
Rjukan-Notodden (Norway) No 1486

Official name as proposed by the State Party

Rjukan-Notodden Industrial Heritage Site

Location

Telemark County

Brief description

Located in a dramatic landscape of mountains, waterfalls and river valleys, the Rjukan-Notodden Industrial Heritage Site comprises a cluster of pioneering hydro-electric power plants, transmission lines, factories, transport systems and towns. The complex was established by the company Norsk-Hydro to manufacture artificial fertilizer from nitrogen in the air in response to the Western world's demand for increased agricultural production in the early 20th century. Rjukan and Notodden company towns, 80 kilometres apart, include workers' housing and social institutions connected by railway lines and ferry services to ports of embarkation for the fertilizer and other products. Three of the pioneering power plant buildings (Vemork, Såheim and Tinfos II) constructed between 1905 and 1940 are intact and still in use.

Category of property

In terms of categories of cultural property set out in Article I of the 1972 World Heritage Convention, this is a *site*.

1 Basic data

Included in the Tentative List

26 November 2009

International Assistance from the World Heritage Fund for preparing the Nomination

None

Date received by the World Heritage Centre

30 January 2014

Background

This is a new nomination.

Consultations

ICOMOS consulted TICCIH and several independent experts.

Technical Evaluation Mission

An ICOMOS technical evaluation mission visited the property from 1 to-5 September 2014.

Additional information received by ICOMOS

A letter was sent to the State Party on 20 August 2014 requesting additional information on the industrial processes, boundaries, protection and management and future development projects. Some information was provided to the technical evaluation mission and received on 19 September 2014 & 6 October 2014 including the timetable for legislation and approval of the Management Plan, explanation of legislative changes, information regarding items in the buffer zone and future development projects. A response to the letter was received on 6 November 2014. A second letter was sent to the State Party following the ICOMOS Panel in December 2014 regarding extension of the property boundary and completion of the legislative protection of the property, together with some management and monitoring issues. A telephone meeting between the State party and ICOMOS was held on 15 January 2015 at the request of the State Party to clarify some points in ICOMOS' second letter. A response was received on 26 February 2015. The information has been incorporated below.

Date of ICOMOS approval of this report

12 March 2015

2 The property

Description

The nominated property comprises the interlinked water courses from the Møsvatn regulating reservoir on the Hardangervidda mountain plateau down to Heddalsvatnet Lake, a stretch of 93km and covers a total area of 4959.5ha. It includes the elements of four interrelated functions or themes: hydroelectric power production, electro-chemical processing industry, the transport system and two company towns Rjukan and Notodden. These are surrounded by a buffer zone of 33,967.6ha.

Hydroelectric power production

The hydroelectric power generation system was developed by Norsk Hydro to exploit the water drops totalling over 700 metres from the high plateau created by the waterfalls of Tinnfossen, Svælgfos and Rjukanfossen. Cheap electricity was required to manufacture synthetic nitrogen fertilizer based on the energy-intensive, electro-chemical Birkeland/Eyde process. The first test facility utilised the Tinfos I power plant outside Notodden from 1901. The gable-roofed, plastered brick building remains as a shell and is used as a workshop. This was followed by Hydro's Svælgfos (1907) which at the time was the second largest power plant in the world after Ontario Power by the Niagara River. Today this is represented only by the stone building which was the lightning arrester house and workshop. The major Hydro pioneering power plants along the interlinked water courses include Tinfos II (1912) with original decorated interiors, fixtures and fittings largely intact; the decorative stone-clad concrete Vemork power station at Rjukan (1911) fed by a high

pressure system with a great head of water and rock tunnels, regulated by the concrete dam at Møsvatn, and Såheim (1915), a distinctive concrete building with cupola-capped towers. Other architectural elements include the old stone intake gatehouse at Vemork; the penstock valve house at Vemork which remains encased in the concrete applied by the Germans to protect it during WWII; concrete workshop buildings associated with Såheim, the concrete Cable House (1915), transformer and distribution station (1915) and remains of power distribution lines. Vemork was possibly the world's biggest power plant when it began operation, and Såheim larger still in terms of output. In world terms however, ICOMOS notes that the important advances in hydroelectric power were really in distribution capability to distant cities and industries rather than output in kilowatts.

Industrial facilities

Norsk Hydro's test factory for the production of nitrogen from the air in order to produce synthetic fertilizer was created at Notodden. This was already a traffic hub and industrial community due to the Tinfos AS Company which was first a paper manufacturer and later developed an ironworks. Today the shell of the concrete Tower House A (1907-21) remains at Notodden, together with other buildings including the rendered brick and concrete Calcium Nitrate Factory (1915-16) which has been much altered, Furnace House C (1907-9), the Testing Plant and Electrical Workshop (1909), Laboratory and Workshop (1915), Hydrogen Factory (1927), the Ammonia Water Plant (1914-16) and the Minaret, a 63m high concrete tower used as air intake for the production of gaseous nitrogen in the ammonia production process.

The facilities at Rjukan were built for large scale production by Hydro and were much more extensive. Here the Furnace House and the Tower House were prominent elements in a production line based on the electric arc process. Remaining buildings at Rjukan include Furnace House I (1910-11) comprising five gabled halls, steel framed and clad in brickwork, the brick Boiler House (1911), Laboratory (1911), Nitrogen Plant (1928), Compressor House (1928), and retains a complete acid tower as a freestanding object, the only one remaining from the original 32 in Tower House 1 (now demolished). This is a granite tower which enclosed limestone quartz aggregate through which water percolated to absorb nitrous gases and produce nitric acid as a stage in the nitrate production. At both sites industrial production has continued inside Hydro's buildings adapted for enterprises that are historically linked to Hydro.

