ProjGrp UiE) in the "Bericht zur Energie- und Medienversorgung"\(^{40}\) (Report on Energy and Utility Supply) and used as a basis for a further specification of the demand in Phase C.

\(^{37}\) The diagram must show the transfer points of the energy and utility supply.

\(^{38}\) Cf. Annex 1.


\(^{40}\) Annex 3.
4.2.3 Phase C (Activation of the Contingent)

During this phase, the Bundeswehr Joint Forces Operations Command (EinsFüKdoBw) shall prepare a detailed statement of requirements for the field accommodation as a basis for the demand satisfaction process.41

In this statement, the requesting agency shall summarize the requirements regarding the sustainability and the capability to provide the static accommodation with energy and utilities in a requirements catalogue. This catalogue shall include the following:

- Assessment of logistic support channels and forward supply chains with regard to the energy and utility demand;42 determination of type and scope of infrastructure facilities for energy and utility supply (transhipment points, transport and storage facilities, etc.);

- Determination of location, number and type of energy conversion and water treatment steps (electrical generators, generation of cooling energy, generation of heat, water treatment);

- Calculation of the entire primary energy/raw water demand for the static accommodation.

The Bundeswehr Joint Forces Operations Command (EinsFüKdoBw) shall be responsible for determining and presenting these data. The results shall be documented by the Project Group for Field Accommodation (ProjGrp UiE) in the "Bericht zur Energie- und Medienversorgung" (Report on Energy and Utility Supply).

During this phase, the Project Group for Field Accommodation (ProjGrp UiE) shall further specify the primary energy and raw water demand in cooperation with the supplying areas of "Infrastructure, Environmental Protection & Services" (IUD) and the Joint Support Service (SKB) and summarize them in a calculation of the primary energy and raw water demand for the static accommodation. The calculation results shall be documented by the Project Group for Field Accommodation (ProjGrp UiE) in the "Bericht zur Energie- und Medienversorgung" (Report on Energy and Utility Supply).

Thus, the calculation results for the primary energy (PEV) and raw water demand constitute a **maximum value** which shall be observed during Phase D (Operation).

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41 Cf. "Vorläufiges Konzept Unterbringung im Einsatz als bundeswehrgemeinsame Aufgabe" (Preliminary Concept for the Provisioning of Field accommodation as a Bundeswehr-wide task), page 25.
42 Assessment of the logistic support channels/interfaces described in Phase B by means of the reference variables of primary energy demand/raw water demand.
4.2.4 Phase D (Operation)

The primary energy and raw water demand determined during Phase C shall be checked for compliance by the operator\textsuperscript{43} of the static accommodation during Phase D (Operation). If the recorded consumption values (primary energy demand (PEV), raw water demand) exceed these values, the operator of the static accommodation shall take measures\textsuperscript{44} to achieve the demand values specified during Phase C. These measures\textsuperscript{45} are intended to limit the primary energy consumption and the raw water consumption.

In case of an extension or a significant change of operation of a static accommodation, the primary energy demand of the respective static accommodation shall be redetermined. The calculation of the redetermined specific site-related primary energy demand and the specific person-related raw water demand shall be documented in the "Bericht zur Energie- und Medienversorgung" (Report on Energy and Utility Supply).

Phase D (Operation) is very important for ensuring the continuous, sustainable maintenance/increase of the security of supply of a static accommodation. In this context, it is important that the energy and utility demand values determined at the beginning of the operation will not be exceeded. Due to this high significance, possible measures for remaining below the reference values of Phase D (Operation) will be described in detail in Section 5.

4.2.5 Summary of the tasks to be carried out during the mission planning process

The holistic identification and assessment of the energy and utility supply by means of reference variables has a fundamental importance for the security of supply of a static accommodation. Therefore, the energy and utility demand and consumption shall be specified further and documented in the course of the individual phases of the mission planning process and during Phase D (Operation). The central document for this purpose is the "Bericht zur Energie- und Medienversorgung" (Report on Energy and Utility Supply). This report shall summarize the estimates, calculations, monitoring results and schematic diagrams of the different project phases (cf. Figure 6).

\textsuperscript{43} Depending on the operation: German Joint Support Service Headquarters (KdoSKB), Federal Office of Bundeswehr Infrastructure, Environmental Protection and Services (BAIUDBw).
\textsuperscript{44} Cf. paragraph 5.3, 5.4.
\textsuperscript{45} Cf. paragraph 5.4.
Figure 6: Contents of the "Bericht zur Energie- und Medienversorgung" (Report on Energy and Utility Supply) of a static accommodation during the Phases A to D of the mission planning process

<table>
<thead>
<tr>
<th>Bericht zur Energie- und Medienversorgung</th>
<th>Report on Energy and Utility Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zusammenfassung der Erkundungsergebnisse</td>
<td>Summary of the reconnaissance results</td>
</tr>
<tr>
<td>Bedarfsschätzung Primärenergie, Rohwasser</td>
<td>Estimate of the primary energy and raw water demand</td>
</tr>
<tr>
<td>Erfassung von Geofaktoren</td>
<td>Collection of geospatial factors</td>
</tr>
<tr>
<td>Schematische Darstellung der Energie-, Medienversorgung</td>
<td>Schematic diagram of the energy and utility supply</td>
</tr>
<tr>
<td>Präzisierung des Bedarfs</td>
<td>Further specification of the demand</td>
</tr>
<tr>
<td>Bildung von Primärenergiefaktoren</td>
<td>Determination of primary energy factors</td>
</tr>
<tr>
<td>Bewertung von Versorgungsketten</td>
<td>Assessment of supply chains</td>
</tr>
<tr>
<td>Primärenergie- und Rohwasserbedarf zur Sicherstellung der Versorgungsketten</td>
<td>Primary energy and raw water demand required to ensure the supply chains</td>
</tr>
<tr>
<td>Ermittlung von Transformations-/Behandlungsschritten für Energie sowie Wasser</td>
<td>Determination of transformation/treatment steps for energy and water</td>
</tr>
<tr>
<td>Berechnung des Primärenergie-/Medienbedarfs</td>
<td>Calculation of the primary energy/utility demand</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Monitoring</td>
</tr>
<tr>
<td>Schema der vorgelagerten Energie-, Medienversorgungskette</td>
<td>Schematic diagram of the forward energy and utility supply chain</td>
</tr>
<tr>
<td>Fließschema innerhalb der UiE</td>
<td>Flow diagram within the field accommodation</td>
</tr>
<tr>
<td>Begrenzung des Verbrauchs</td>
<td>Limitation of consumption</td>
</tr>
</tbody>
</table>
At the same time, the document provides the basis for selecting suitable measures and strategies for limiting/reducing the consumption of primary energy and raw water.
5. **Measures to Optimise the Security of Energy and Utility Supply during Operation (Phase D)**

5.1 **Monitoring of Consumption of Energy and Utilities**

Identification and measurement of the consumption of energy and utilities are necessary measures to control the reference variables. For this purpose, basic data as reference values (e.g. usable areas, volumes, number of persons, consumption of energy and water) must be identified by the operator of field accommodations and further used to compile specific variables (cf. paras 1.3.4 and 1.3.5.1).

In the event of weather-dependent fluctuations in the consumption of energy and utilities, additional influences of the weather (e.g. outside temperature, dry season, rainy season) must be taken into account by the operator of field accommodations. To this end, appropriate measuring stations must be established and operated within the static accommodation by the Bundeswehr Geoinformation Center (ZGeoBw). The measuring results must be submitted to the operator of the static accommodation on a monthly basis.

In order to identify the consumption of primary energy and raw water, the following monitoring measures must be implemented by the operator of the field accommodation:

- base load, low load and peak load behaviour of the electrical power must be recorded;
- base load behaviour of the heat demand must be recorded;
- water consumption must be recorded (raw water, drinking water, non-potable water);
- transparency of generation of waste water must be ensured up to the level of the individual consumer of water;
- waste water substances (e.g. detergents) must be recorded;
- transparency of the consumption of energy and utilities must be ensured up to the level of the individual measuring station;
- malfunction reports in terms of quality management (e.g. burst water mains, electricity black-outs) must be recorded and analysed;
- staffing of a static accommodation must be recorded;
- evaluated weather records must be documented.
The monitoring results must be documented in a report on energy and utility supply by the operator of the static accommodation on a monthly basis.

5.2 Identification of Forward Supply Chains

During operation (Phase D), forward supply chains may change. This goes along with a change in the demand of primary energy and raw water.

These changes in the supply chains must be taken into account in the calculation of the demand of primary energy in a static accommodation in the context of the monitoring measures by the operator and be documented in the report on energy and utility supply. The calculation must be carried out in accordance with para 1.3.2.2. The loss/consumption of energy and utilities along the supply chain must be shown schematically and numerically in the report on energy and utility supply (cf. figure 7).

![Figure 7: Exemplary schematic/numerical representation of an energy supply chain. Determination of the primary energy factor for electrical power](image)

<table>
<thead>
<tr>
<th>Nutzung</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEF</td>
<td>PEF</td>
</tr>
<tr>
<td>Verluste</td>
<td>Losses</td>
</tr>
<tr>
<td>Summe PE</td>
<td>Sum primary energy (PE)</td>
</tr>
<tr>
<td>Nutzenergie</td>
<td>Useful energy</td>
</tr>
</tbody>
</table>

Energy supply by means of locally available infrastructure (e.g., connection to the local electricity grid) must be taken into account in the computation of the PE demand. If supply

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46 Assumption: Transport by air of the energy carrier over 5000 km; electrical efficiency of the generators: 30%, distribution losses: 13%
chains cannot be traced back to the PE source, they must, however, be shown as far as they can be made transparent using the available sources of information.

### 5.3 Identification and Assessment of the Demand/Consumption of Energy and Utilities within the Static Accommodation

In order to limit the consumption of primary energy/utilities, it is necessary to analyse current information on the PE consumption of individual users within the static accommodation. In this context, the term “energy” is not clearly defined and not suitable for the definition of measures to enhance efficiency.

Information about the type of the useful energy demand (heating/cooling power, electric energy/power), energy quantity and the electric voltage provided for that purpose and the temperature are required to effectively assess measures to enhance efficiency. They must be shown the **energy/utility supply scheme**\(^{47}\) of the static accommodation.

![Figure 8: Exemplary schematic representation of the energy supply within the static accommodation over a defined period of time.](image)

<table>
<thead>
<tr>
<th>Elektr. Leistung/Verbrauch/Spannung</th>
<th>Electrical power/consumption/voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kälteleistung/Verbrauch/Temperatur</td>
<td>Cooling power/consumption/temperature</td>
</tr>
<tr>
<td>Energieerzeuger</td>
<td>Energy producer</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Monitoring</td>
</tr>
<tr>
<td>Kompressionskältemaschine</td>
<td>Compression refrigeration system</td>
</tr>
<tr>
<td>Energieverbraucher</td>
<td>Energy consumer</td>
</tr>
<tr>
<td>Generator</td>
<td>Generator</td>
</tr>
<tr>
<td>Nutzung</td>
<td>Use</td>
</tr>
</tbody>
</table>

---

\(^{47}\) Cf. Annex 3 paras 6.2 and 6.3.
An exemplary energy supply scheme of a functional unit is depicted in Figure 8. It reveals that the required cooling power is composed of 600 kW at a temperature level of 15° C. The electric power required for this purpose is 50 kW. The functional unit's demand of useful energy amounts to 12 MWh of cooling power and 0.5 MWh of electric power.