Transport system

An interconnected transport system of two railway lines and two steam-powered ferry crossings joined Rjukan's facilities to Notodden to enable the saltpetre to be transported on to world markets via the Telemark Canal. The railway was electrified in 1911 and is largely intact including railway buildings, ferry quays and two ferries now installed as part of the Norwegian Industrial Workers

Museum at Vemork. Important structures are tunnels and bridges including the Gaupesprang riveted steel truss bridge (1909); the picturesque Notodden old railway station building (1908-9); Rjukan Quay (1909 - the Railway Quay); Tinnoset Railway Station buildings (1909); Tinnoset Ferry Quay and buildings (1909); 10 of the original 11 lighthouses along Tinnsjøen Lake (1908/1939/1962), Mæl Ferry Quay 1909; Mæl Railway Station 1909/1917; Mælsvingen houses (c 1914); Ingølsland Railway Station; Rjukan Railway Station; Såheim Engine Shed; together with railway track, signalling and overhead line equipment. The line closed in 1991 and its ownership together with that of the ferry quays, slipways, lighthouses, railway stock, tracks and railway buildings was transferred to the Rjukan Line Foundation in 1997. In 2012 ownership was transferred to the Vemork Museum.

Rjukan and Notodden Company towns

Notodden

Workers' housing in Notodden was provided by both Tinfos AS and Hydro, expanding the original settlement which served the surrounding farming community. The Hydro housing areas of Grønnebyen (1906) and Villamoen (1908) are located on terraces above the factory and the lake, with Own Homes (1910-14) and Tinnebyen (1917-20) to the east. Hydro housing is also located at Svælgfos (from 1905) and Lienfos (from 1909) north of the urban centre. Hydro is credited with laying out the commercial centre and also built a primary school, theatre and municipal baths – now all demolished - a hospital which still exists and an administration building. The housing layout reflects garden city ideals and architecture of the period.

Rjukan

This was a self-contained model company town created by Hydro based on ideas drawn from Sweden and Germany and laid out along both sides of the Mana River. The housing was mostly along the north side in order to maximise sunlight and stratified according to social order with workers' housing lower down. Over 140 house types were designed often by German-trained architects in both wood and brick and following modern ideas of light and ventilation. Bathrooms with hot water, a flush toilet and electric lighting in every apartment were intended to attract workers, who would get an opportunity to buy their own home. The town reached its peak of around 12,000 residents in 1920, when it was the largest industrial town in Norway. Schools, children's home, parks, hospital, library, post office, sports grounds and halls were all built by Hydro, as well as the necessary infrastructure, again reflecting garden city ideals. The prestigious buildings were designed by recognised architects in styles varying from historicism, art nouveau, neoclassicism to functionalism. Power plant buildings were constructed using reinforced concrete, steel and glass.

A catalogue of existing buildings and structures considered to be attributes of the property's value is included in the nomination dossier.

History and development

Telemark is a traditional farming area and the development of the Rjukan-Notodden hydroelectric scheme, saltpetre factories and towns required the purchase of farms on which to build. The area is also rich in mineral resources which have been mined in the past. The watercourses had been used in earlier centuries for waterwheels to generate power for mills and saws and floating timber from the forests to the saw mills. From the 18th century the mountains and waterfalls also attracted tourists. The existing conditions which enabled the establishment of Hydro's large factories for production of fertilizer were the canalised river system with locks connecting to the sea; the Tinfos power plant which could be used for the test factory, and the water drop of the Rjukanfossen waterfall which could be harnessed for the large amount of cheap energy required.

The establishment of the Norsk Hydro Company by engineer and industrialist Sam Eyde in 1905, the year of Norway's full independence opened the way for large-scale industrial development in Telemark. At the beginning of the 20th century the world's known natural sodium nitrate resources (saltpetre) in South America were greatly depleted and the search was on to find a synthetic replacement to increase crop yields in advance of the predicted food crisis. Development of the alternating current system of electricity in the late 19th century and its use at the first power plant at Niagara Falls paved the way for the use of hydroelectricity to power Birkeland's electric arc furnace which drew nitrogen from the air, producing 'Norway saltpetre'. Working with engineer and entrepreneur Sam Eyde, who had studied in Germany and had business and social connections both there and in Sweden, the two brought together expertise and financial capital from a wide range of sources. By 1912, Hydro was contributing 71,000 tonnes to the world's fertilizer market.

During WWI ammonia nitrate became more important as it could be used to make explosives and Hydro built an ammonia nitrate plant at Notodden. After the war the focus returned to agricultural fertilizer and by 1920 production of Norway saltpetre amounted to 135,000 tonnes, doubling every ten years until it became the largest nitrogen exporter in Europe by the 1950s. In the inter-war period Hydro changed to a production method based on electrolytic hydrogen and new facilities were built 1928-9, with ammonia production in Notodden and continued fertilizer production using the Haber-Bosch method in Rjukan. The stock market crash led to rationalisation of Hydro's activities during the 1930s. Germany took over Rjukan's facilities during WWII and built installations to produce heavy water shipped to Germany for use in controlling nuclear fission. Rjukan consequently became the focus of sabotage attacks by the Allies and at the end of the War the Norwegian State took over as the majority shareholder due to the strategic importance of the enterprise. Hydro subsequently moved its fertilizer business and activities to Herøya near Porsgrunn in the late 1960s.

Today Notodden Industrial Park is home to around 50 enterprises and the town continues as a centre for commerce, the service industry and education. Rjukan Industrial Park accommodates 30 different enterprises in an area of 21 ha containing 34 buildings. The town is regarded as a tourism centre for Tinn Municipality.

The East-Telemark watercourse continues to be used for hydroelectric power production and as a tourist waterway. The original Tinfos II, Vemork and Sâheim power stations are still intact and in operation. They have been supplemented by several new plants which have generally been constructed in rock caverns. The visible façade of the New Vemork power plant located in a rock cavern behind the old power plant is a Brutalist-style concrete structure. The old Vemork power plant now houses the Norwegian Industrial Workers Museum with its exhibition, offices, cafeteria and shop. The original generator sets still in place in the generator hall form part of the permanent exhibition of the museum. The old Tinfos I power plant remains as building shell. The New Tinfos I plant (1955) is a Functionalist-style building of painted concrete. The lakes and rivers are no longer used commercially except for tourist vessels.

3 Justification for inscription, integrity and authenticity

Comparative analysis

The State Party points out that the comparative analysis for this property needs to be seen in the light of the ICOMOS 'Filling the Gaps' report of 2005 which highlights typological, chronological-regional and thematic categories into which this property fits. Within Norway the property is compared with Odda and Tysedal on the Tentative List which represents the exploitation of the natural topography for use of hydroelectric power to produce artificial fertilizer by the carbide and cyanamide processes. The industrial process could be seen to complement that at Rjukan-Notodden but the overall establishment does not include transport infrastructure or a company town and is thus less representative of the overall enterprise. The property is also compared with Hydro's establishment at Herøya near Porsgrunn where the company established the world's biggest calcium nitrate factory in the 1920s with options for both sea and overland transport and to which it moved its activities from Rjukan-Notodden in the late 1960s. This represents the industrial phase that followed the pioneering plants at Rjukan-Notodden but is said not to demonstrate the same values at similar depth. Other industrial enterprises referred to in Norway are said to either represent a later phase of industrial development or do not reflect similar values.

The property is compared with World Heritage listed properties at Ironbridge Gorge, UK (1986, (i), (ii), (iv) & (vi)); Blaenavon Industrial Landscape, UK (2000, (iii) & (iv)); New Lanark, UK ((2001, (ii), (iv) & (vi)); Saltaire, UK (2001, (ii) & (iv)); Crespi d'Adda, Italy (1995, (iv) & (v)); Volklingen Iron Works, Germany (1994, (ii) & (iv));

Zollverein Coal Mine Industrial Complex in Essen, Germany (2001, (ii) & (iii)); and Salins-les-Bains & Royal Saltworks of Arc-et-Senans, France (1982, 2009, (i), (ii) & (iv)), none of which represent the same period and type of global industrial development. Humberstone & Santa Laura Saltpeter Works, Chile (2005, (ii), (iii) & (iv)) is similar in responding to the world-wide demand for fertilizer but not in terms of the combination of hydroelectricity and electro-chemical processes.

The property is also compared with properties on the Tentative List at Ivrea, Italy; Industrial complexes at Ostrava, Czech Republic; Kyushu and Yamaguchi, Japan; La Constancia Mexicana, Mexico; Pilgrim's Rest Reduction Works, South Africa and other relevant enterprises in UK, Germany, Sweden, France, Switzerland, Austria, and particularly Canada and the USA, where the Niagara Falls were the site of the beginnings of hydroelectric power and electro-metallurgic industry. The State Party argues that Rjukan-Notodden stands out as representative of the new form of global industrial economy based on electricity in the early 20th century by the way it was organised and financed in one overall project. The State Party suggests however that in relation to hydroelectric power generation reflecting the importance of electricity, a number of sites could be combined as a transnational series. ICOMOS considers that in fact the restriction of the tie-in of power production to the limited purpose of fertilizer production at Rjukan-Notodden meant that by comparison the Niagara plants in particular supplied greater capacity for more uses distributed over far greater areas. However ICOMOS concurs with the State Party's claim that the nominated property is clearly distinguished by its combination of industrial themes and assets which together make it an exceptional representation of early 20th century industrial development.

ICOMOS considers that the comparative analysis justifies consideration of this property for the World Heritage List.

Justification of Outstanding Universal Value

The nominated property is considered by the State Party to be of Outstanding Universal Value as a cultural property for the following reasons:

- Ground-breaking industrial development as electricity replaced coal as a source of energy
- Testament to social transformation in the Western world at the beginning of the 20th century
- Created to produce a product (synthetic fertilizer) considered essential for the future of civilisation
- Representative of the exchange of results from science and research across national borders
- A complete ensemble of the contributing elements of hydroelectric power, industrial production, transport system and company towns created as one project.

ICOMOS considers that the first point of this justification needs to consider that coal-fired and oil-fired electricity also powered new global industries in the early 20th century. It would be more appropriate to say "ground-breaking industrial development using electricity as a source of energy". ICOMOS considers that the other points are appropriate.

Integrity and authenticity

Integrity

In general all important remaining physical structures and objects that are testimony to the industrial pioneering period of the production of artificial fertilizer for agriculture in Norway in the early 20th century are within the boundaries of the nominated area. ICOMOS notes that the ruins of Svælgfos I power plant, the Lienfos Dam and the foundations of the nitrogen and the ammonia gasometers at Rjukan together with some other structures within the nominated property are not considered as attributes by the State Party because of their ruinous state, but are considered as "supporting values". ICOMOS considers that they are integral to the hydropower and fertilizer production and should be maintained as part of the nominated property. ICOMOS notes that the ruins of Svælgfos II power plant, transformer station, plant operations manager's residence, penstock foundations, a section of the Svælgfos-Tinfos timber flume, and Lienfos power station remains which are part of the Svælgfos and Lienfos cultural environments are not included within the property but are in the buffer zone, although said to be part of the pioneering period of significance of the site. According to the State Party this is because of their lack of integrity and authenticity. ICOMOS also notes that there are also nine other power stations which are specified neither as attributes, nor as "supporting values". Additional information provided by the State Party in response to ICOMOS' query on this states that these were all built many years later than those relating to the key period of the property and all except New Tinfos I power plant (built in 1955) are located in the buffer zone and not in visible vicinity of the older ones. While not considered an attribute of the nominated property, New Tinfos I is protected under the Cultural Heritage Act as of 20 June 2014. ICOMOS considers that the nominated property is of adequate size to ensure the complete representation of the features and processes which convey the property's significance. However ICOMOS considers that integrity would be improved by inclusion of the Svælgfos and Lienfos cultural environments within the property boundary. In response to ICOMOS' letter and subsequent telephone meeting the State Party has provided new maps showing that the boundaries now enclose these areas. The physical fabric of the property and its significant features are generally in a good condition. The property is not suffering from adverse effects of development or neglect.

Authenticity

ICOMOS considers that the overall authenticity of the nominated property and its setting is high.