Monitoring systems (electricity meter, water meter, room sensor, etc.) must be recorded in the energy supply scheme. The consumptions of useful energy of the different consumers must be documented in chronological order in the annex to the energy supply scheme.

In addition to the energy supply scheme, a representation of the utility supply scheme within the static accommodation showing both the volume flow rates and the type of the transported utilities (raw water, non-potable water, drinking water, waste water) is also required. The utility volume flow rates of functional units must be documented in chronological order in the annex to the utility supply scheme, where appropriate using an energy management system (EMS)\(^{48}\) and an energy information system (EIS)\(^{49}\) in Annex 3 para 4.4.1.

The representation and updating of the energy and utility flow rate scheme must be initiated by the operator of the static accommodation and be documented in the report on energy and utility supply.

5.4 Measures to Limit the PE Demand in the Operational Infrastructure

If the PE consumption of a static accommodation exceeds the maximum value calculated for phase C, measures must be taken. These measures are intended to bring the PE consumption (monitoring result from phase D) below the maximum value (calculation from phase C) of a static accommodation and to limit it. These measures are divided into technical, organisational and logistic measures. Whereas technical measures depending on the utility analysis must predominantly be initiated in the planning of the field facilities, organisational and logistic measures are mainly appropriate during the operation to limit the consumptions. In the following, possible measures to reduce/limit the consumptions will be described.

5.4.1 Technical Measures

- Use of power generating units with a high electrical efficiency;

\(^{48}\), \(^{48}\) cf. DIN EN ISO 50001.
• use of waste heat from technical processes (use of combined heat and power stations);
• use of renewable energies to produce electricity and heat;
• power generation from waste incineration;
• use of energy-saving cooling techniques;
• use of water- and energy-efficient laundry technology;
• use of dead-end-filtration for water treatment;
• use of ultrafiltration and/or nanofiltration membranes instead of reverse osmosis;\(^{50}\)
• use of power generating units which can be operated using different energy sources (oil, gas, wood, diesel);
• use of motion detection for efficient lighting control;
• use of LEDs for lighting;
• closure of usable areas not used.

5.4.2 Organisational Measures

• Deployment of a representative for matters concerning energy management\(^{51}\) to measure and control the energy consumption;
• raising of awareness among the consumers with regard to economic energy use;
• use of optimum ventilation strategies, e. g. night ventilation for cooling rooms;
• briefing of personnel on the operation of air conditioning and heating systems;
• coordination of the use of space (concentration of usable areas, multiple use of space);
• conduct of audits\(^{52}\) to measure and reduce energy losses.

\(^{50}\) Depending on the quality of the raw water and release by the Senior Theatre Hygienist.
\(^{51}\) Cf. field of activity in accordance with DIN EN ISO 50001.
\(^{52}\) Analysis whether processes and requirements meet the standards required.
5.4.3 Logistic Measures

- Organising energy production close to the consumer (hot-water supply directly at the water tap, power generation close to the consumer);

- shortening transportation routes for energy/energy carriers (selection of suitable providers, mains, check the selection of traffic routes, means of transport);

- selecting energy carriers which require the least transport energy and, as appropriate, are locally available (e.g. wood, oil).

The selection of the measures shall be designed to reduce the PE consumption. In any event, the maximum value should not be exceeded (cf. paras 4.2.3 and 4.2.4).

5.5 Measures to Limit the Raw Water Demand in the Operational Infrastructure

If the consumption of raw water exceeds the raw water demand calculated for phase C, technical, organisational and logistic measures must be initiated. These measures are intended to bring the raw water consumption (monitoring result from phase D) below the raw water demand (calculation from phase C) of a static accommodation and to limit it. In the following, possible measures to reduce/limit the consumption will be described.

5.5.1 Technical Measures

- Use of dead-end-filtration for water treatment;\(^{53}\)

- use of the retentate\(^{54}\) as non-potable water/industrial water;

- regular inspection and cleaning of water mains to avoid broken water mains;

- use of all-water washing machines\(^ {55}\) and dishwashers to reduce the consumption of drinking water;

- installation of shut-off valves and measuring equipment to localise leakages in water mains;

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\(^{53}\) Conventional form of filtration via a flat membrane. Can be used only with slightly polluted raw water.

\(^{54}\) Concentrate (volume flow containing particles which are retained by the membrane).

\(^{55}\) Reduction of the consumption of drinking water by the combined use of non-potable water and drinking water.
• shutdown of water supplies to usable areas not used.

5.5.2 Organisational Measures

• Close monitoring of the water consumption for an early localisation of burst water pipes and leakages;

• raising of awareness among the consumers with regard to economic utility use;

• keeping areas free from building development where water-carrying pipelines are laid.

5.5.3 Logistic Measures

• Development of raw water sources (wells, local supplies) close to the consumer;

• keeping of necessary raw water supplies to cover peaks in demand;

• keeping of necessary drinking water supplies to cover peaks in demand;

• installation of water supplies close to the consumer;

• establishment of major waste water producers in the vicinity of waste water treatment plants;

• outsourcing of water consumers to areas with sufficient water supplies (e.g. laundry);

• use of disposable dishes in cafeterias/messing facilities.

The selection of measures shall be designed to bring the consumption of raw water below the maximum value (cf. paras 4.2.3 and 4.2.4). The measures planned and implemented must be documented in the report on the energy and utility supply.

5.6 Measures to Limit the PE Demand in the Camp

5.6.1 Technical Measures

• Use of energy efficient camp components;

• design of the utility system components in the camp module according to the plans;

• heat extraction from power generation units to cover the thermal energy demand of large-quantity consumers (kitchen, shower);
• use of solar-thermal systems for hot water generation;

• use of renewable energy sources for power generation;

• use of energy storage devices in connection with an energy management system to alleviate peak loads;

• use of nanofiltration and ultrafiltration membranes instead of reverse osmosis membranes with the already installed drinking water treatment units;\(^{56}\)

• complementing the field components by construction measures using organic resources to enhance the energy efficiency (construction of vestibules, shadowing).

5.6.2 Organisational Measures

• Observance of maintenance and inspection intervals to maintain a high energy efficiency;

• appointment of a representative for matters concerning energy management to measure and control the energy consumption;

• raising of awareness among the consumers with regard to economic energy use;

• reduction of the heating and cooling capacity when facilities are not used;

• use of optimum ventilation strategies, e. g. night ventilation for cooling rooms;

• briefing of personnel on the operation of air conditioning and heating systems;

• coordination of the use of space (concentration of usable areas, multiple use of space);

• establishment of rigorous usage rules;

• conduct of audits to record and increase energy efficiency.

5.6.3 Logistic Measures

• Use of drinking water treatment units directly at the raw water source;

\(^{56}\) The use of ultrafiltration membranes instead of reverse osmosis membranes results in an 70-percent increase in efficiency when electrical energy is used.
• Organising energy production close to the consumer (hot-water supply directly at the water tap, power generation close to the consumer);

• shortening transportation routes for energy/energy carriers (selection of suitable providers, mains, check the selection of traffic routes, means of transport);

5.7 Measures to Limit the Raw Water Demand in the Camp

5.7.1 Technical Measures

• Use of water-saving fittings with a reduced water flow;

• use of dead-end-filtration for water treatment;

• use of the retentate as non-potable water/industrial water;

• regular inspection and cleaning of water mains to avoid broken water mains;

• use of non-potable water from water recycling processes for toilet flushing and vehicle cleaning;

• installation of shut-off valves and measuring equipment to localise leakages in water mains;

• shutdown of water supplies to usable areas not used.

5.7.2 Organisational Measures

• Close monitoring of the water consumption for an early localisation of burst water pipes and leakages;

• raising of awareness among the consumers with regard to economic utility use;

• strict prohibition of the use of water for purposes other than intended;

• establishment/administration of rigorous usage rules.

5.7.3 Logistic Measures

• Development of raw water sources (wells, local supplies) close to the consumer;

• keeping of necessary drinking water supplies to cover peaks in demand;
installation of water supplies close to the consumer;

establishment of major waste water producers in the vicinity of waste water treatment plants.

6. Further Development

The concept must be continuously developed and adapted to new framework conditions.57 The capabilities necessary for accomplishing the mission and tasks of the Bundeswehr and the development of relevant framework conditions will continue in future to be major factors determining the further development of the energy and utility supply.

Experience obtained with the implementation of the measures as described above must be taken into account for the further development of the concept. In particular, the reference values concerning the demand/consumption of primary energy as well as the demand/consumption of raw water for different locations of deployment must be further developed and used as possible maximum values in the context of the further development of the concept.

6.1 Personnel, Basic, Advanced and Follow-on Training

Personnel undertaking tasks in the mission planning phases A through C in the context of this concept shall be trained as energy managers58 according to DIN EN ISO 5000159. Operating personnel responsible for the energy and utility supply during phase D (operational phase) shall be trained as energy management representatives according to DIN EN ISO 5000160. The training level must be updated by means of advanced training courses at regular intervals. The Federal Office of Bundeswehr Infrastructure, Environmental Protection and Services (BAIUDBw) must identify suitable training facilities for the conduct of training. The Federal Office of Bundeswehr Personnel Management (BAPersBw) will be responsible for the training management.

57 BAIUDBw – Infra IV 3 – will be responsible for this.
58 The course duration will be about 5 days.
60 The course duration will be about 2 days.
6.2 Materiel and Equipment

In order to achieve the objectives as specified in para 1.2, the operating personnel of the static accommodation must be provided with suitable materiel. Among other things, this includes:

- flow meters to measure utility volume flows;
- hydrometers;
- a contactless (electric) multimeter;
- a temperature sensor to measure inside and outside temperatures;
- an anemometer;\(^{61}\)
- a pyrometer;\(^{62}\)
- a thermal imaging camera;
- PC software to measure energy flows and automatically establish or update the "report on the energy and utility supply of a static field accommodation".

The necessary equipment is based on the specific objectives of a field facility's security of supply.

6.3 Interoperability

The ability to provide the static field accommodation with

- the Host Nation,
- multinational partners,
- commercial service providers and
- agencies

must be further developed to enhance the security of energy and utility supply.

---

\(^{61}\) Wind measuring device. \(^{62}\) Radiation thermometer.
The applied techniques and strategies must be designed taking into account common standards (interoperability) as much as possible. Synergies with the energy and utility supply must be used as much as possible at a multinational level. This applies, in particular, to:

- the usage of cogeneration in jointly operated military sites;
- the use of shared water treatment units/systems;
- the common measuring of the consumption of energy and utilities by means of EMS and EIS;
- the use of shared transport chains for the energy and utility supply.
7. **Reference Documents**

1. "Vorläufiges Konzept Unterbringung im Einsatz als bundeswehrgemeinsame Aufgabe" (Preliminary Concept for the Provisioning of Field accommodation as Bundeswehr-wide task), BAIUDBw of 14 June 2016;