Hydroelectric power production

Hydro's power plants in the Tinnelva River have mostly been demolished, but some ruins of Lienfos as well as of Svælgfos I and II are still in place. The Myrens Dam that supplied water to Tinfos I power station is now dry and its penstock has been removed. The old Møsvatn Dam and Skardfoss Dam have been replaced by new dams but are still in place beneath the higher water level.

Industrial facilities

Notodden

Since the 1950s new buildings unrelated to the fertilizer production have been added and some of the historic buildings had been demolished. However the remaining shells of the historic buildings and their positions relative to each other still convey the organisation of the electric arc production lines A (1906-1934), B (1911-1934) and the Haber-Bosch production line (1929-1968). The form and design as well as the construction material of the buildings have largely been preserved, but most of the buildings have had minor alterations (new doors, windows, colours and some extensions) and have been re-roofed, although the traditional type of roofing has been used.

Rjukan

The demolition of buildings including all but one tower since the 1950s has left large vacant spaces. The remaining Barrel Factory has had significant changes to its façade. However, the remaining buildings with their positions relative to each other still convey the functional stages of the Rjukan I and II electric arc processes and the Rjukan III Haber-Bosch process.

Transport system

The whole transport system has been preserved, and its character and setting remain largely unchanged. Overhead line equipment is damaged and partly missing but still conveys electrification. Cranes have been removed from Rjukan Quay at Tinnoset harbour but the foundations and railway tracks remain. The lighthouses along Tinnstjøen Lake remain intact.

Rjukan and Notodden company towns

Notodden

Houses in the Grønnebyen area underwent some modernisation in the 1950s, but their general character, form, design and materials are well preserved apart from the replacement of the original outhouses by uniformly designed garages. The Villamoen area has changed to a greater degree due to new houses built by others than Norsk Hydro, but the overall 'villa' character of the settlement is retained.

Rjukan

The town plan and structure with its different housing areas and town square as well as the individual type-

houses, administrative, social and infrastructure buildings remain nearly unchanged from the 1920s. Individual buildings have had inappropriate architectural alterations (windows, doors, cladding, décor and extensions) since the time Norsk Hydro pulled out, but this has not affected the area as a whole and guidelines are being prepared for improvements and restoration.

In conclusion, ICOMOS considers that the conditions of integrity and authenticity have now been met.

Criteria under which inscription is proposed

The property is nominated on the basis of cultural criteria (ii) and (iv).

Criterion (ii): *exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;*

This criterion is justified by the State Party on the grounds that the results of science and research from Europe and North America were brought together in the artificial fertilizer production enterprise at Rjukan-Notodden where the natural topography enabled generation of hydroelectricity in the large amounts required for the process. Together with social innovations in workforce provision which brought together international planning ideas and innovative transport solutions, these themes combined to enable production of a new, globally significant product for the world-wide market.

ICOMOS considers that the property manifests an exceptional combination of industrial themes and assets tied to the landscape, which exhibit an important exchange on technological development in the early 20th century.

ICOMOS considers that this criterion has been justified.

Criterion (iv): *be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;*

This criterion is justified by the State Party on the grounds that the dams, tunnels and pipes to take water to the power plants; power lines to the factories; the factory areas and equipment; the company towns with workers' housing and social institutions; and the railway lines and ferry service necessary to take the product to a world market, all created within the powerful natural environment that enabled hydroelectric power production, combine as an outstanding technological and architectural ensemble illustrating new global industry in the early 20th century.

ICOMOS considers that the sites all combine as an outstanding technological and architectural complex in a natural landscape harnessed for industrial purposes.

ICOMOS considers that this criterion has been justified.

ICOMOS considers that the nominated property meets criteria (ii) & (iv) and conditions of authenticity and integrity.

Description of the attributes

The attributes are the buildings, structures and objects that relate to the pioneering period of the production of hydroelectric power and artificial fertilizer for agriculture in Norway in the early 20th century as set out in the nomination dossier. These include the Tinfos, Svælgfos, Vemork and Såheim power plants with their specified related buildings and structures; regulating dams and power transmission structures; the Hydro Industrial Parks in Notodden and Rjukan with their specified associated buildings, structures and production equipment; the Transport System including the Tinnoset and Rjukan Lines with their specified associated buildings, structures, rolling stock and ferries; Notodden and Rjukan company towns to the extent of the specified housing areas, buildings, structures and parks together with the waterways and landscape setting.

4 Factors affecting the property

The town of Rjukan has not been subject to development pressure due to its relatively remote location. Notodden is subject to greater development pressure and the proposal to upgrade the highway between Eastern and Western Norway to cross the nominated property either through or slightly north of Notodden's town centre may exacerbate this. Municipal plans have capacity to deal with increased residential density. Development pressure is significant along the valley between Møsvatn and Tinnsjøen lakes on the periphery of the buffer zone due to demand for holiday homes and tourism related activities particularly skiing. However view lines are currently affected primarily by vegetation growth. The estimated number of residents in the nominated property is 300 in Notodden and 850 in the Rjukan area.

Modifications of power plants to meet safety requirements and upgrades for increased production are considered the biggest development factors in relation to the hydroelectric power components.

The Notodden Industrial Park is subject to development pressure from new and upgraded enterprises currently controlled by zoning plans. Industrial production equipment stored in the open at these sites is subject to severe deterioration due to weather.

Notodden Railway Quay and Station will be subject to upgrade and change in the longer term due to use for new purposes subject to State and Municipal plans. The Rjukan Line is part of the Norwegian Industrial Workers' Museum but both it and the Tinnoset Line are subject to deterioration and the latter has suffered theft of overhead lines in uninhabited areas. Planned

electrification of the rebuilt section of the former Tinnoset Line which connects the Bratsberg Line to the new public transport terminal just west of the Notodden Old Railway Station will require some modification to the platform at the old station building. This will be subject to relevant legislative Heritage permits.