4. General Publication B-100/9 “Unterbringung im Einsatz (UiE)” (Field Accommodation), BMVg IUD I 2 of 14 March 2016;

# Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAAINBw</td>
<td>Bundesamt für Ausrüstung, Informationstechnik und Nutzung der Bundeswehr (Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support)</td>
</tr>
<tr>
<td>BAIUDBw</td>
<td>Bundesamt für Infrastruktur, Umweltschutz und Dienstleistungen der Bundeswehr (Federal Office of Bundeswehr Infrastructure, Environmental Protection and Services)</td>
</tr>
<tr>
<td>BAPersBw</td>
<td>Bundesamt für das Personalmanagement der Bundeswehr (Federal Office of Bundeswehr Personnel Management)</td>
</tr>
<tr>
<td>BMVg</td>
<td>Bundesministerium der Verteidigung (Federal Ministry of Defence)</td>
</tr>
<tr>
<td>Bw</td>
<td>Bundeswehr</td>
</tr>
<tr>
<td>bwgem</td>
<td>bundeswehrgemeinsam (Bundeswehr-wide)</td>
</tr>
<tr>
<td>EinsFuKdoBw</td>
<td>Einsatzführungskommando der Bundeswehr (Bundeswehr Joint Forces Operations Command)</td>
</tr>
<tr>
<td>EIS</td>
<td>Energieinformationssystem (energy information system)</td>
</tr>
<tr>
<td>EMS</td>
<td>Energiemanagementsystem (energy management system)</td>
</tr>
<tr>
<td>IUD</td>
<td>Infrastruktur, Umweltschutz und Dienstleistungen (Infrastructure, Environmental Protection and Services)</td>
</tr>
<tr>
<td>SFP</td>
<td>Spezifischer flächenbezogener Primärenergiebedarf (specific site-specific demand for primary energy)</td>
</tr>
<tr>
<td>LogKdoBw</td>
<td>Logistikkommando der Bundeswehr (Bundeswehr Logistics Command)</td>
</tr>
<tr>
<td>SKB</td>
<td>Streitkräftebasis (Joint Support Service)</td>
</tr>
<tr>
<td>KdB</td>
<td>Konzeption der Bundeswehr (The Bundeswehr Concept)</td>
</tr>
<tr>
<td>PE</td>
<td>Primärenergie (primary energy)</td>
</tr>
<tr>
<td>PEV</td>
<td>Primärenergiebedarf/-verbrauch (demand for/consumption of primary energy)</td>
</tr>
<tr>
<td>PEF</td>
<td>Primärenergiefaktor (primary energy factor)</td>
</tr>
<tr>
<td>RW</td>
<td>Rohwasser (raw water)</td>
</tr>
<tr>
<td>TK</td>
<td>Teilkonzept (subconcept)</td>
</tr>
<tr>
<td>MilOrgBer</td>
<td>Militärischer Organisationsbereich (Major Military Organisational Element)</td>
</tr>
<tr>
<td>WE</td>
<td>Weiterentwicklung (further development)</td>
</tr>
</tbody>
</table>
9. Annexes

Annex 1: Diagram of the Energy Supply Chains, Determination of PEF, PEV, SFP

Annex 2: Primary Energy Factors (PEF)


Annex 4: Utility Analysis
Concept: Increasing the Security of Supply by Optimising Energy and Utility Supply for Static Field Accommodation

Annex 1: Diagram of the energy supply chains, determination of PEF, PEV, SFP

Sample calculation of the Primary Energy Factor (PEF), the Primary Energy Consumption (PEV) and the Specific Area-Related Primary Energy Demand (SFP)

Definition of Task:

A static accommodation with an estimated usable area of 10,000 m² and an estimated energy demand (electric current) of 410,000 kWh/year is to be supplied.

The following three energy supply chains (E1; E2; E3) are to provide electric energy:

1. Diesel is transported by air (5,000 km) to the static accommodation and converted into electricity there (E1 = 100,000 kWh/year).
2. Electricity is provided by an Alliance partner. The transport of the energy source (diesel) is carried out by the Alliance partner by land by means of a convoy, including convoy protection, over a distance of 1,300 km (E2 = 300,000 kWh/year).
3. Electricity is generated by renewable energy sources directly at the static accommodation (E3 = 10,000 kWh/year).

The aim of the following calculation is to describe, as an example, a situation picture of the energy supply chains (Phase A) and a schematic diagram of the energy supply chains (Phase B), and to determine PEF, PEV and SFP (Phase B).
Annex 1

Calculation Bases:

Calorific value of diesel = calorific value of kerosene: 10 kWh / litre
Kerosene consumption per km (air transport): 3 litres / km
Diesel consumption per transport vehicle: 25 litres / 100 km
Transport vehicles used per convoy: 10
Diesel fuel transported per convoy: 45,000 litres
Electrical efficiency of the generator: 30 %
Reactive power in the electrical network: 5 %

\[ PEF = \frac{\text{Energy used}}{\text{Energy delivered}} \quad SPF = \frac{\text{Primary energy used}}{\text{Usable area}} \]

<table>
<thead>
<tr>
<th>Energy carrier/source</th>
<th>PEF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combustible primary energy sources (fuel oil, diesel, kerosene, natural gas, coal)</td>
<td>1.2</td>
</tr>
<tr>
<td>Combined heat and power from fossil fuel</td>
<td>0.7</td>
</tr>
<tr>
<td>Electricity (electricity mix of conventional and renewable energy sources)</td>
<td>1.8</td>
</tr>
<tr>
<td>Environmental energy (solar thermal energy, photovoltaics, wind power)</td>
<td>0</td>
</tr>
</tbody>
</table>

No combustible primary energy sources are used.

Primary energy factors based on DIN V 18599-1:2016-10 (cannot be used if direct determination is not possible)
Annex 1

Schematic Overview of Energy Supply Chains
Annex 1

Calculation of PEF, Supply Chain 1

a) \( PEF_a \) as per DIN 18599-1:2016-10, page 76, "Fossile Brennstoffe" (Fossil Fuels). Non-renewable portion \( \rightarrow 1.1 \text{ to } 1.2 \) \( \rightarrow \) Assumption: 1.2

b) Transport by air: 5000 km
   Consumption of kerosene: 3 litres / km \( \rightarrow 15,000 \) litres in total
   Diesel transported: 15,000 litres
   Assumption: Calorific value of diesel = calorific value of kerosene = 10 kWh per litre

    \[
    PEF_b = \frac{\text{Energy used}}{\text{Energy delivered}} = \frac{(15,000 \text{ litres}_{\text{diesel}} + 15,000 \text{ litres}_{\text{kerosene}}) \cdot 10 \text{ kWh/litres}}{15,000 \text{ litres}_{\text{diesel}} \cdot 10 \text{ kWh/litres}} = 2.0
    \]

c) Electrical efficiency of the generator: 30 %
   Conversion of 15,000 litres of diesel with a calorific value of 10 kWh/litre into 45,000 kWh of electricity

    \[
    PEF_c = \frac{15,000 \text{ litres}_{\text{diesel}} \cdot 10 \text{ kWh/litres}}{(15,000 \text{ litres}_{\text{diesel}} \cdot 10 \text{ kWh/litres}) \cdot 0.3_{\text{Electr. effciency}}} = \frac{150,000 \text{ kWh}_{\text{diesel}}}{45,000 \text{ kWh}_{\text{Electr. current}}} = 3.33
    \]

d) \( PEF_d \): Reactive power in the electrical network: 5 % \( \rightarrow 1.05 \)

\[
PEF1 = PEF_a \cdot PEF_b \cdot PEF_c \cdot PEF_d = 1.2 \cdot 2.0 \cdot 3.33 \cdot 1.05 = 8.32
\]
Annex 1

Example of Calculating the PEF, Supply Chain 2

a) $PEF_a$ as per DIN 18599-1:2016-10, page 76, "Fossile Brennstoffe". Non-renewable portion $\rightarrow$ 1.1 to 1.2 $\rightarrow$ Assumption: 1.2

b) Transport by truck 1,300 km; 10 vehicles (incl convoy protection); 25 litres/100 km
Average consumption of diesel: 25 litres/100 km $\rightarrow$ Consumption 3250 litres
Diesel consumption for the return trip: 3250 litres
Total diesel consumption: 3250 + 3250 = 6500 litres
Diesel transported: 45,000 litres

$$PEF_b = \frac{\text{Energy used}}{\text{Energy delivered}} = \frac{45,000 \text{ litres}_{\text{diesel}} + 6,500 \text{ litres}_{\text{diesel consumption}}}{45,000 \text{ litres}_{\text{diesel}} \cdot 10 \frac{\text{kWh}}{\text{litres}}} \cdot 10 \frac{\text{kWh}}{\text{litres}} = 1.14$$

c) Electrical efficiency of the generator: 30 %
Conversion of 45,000 litres of diesel with a calorific value of 10 kWh/litre into 135,000 kWh of electricity

$$PEF_c = \frac{45,000 \text{ litres}_{\text{diesel}} \cdot 10 \frac{\text{kWh}}{\text{litres}}}{\left(45,000 \text{ litres}_{\text{diesel}} \cdot 10 \frac{\text{kWh}}{\text{litres}}\right) \cdot 0.3 \text{ electr. efficiency}} = \frac{450,000 \text{kWh}_{\text{diesel}}}{135,000 \text{kWh}_{\text{electr. current}}} = 3.33$$

d) $PEF_d$: Reactive power in the electrical network: 5 % $\rightarrow$ 1.05

$$PEF_2 = PEF_a \cdot PEF_b \cdot PEF_c \cdot PEF_d = 1.2 \cdot 1.14 \cdot 3.33 \cdot 1.05 = 4.78$$
Annex 1

Calculation of PEF, Supply Chain 3

a) \( PEF_a \) as per DIN 18599-1:2016-10, page 76, "Umweltenergie" (Environmental Energy). Non-renewable portion \( \rightarrow PEF = 0 \)

b) \( PEF_b \): Reactive power in the electrical network: 5% \( \rightarrow PEF = 1.05 \)

\[
PEF3 = PEF_a \cdot PEF_b = 0 \cdot 1.05 = 0
\]
Annex 1
Calculation of PEF and SFP, Supply Chains 1, 2, 3

Calculation of the Total PEV of the Static Accommodation

1. PEF = 8.32
2. PEF = 4.78
3. PEF = 0

\[
PEV_{\text{total}} = \sum_{i=1}^{3} E_i \cdot \text{PEF}_i = 100,000 \text{ kWh} \cdot 8.32 + 300,000 \text{ kWh} \cdot 4.78 + 10,000 \text{ kWh} \cdot 0
\]

\[
PEV_{\text{total}} = 2,266,000 \frac{kWh}{\text{year}}
\]

\[
SFP = \frac{2,266,000 \frac{kWh}{\text{m}^2 \cdot \text{year}}}{10,000 \text{ m}^2} = 227 \frac{\text{kWh}}{\text{m}^2 \cdot \text{year}}
\]
Annex 1

Assessment of PEV and SFP, Result

The Primary Energy Demand (PEV) of the static accommodation is:

\[
2,266,000 \frac{kWh}{\text{year}}
\]

The Specific Area-Related Primary Energy Demand (SFP) of the static accommodation is:

\[
227 \frac{kWh}{m^2 \text{ year}}
\]

The SFP serves to assess the efficiency in the energy supply to the static field accommodation.