Climate change involving a higher rainfall in Norway is expected to increase erosion and vegetation overgrowth as well as the risk of floods, landslides and avalanches. The hydro-electric power facilities enable flood control; dam reinforcement guards against dam failure, and warning systems are in place to enable evacuation in the event of a major uncontrolled discharge. Seismic activity is considered minimal; municipal and county authorities deal with landslides and rock falls on a regular basis. Threats due to strong gusty winds and fire are countered by the Municipal 24 hour fire service. The industrial enterprises comply with Norway's fire safety legislation in relation to fire protection.

The nomination dossier records that risk zone maps have been prepared and indicate that emergency procedures could be improved in relation to securing buildings prior to flood; areas subject to landslide and avalanche and response times in areas at risk of fire.

Tourism numbers swell to equal the population of the municipality in Rjukan in winter, largely due to skiing but are negligible in Notodden. It is considered that both towns have adequate capacity to accommodate a further increase in visitors, as do the industrial parks and railway/ferry systems. The estimated number of visitors to Notodden Hydro Industrial Park is 2-3,000 annually.

ICOMOS considers that the main threats to the property are deterioration in exposed and unused areas and extreme weather impacts. View lines are vulnerable to development pressure.

5 Protection, conservation and management

Boundaries of the nominated property and buffer zone

The nominated property boundaries enclose the interlinked watercourses used by Hydro and Tinfos AS for power production around 1920 from Møsvatn Dam to Heddalsvatnet Lake. Where the water runs through tunnels and pipes the boundaries follow the outside of these installations. Where the railway runs along the watercourses its outer boundary forms the property boundary. Where the boundary crosses Tinnsjøen Lake it includes the ferry route and lighthouses, but excludes the northern part of the lake. The towns of Rjukan and Notodden are included to the extent they covered in 1930.

The buffer zone covers the landscape of valleys in which the watercourses run and includes Møsvatn Lake, the Vestfjorddalen Valley, Tinnsjøen basin and valley down to

Heddalsvatnet Lake. It is bounded by the horizon as seen from the valley floor, or from vessels on Tinnsjøen Lake and includes the immediate setting of the property with all additional objects of “supporting value” as well as all important view lines.

ICOMOS considers that the boundaries of the nominated property and of the buffer zone are adequate.

Ownership

All attributes within the nominated property are privately owned except for the production equipment which is owned by the Municipality and the two railway lines and parts of Rjukan Hydro Town which are owned by the State. The buffer zone is almost all in private ownership, exceptions being some properties owned by the Municipality and the National road which is State-owned.

Protection

Cultural Heritage protection in Norway is largely the responsibility of the Ministry of Climate and Environment, through its Directorate of Cultural Heritage, which administers the Cultural Heritage Act 1978, amended 2009. It is also the responsibility of the County Council which cooperates with the municipalities in preparing master plans and zoning plans to ensure protection of Cultural Heritage of national or regional value under the Planning and Building Act 2009, amended 2012.

A table in the nomination dossier shows which attributes and their component parts are protected by The Cultural Heritage Act 2013. These include both Industrial Parks in total, and the whole Transport System except for Mælsvingen with five houses which are protected under the Planning and Building Act 1985. Of the Power Plants; Tinfos I & II, parts of Vemork and Såheim are protected under the Cultural Heritage Act, and other parts are protected by the Planning and Building Act or other general legislation not Heritage related. Only a few specific buildings in Notodden and Rjukan towns are protected under the Cultural Heritage Act, the remainder are protected under the Planning & Building Act or other general legislation. In response to ICOMOS' second letter and the telephone meeting, the State Party has provided a new timetable showing that all items will be protected by the Cultural Heritage Act or specific Heritage provisions of the Planning & Building Act by June 2015, together with supporting letters from the relevant authorities.

All objects with “supporting value” within the buffer zone are cultural Heritage sites and protected by the Cultural Heritage Act and/or the additional regulations of the Planning and Building Act. A further protective function is established by the zoning plans of the municipalities.

ICOMOS considers that the legal protection planned to be complete by June 2015 will be adequate. ICOMOS considers that the protective measures for the property are adequate.

Conservation

The thirteen nominated attributes of the property and their components have been inventoried in detail and their condition assessed according to the Norwegian Standard 3423 ‘Condition Survey of protected buildings and buildings with historical value’. Tables are provided in the nomination dossier, which show that conservation/maintenance works have been undertaken, are underway or are planned where required. ICOMOS considers that the conservation measures are appropriate to conserve the property's values, integrity and authenticity.

ICOMOS considers that conservation is adequate.

Management

Management structures and processes, including traditional management processes

A ‘Declaration of Intent’ has been signed by the State Party and relevant county council and municipalities undertaking to protect the Outstanding Universal Value and the buffer zone. A provisional World Heritage Council comprising representatives from the Directorate for Cultural Heritage, the Telemark County Council, the three municipalities (Notodden, Tinn and Vinje) and the Norwegian Industrial Workers Museum has been set up to deliver a management structure for the property should it achieve World Heritage status. The Tinn and Notodden municipalities currently have one World Heritage coordinator each. If World Heritage status is achieved, a World Heritage Coordinator with responsibility for the whole area will be appointed. According to additional information provided by the State Party in response to ICOMOS' letter, the partnership agreement between Telemark County and the municipalities as a basis for setting up the permanent World Heritage Council was approved in June 2014, with a World Heritage coordinator as Secretary. It is proposed that the World Heritage Council will meet annually with central stakeholders, including the owners of companies within the Industrial Parks who may also participate in its ordinary meetings.

Meanwhile the attributes are managed by the County Council and municipalities under the Ministry of Climate and Environment and its Directorate for Cultural Heritage with input from various ministries and government agencies. The Directorate's staff includes specialists in relevant fields as does the staff of the County and Municipal authorities. Other expertise is provided by the Norwegian Institute for Cultural Heritage Research, three ship conservation centres and the Norwegian Industrial Workers' Museum. Funding is provided through the annual allocation to the Directorate for Cultural Heritage for work on World Heritage sites. The total for 2013 was NOK 60 million. Various other sources of funds are available to private owners and businesses. ICOMOS notes that the Management Plan does not include further risk preparedness measures said in the nomination dossier to be required – see Factors affecting the property above. However in response to ICOMOS'

second letter the State Party has provided further details of the risk preparedness measures which will be included in the Management Plan.