The determined PEV of a static accommodation is to be observed by the implementation of measures (cf. Section 5.4). In this context, the PEV constitutes the maximum value to be observed.
## Annex 2: Primary Energy Factors

<table>
<thead>
<tr>
<th>Primary Energy Factor based on combustible primary energy carriers</th>
<th>$PEF_a$</th>
<th>$PEF_b$</th>
<th>$PEF_c$</th>
<th>$PEF_d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diesel / rape oil / biodiesel</td>
<td>1.2</td>
<td>$1 + \left( \frac{0.00156 \cdot km}{100} \right)$</td>
<td>3.33</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1 + \left( \frac{0.02 \cdot km}{100} \right)$</td>
<td>1.11</td>
<td>1.25</td>
</tr>
<tr>
<td>Natural gas</td>
<td>1.2</td>
<td></td>
<td>2</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.11</td>
<td>1.25</td>
</tr>
<tr>
<td>Coal</td>
<td>1.1</td>
<td>$1 + \left( \frac{0.00223 \cdot km}{100} \right)$</td>
<td>3.33</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.11</td>
<td>1.25</td>
</tr>
<tr>
<td>Wood</td>
<td>1.2</td>
<td>$1 + \left( \frac{0.0045 \cdot km}{100} \right)$</td>
<td>3.33</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.11</td>
<td>1.25</td>
</tr>
</tbody>
</table>

---


Annex 2: Primary Energy Factors

<table>
<thead>
<tr>
<th>Primary Energy Factors (PEF)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( PEF_a )</td>
<td>( PEF_b )</td>
<td>( PEF_c )</td>
<td>( PEF_d )</td>
</tr>
<tr>
<td>Combined heat and power based on combustible primary energy carriers</td>
<td></td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>Electric power from the public grid</td>
<td>Production</td>
<td>Processing</td>
<td>Transport</td>
</tr>
<tr>
<td>Electric power generated from coal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric power generated from oil /oil products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric power generated from nuclear power</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric power generated from water power (no use of combustible primary energy carriers)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Annex 2: Primary Energy Factors

<table>
<thead>
<tr>
<th>Environmental energy</th>
<th>PEF&lt;sub&gt;a&lt;/sub&gt;</th>
<th>PEF&lt;sub&gt;b&lt;/sub&gt;</th>
<th>PEF&lt;sub&gt;c&lt;/sub&gt;</th>
<th>PEF&lt;sub&gt;d&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar thermal energy / photovoltaics / wind (no use of combustible primary energy carriers)</td>
<td>0</td>
<td>0</td>
<td>–</td>
<td>1.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Heat distribution&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

---

Report on Energy and Utility Supply

Camp: "Sample"
Nearest municipality: "Sample Town"
Region: "Sample Province"
Country: "Sample Country"
Mission: "Sample Force"

Prepared by: > ... <
As of > Date <
Annex 3: Sample Form for the "Report on Energy and Utility Supply"

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1. General Description

1.1 Sub-Heading I

1.2 Sub-Heading II

1.2.1 Sub-Heading II.1

1.3 Sub-Heading III

2. Description of Geospatial Factors/Further Parameters

2.1 Climate

2.2 Security Situation

2.3 Supply Infrastructure

2.3.1 Sub-Heading

2.3.2 Sub-Heading

3. Technical Optimisation of Energy and Utility Supply

3.1 Benefit Analysis

3.2 Description of Technical Measures Proposed and Implemented

3.2.1 For Example: Combined Heat and Power

3.2.2 For Example: Solar Thermal Energy

3.2.3 For Example: PV System

4. Operational Planning

4.1 Phase (A)

Analysis Phase

4.1.1 Reconnaissance Results on Energy and Utility Supply
4.1.2 Estimate of Primary Energy and Raw Water Demand for Static Accommodation

4.1.3 Geospatial Factors Relevant to the Energy Supply such as:

4.1.3.1 Existing Supply Infrastructure

4.1.3.2 Special Climatic Conditions

4.1.3.3 Availability of Raw Materials

4.2 Phase (B)

Planning Phase

4.2.1 Schematic Diagram of the Forward Energy and Utility Supply Chains – Identification of Large-Scale Users of Energy and Utilities

4.2.2 Further Specification of the Primary Energy/Raw Water Demand Based on the Services/Requirements Specified by the Bundeswehr Joint Forces Operations Command (EinsFüKdoBw)

4.2.3 Determination of the Primary Energy Factors of Locally Available Types of Energy

4.3 Phase (C)

Activation of the Contingent

4.3.1 Assessment of Logistic Support Channels/Forward Supply Chains with Regard to the Energy and Utility Demand

4.3.2 Type and Scope of Infrastructure Facilities for Energy and Utility Supply

4.3.3 Location, Number and Type of Energy Conversion and Water Treatment Steps

4.3.4 Primary Energy/Raw Water Demand for Static Accommodation
4.4  Phase (D)
Operation Phase

4.4.1 Primary Energy/Raw Water Consumption for Static Accommodation

4.4.2 Measures to Reduce Primary Energy/Raw Water Consumption

**Maximum Values**

Primary energy consumption: MWh of primary energy/year

Specific raw water consumption: Raw water/(person*day)

**Auxiliary Values:**

PEF of energy supply chains

SPF: kWh/(m²*year)

5. Mission Execution

Permanent logging of reference variables, target/actual value comparison, measures taken
6. Annexes

6.1 Camp Layout Plans (Updated)

6.2 Energy Flow Diagram

6.2.1 Primary Energy

6.2.2 Secondary Energy

6.2.3 Final Energy

6.2.4 Useful Energy

6.3 Utility Flow Diagram

6.3.1 Raw Water

6.3.1.1 Analytical Data on the Raw Water

6.3.2 Drinking Water

6.3.2.1 Drinking Water Consumers

6.3.2.2 Analytical Data on the Drinking Water

6.3.3 Waste Water

6.3.3.1 Waste Water Producers

6.3.3.2 Analytical Data on the Waste Water

6.4 Further Descriptions, Records, Annexes, etc.
Annex 4: Benefit Analysis

Explanation of the Approach in the Benefit Analysis

The benefit analysis was used to formulate recommendations concerning technologies and strategies for every region and taking into account assumptions and parameters. The assumptions and parameters are summarised in Tables 1–3.