Policy framework: management plans and arrangements, including visitor management and presentation

A number of national, regional, county and local plans cover the nominated property area. The future major road crossing the site is mentioned above. This will be subject to relevant legislative controls. The Regional Plan for Tourism and Experiences 2011-24 adopted by the County Council 15 June 2011 provides funds for tourism projects that promote the application for World Heritage status in the period 2013-2016. The strategy for culture and cultural Heritage in Telemark will contain objectives and measures related to World Heritage. Long term priorities include increasing knowledge of cultural Heritage in the county and craftsmen training. Notodden local plans include conservation guidelines relating to cultural Heritage protection and a municipal emergency response plan. Tinn local plans focus on developing business and services opportunities in parallel with supporting World Heritage status.

The Management Plan has been prepared and was approved by the parties to the 'Joint Declaration of Intent' in 2013. An Action Plan is provided for 2014-2019. This includes goals and actions for conservation, strengthening of Outstanding Universal Value, competence building and research, information & presentation, and visitor management and will be reviewed in 2020. ICOMOS notes that as well as omitting the risk preparedness strategy, the Action Plan does not mention reactivating the Railway Line/Ferry system for tourism purposes, although it appears to be intended.

Involvement of the local communities

It is proposed in the Management Plan that the World Heritage Council will hold meetings with stakeholders, representatives of business and industry and voluntary organisations at least once a year.

ICOMOS considers that the current management system is effective.

In conclusion, ICOMOS considers that the management system for the property is adequate. The Management Plan should be extended to include a risk preparedness strategy as proposed in the State Party's additional information.

6 Monitoring

An outline for monitoring activities is provided in the nomination dossier with the division of responsibilities still to be determined by The Directorate of Cultural Heritage and the County and Municipal authorities. ICOMOS notes that detailed indicators are also yet to be defined. In

response to ICOMOS' second letter the State Party has provided a more detailed outline of the monitoring programme to be included in the Management Plan. ICOMOS considers this needs to be further refined to relate to the inventory/data base of objects.

ICOMOS considers that the monitoring system will be adequate when it is further refined to relate to the inventory/data base.

7 Conclusions

ICOMOS considers that the comparative analysis justifies consideration of this property for the World Heritage List; that the nominated property meets criteria (ii) & (iv) and conditions of integrity and authenticity. The main threats to the property are deterioration in exposed and unused areas and extreme weather impacts. View lines are vulnerable to development pressure. The boundaries of the nominated property and of the buffer zone are adequate.

ICOMOS considers that the legal protection will be adequate when all proposed changes to the legislation are in place, which is expected to be by June 2015. ICOMOS considers that conservation is adequate and the management system for the property is adequate. The monitoring system needs to be further refined to relate to the inventory/data base.

8 Recommendations

Recommendations with respect to inscription

ICOMOS recommends that Rjukan-Notodden Industrial Heritage Site, Norway be inscribed on the World Heritage List on the basis of **criteria (ii) and (iv)**.

Recommended Statement of Outstanding Universal Value

Brief synthesis

Located in a dramatic landscape of mountains, waterfalls and river valleys, the Rjukan-Notodden Industrial Heritage Site comprises a cluster of pioneering hydro-electric power plants, transmission lines, factories, transport systems and towns. The complex was established by the Norsk-Hydro company which brought together results of science and research from Europe and North America to produce hydroelectricity and manufacture artificial fertilizer from nitrogen in the air in response to the Western world's demand for increased agricultural production in the early 20th century. Rjukan and Notodden company towns incorporated social innovations in workforce provision influenced by international planning ideas which together with innovative transport solutions enabled supply of a new, globally significant product for the world-wide market.

Criterion (ii): Rjukan-Notodden Industrial Heritage Site manifests an exceptional combination of industrial themes and assets tied to the landscape, which exhibit an important exchange on technological development in the early 20th century.

Criterion (iv): The technological ensemble of Rjukan-Notodden comprising dams, tunnels, pipes, power plants, power lines, factory areas and equipment, the company towns, railway lines and ferry service, located in a landscape where the natural topography enabled hydroelectricity to be generated in the necessary large amounts stands out as an example of new global industry in the early 20th century.

Integrity

In general all important remaining physical structures and objects that are testimony to the industrial pioneering period of the production of artificial fertilizer for agriculture in Norway in the early 20th century are within the boundaries of the nominated area which is of adequate size to ensure the complete representation of the features and processes which convey the property's significance. The physical fabric of the property and its significant features are generally in a good condition. The property is not suffering from adverse effects and neglect.

Authenticity

The property incorporates buildings, structures and remains which convey credibly and truthfully its Outstanding Universal Value as a pioneering industrial enterprise for the production of artificial fertilizer in the early 20th century.

Management and protection requirements

The property is protected under the Cultural Heritage Act 1978, amended 2009 and the Planning & Building Act 2009, amended 2012. All specified items will be protected by the Cultural Heritage Act or specific heritage provisions of the Planning & Building Act by June 2015. The buffer zone is protected under the Cultural Heritage Act and zoning controls pursuant to the Planning & Building Act.

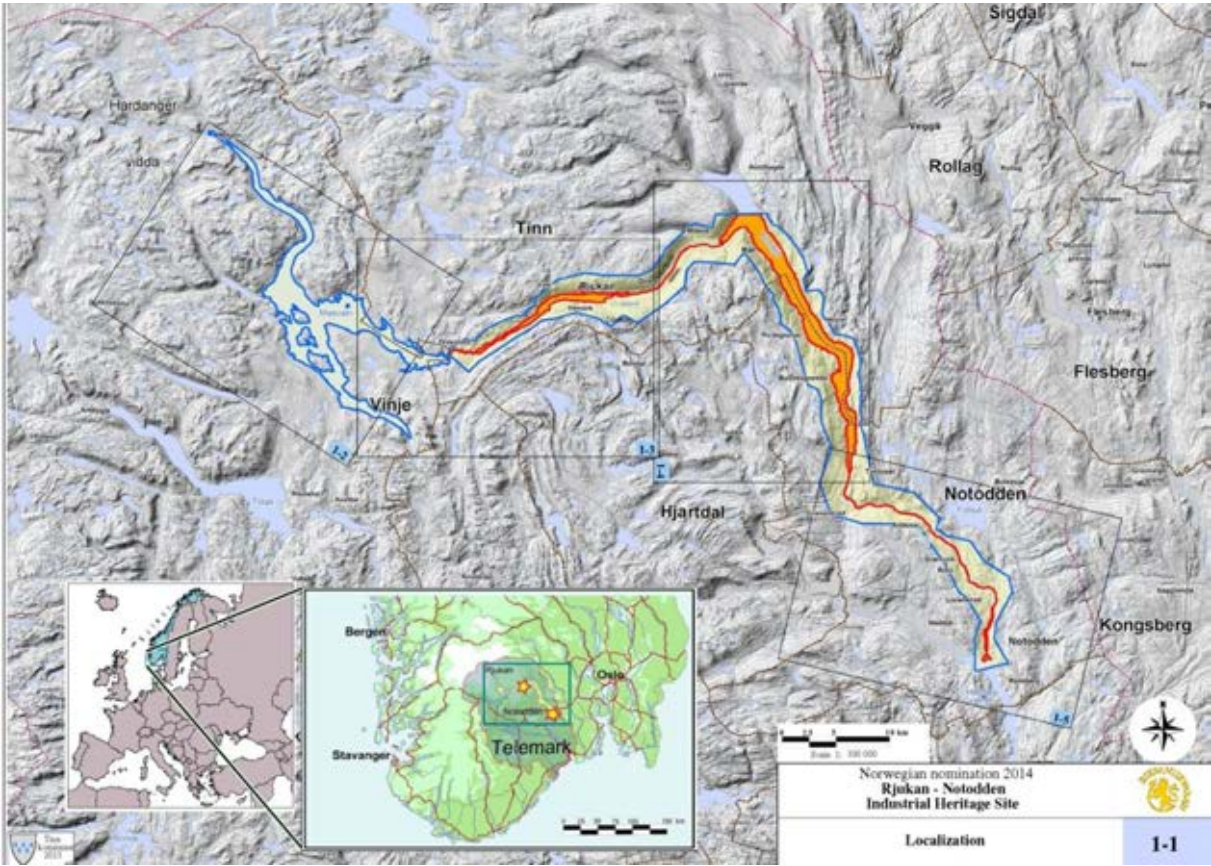
A 'Declaration of Intent' has been signed by the State Party and relevant county council and municipalities undertaking to protect the Outstanding Universal Value and the buffer zone. A provisional World Heritage Council comprising representatives from the Directorate for Cultural Heritage, the county authority, municipalities and the Norwegian Industrial Workers Museum has been set up to deliver a management structure for the property. A World Heritage Coordinator with responsibility for the whole area will be appointed. The Management Plan 2014-2019 includes an Action Plan with goals and actions for conservation, strengthening of Outstanding Universal Value, competence building and research, information & presentation, and visitor

management and will include a risk preparedness strategy.

Additional recommendations

ICOMOS recommends that the State Party give consideration to the following:

- Extending the Management Plan to include a risk preparedness strategy as proposed;
- Refining the Monitoring System to relate to the inventory/data base.



Revised map showing the boundaries of the property



Tinfos II Power Plant



Såheim Power Plant



Notodden, Hydro Industrial Park



Rjukan, Hydro Industrial Park

Rjukan-Notodden (Norway) No 1486

Official name as proposed by the State Party

Rjukan-Notodden Industrial Heritage Site

Location

Telemark County

Brief description

Located in a dramatic landscape of mountains, waterfalls and river valleys, the Rjukan-Notodden Industrial Heritage Site comprises a cluster of pioneering hydro-electric power plants, transmission lines, factories, transport systems and towns. The complex was established by the company Norsk-Hydro to manufacture artificial fertilizer from nitrogen in the air in response to the Western world's demand for increased agricultural production in the early 20th century. Rjukan and Notodden company towns, 80 kilometres apart, include workers' housing and social institutions connected by railway lines and ferry services to ports of embarkation for the fertilizer and other products. Three of the pioneering power plant buildings (Vemork, Såheim and Tinfos II) constructed between 1905 and 1940 are intact and still in use.

Category of property

In terms of categories of cultural property set out in Article I of the 1972 World Heritage Convention, this is a *site*.

1 Basic data

Included in the Tentative List

26 November 2009

International Assistance from the World Heritage Fund for preparing the Nomination

None

Date received by the World Heritage Centre

30 January 2014

Background

This is a new nomination.

Consultations

ICOMOS consulted TICCIH and several independent experts.

Technical Evaluation Mission

An ICOMOS technical evaluation mission visited the property from 1 to-5 September 2014.

Additional information received by ICOMOS

A letter was sent to the State Party on 20 August 2014 requesting additional information on the industrial processes, boundaries, protection and management and future development projects. Some information was provided to the technical evaluation mission and received on 19 September 2014 & 6 October 2014 including the timetable for legislation and approval of the Management Plan, explanation of legislative changes, information regarding items in the buffer zone and future development projects. A response to the letter was received on 6 November 2014. A second letter was sent to the State Party following the ICOMOS Panel in December 2014 regarding extension of the property boundary and completion of the legislative protection of the property, together with some management and monitoring issues. A telephone meeting between the State party and ICOMOS was held on 15 January 2015 at the request of the State Party to clarify some points in ICOMOS' second letter. A response was received on 26 February 2015. The information has been incorporated below.