Assumptions:

<table>
<thead>
<tr>
<th>Duration of operation with field accommodation</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 60 days</td>
<td>Possibility 1 (not considered)</td>
</tr>
<tr>
<td>&lt; 3 years</td>
<td>Possibility 2</td>
</tr>
<tr>
<td>Up to 10+</td>
<td>Possibility 3</td>
</tr>
</tbody>
</table>

Table 1 "Duration of operation"¹

<table>
<thead>
<tr>
<th>Size of site [number of personnel]</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 300</td>
<td>less than 300 personnel</td>
</tr>
<tr>
<td>300 – 1,000</td>
<td>300 – 1,000 personnel</td>
</tr>
<tr>
<td>&gt; 1000</td>
<td>more than 1,000 personnel</td>
</tr>
</tbody>
</table>

Table 2 "Size of site"

¹ Cf. General Publication B-100/9 "Unterbringung im Einsatz" (Field Accommodation), page 9.
Annex 4: Benefit Analysis

<table>
<thead>
<tr>
<th>Assumptions: Climate</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incoming solar radiation</td>
<td>[W/m²]</td>
</tr>
<tr>
<td>Temperature</td>
<td>[°C]</td>
</tr>
<tr>
<td>Mean wind speed</td>
<td>[m/sec]</td>
</tr>
</tbody>
</table>

Table 3: Climatic assumptions

The assumptions made about the static field accommodation form the basis for the selection of appropriate measures to increase the security of energy and water supply.

The potential **parameters** include the available technologies such as:

- Batteries
- Solar thermal chillers
- Heat recovery
- Solar thermal plants
- Small wind power plants
- Wind power plants
- Photovoltaics
- Waste incineration plants
- Combined heat and power
- Biogas power plants
and strategies such as:

- Waste water recycling
- External certifications
- Training of personnel
- Energy delivery contracting
- Reduction of energy consumption

Technologies and strategies are selected by means of a benefit analysis. This is an appropriate assessment method because a complex decision must be taken by means of several assumptions and parameters influencing one another.

Procedure:

Depending on the individual case, the assumptions and parameters can have a competing, a complementary and a neutral relation to each other. Therefore the aim of the benefit analysis is to determine, from the diversity of these relations, the combination that promises the maximum possible benefit for achieving the formulated goal of "increasing the security of supply by optimising energy and utility supply for static field accommodation". The benefit is represented by means of a priority number which is squared in order to point out its particular importance (cf. Figure 1, last line). In addition, the selected technologies and strategies are placed in the order of the highest priority number. Subsequently, a recommendation of the first three selected measures and strategies will be made in the Report on Energy and Utility Supply in accordance with Annex 3 to the concept.

The assumptions and parameters are to be illustrated as in Figure 1 and to be assessed for their suitability to limit the primary energy demand. This assessment is to be included in the Report on Energy and Utility Supply.
Example of an Assessment of Strategies and Technologies by Means of a Benefit Analysis:

The assessment of the technology "heat recovery" illustrated in Figure 1 is presented in the following example for the Baltic Region (represented here by Estonia). The assessment is made by means of three characteristic values (cf. Figure 1):

- 0: Neutral
- 1: Promising
- 2: Particularly promising

The assessment of technologies and strategies is to be documented in detail (cf. Table 4). The documentation is to be included in the Report on Energy and Utility Supply.
### Annex 4: Benefit Analysis

Example of Preparing the Documentation by the Example of the Technology: Heat Recovery:

<table>
<thead>
<tr>
<th>Assumptions and Parameters</th>
<th>Heat Recovery Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>&lt; 3 years</strong></td>
<td>The installation of heat recovery systems at field facilities with a duration of operation of up to 3 years is advantageous and feasible. Heat recovery saves a large amount of energy – especially during the cold seasons – and hence increases the sustainability of field facilities.</td>
</tr>
<tr>
<td><strong>150 – 800 personnel</strong></td>
<td>The use of heat recovery is possible, taking into account the number of forces at the field facility (number of personnel), especially in community rooms and large warehouses. The measure increases the sustainability of the field facility.</td>
</tr>
<tr>
<td><strong>Incoming solar radiation (900 kWh/year, m²)</strong></td>
<td>The small amount of incoming solar radiation leads to poor solar heat gains in accommodation quarters and usable space. The consequence is a high energy consumption for heating. Under these circumstances, the use of heat recovery leads to a low energy consumption of buildings and hence increases the sustainability of the field facility.</td>
</tr>
<tr>
<td><strong>Temperature (5.1 °C)</strong></td>
<td>The climatic conditions result in a high energy demand for heating accommodation quarters and usable space. In this context, the use of heat recovery is particularly advisable because the outdoor-indoor temperature gradient is particularly high.</td>
</tr>
<tr>
<td><strong>Mean wind speed 4.12 m/s</strong></td>
<td>There is a neutral relationship between the wind speed and the technology &quot;heat recovery&quot;.</td>
</tr>
</tbody>
</table>

| Result | 7 |
| Priority number | 49 |

Table 4: Assessment documentation
Annex 4: Benefit Analysis

The priority number for the technology "heat recovery" is the highest one among those that were also examined (cf. Figure 1) and is therefore adopted in the recommendations of the Report on Energy and Utility Supply (Annex 3).