Date of ICOMOS approval of this report

12 March 2015

2 The property

Description

The nominated property comprises the interlinked water courses from the Møsvatn regulating reservoir on the Hardangervidda mountain plateau down to Heddalsvatnet Lake, a stretch of 93km and covers a total area of 4959.5ha. It includes the elements of four interrelated functions or themes: hydroelectric power production, electro-chemical processing industry, the transport system and two company towns Rjukan and Notodden. These are surrounded by a buffer zone of 33,967.6ha.

Hydroelectric power production

The hydroelectric power generation system was developed by Norsk Hydro to exploit the water drops totalling over 700 metres from the high plateau created by the waterfalls of Tinnfossen, Svælgfos and Rjukanfossen. Cheap electricity was required to manufacture synthetic nitrogen fertilizer based on the energy-intensive, electro-chemical Birkeland/Eyde process. The first test facility utilised the Tinfos I power plant outside Notodden from 1901. The gable-roofed, plastered brick building remains as a shell and is used as a workshop. This was followed by Hydro's Svælgfos (1907) which at the time was the second largest power plant in the world after Ontario Power by the Niagara River. Today this is represented only by the stone building which was the lightning arrester house and workshop. The major Hydro pioneering power plants along the interlinked water courses include Tinfos II (1912) with original decorated interiors, fixtures and fittings largely intact; the decorative stone-clad concrete Vemork power station at Rjukan (1911) fed by a high

pressure system with a great head of water and rock tunnels, regulated by the concrete dam at Møsvatn, and Såheim (1915), a distinctive concrete building with cupola-capped towers. Other architectural elements include the old stone intake gatehouse at Vemork; the penstock valve house at Vemork which remains encased in the concrete applied by the Germans to protect it during WWII; concrete workshop buildings associated with Såheim, the concrete Cable House (1915), transformer and distribution station (1915) and remains of power distribution lines. Vemork was possibly the world's biggest power plant when it began operation, and Såheim larger still in terms of output. In world terms however, ICOMOS notes that the important advances in hydroelectric power were really in distribution capability to distant cities and industries rather than output in kilowatts.

Industrial facilities

Norsk Hydro's test factory for the production of nitrogen from the air in order to produce synthetic fertilizer was created at Notodden. This was already a traffic hub and industrial community due to the Tinfos AS Company which was first a paper manufacturer and later developed an ironworks. Today the shell of the concrete Tower House A (1907-21) remains at Notodden, together with other buildings including the rendered brick and concrete Calcium Nitrate Factory (1915-16) which has been much altered, Furnace House C (1907-9), the Testing Plant and Electrical Workshop (1909), Laboratory and Workshop (1915), Hydrogen Factory (1927), the Ammonia Water Plant (1914-16) and the Minaret, a 63m high concrete tower used as air intake for the production of gaseous nitrogen in the ammonia production process.

The facilities at Rjukan were built for large scale production by Hydro and were much more extensive. Here the Furnace House and the Tower House were prominent elements in a production line based on the electric arc process. Remaining buildings at Rjukan include Furnace House I (1910-11) comprising five gabled halls, steel framed and clad in brickwork, the brick Boiler House (1911), Laboratory (1911), Nitrogen Plant (1928), Compressor House (1928), and retains a complete acid tower as a freestanding object, the only one remaining from the original 32 in Tower House 1 (now demolished). This is a granite tower which enclosed limestone quartz aggregate through which water percolated to absorb nitrous gases and produce nitric acid as a stage in the nitrate production. At both sites industrial production has continued inside Hydro's buildings adapted for enterprises that are historically linked to Hydro.

Transport system

An interconnected transport system of two railway lines and two steam-powered ferry crossings joined Rjukan's facilities to Notodden to enable the saltpetre to be transported on to world markets via the Telemark Canal. The railway was electrified in 1911 and is largely intact including railway buildings, ferry quays and two ferries now installed as part of the Norwegian Industrial Workers

Museum at Vemork. Important structures are tunnels and bridges including the Gaupesprang riveted steel truss bridge (1909); the picturesque Notodden old railway station building (1908-9); Rjukan Quay (1909 - the Railway Quay); Tinnoset Railway Station buildings (1909); Tinnoset Ferry Quay and buildings (1909); 10 of the original 11 lighthouses along Tinnsjøen Lake (1908/1939/1962), Mæl Ferry Quay 1909; Mæl Railway Station 1909/1917; Mælsvingen houses (c 1914); Ingølsland Railway Station; Rjukan Railway Station; Såheim Engine Shed; together with railway track, signalling and overhead line equipment. The line closed in 1991 and its ownership together with that of the ferry quays, slipways, lighthouses, railway stock, tracks and railway buildings was transferred to the Rjukan Line Foundation in 1997. In 2012 ownership was transferred to the Vemork Museum.

Rjukan and Notodden Company towns

Notodden

Workers' housing in Notodden was provided by both Tinfos AS and Hydro, expanding the original settlement which served the surrounding farming community. The Hydro housing areas of Grønnebyen (1906) and Villamoen (1908) are located on terraces above the factory and the lake, with Own Homes (1910-14) and Tinnebyen (1917-20) to the east. Hydro housing is also located at Svælgfos (from 1905) and Lienfos (from 1909) north of the urban centre. Hydro is credited with laying out the commercial centre and also built a primary school, theatre and municipal baths – now all demolished - a hospital which still exists and an administration building. The housing layout reflects garden city ideals and architecture of the period.

Rjukan

This was a self-contained model company town created by Hydro based on ideas drawn from Sweden and Germany and laid out along both sides of the Mana River. The housing was mostly along the north side in order to maximise sunlight and stratified according to social order with workers' housing lower down. Over 140 house types were designed often by German-trained architects in both wood and brick and following modern ideas of light and ventilation. Bathrooms with hot water, a flush toilet and electric lighting in every apartment were intended to attract workers, who would get an opportunity to buy their own home. The town reached its peak of around 12,000 residents in 1920, when it was the largest industrial town in Norway. Schools, children's home, parks, hospital, library, post office, sports grounds and halls were all built by Hydro, as well as the necessary infrastructure, again reflecting garden city ideals. The prestigious buildings were designed by recognised architects in styles varying from historicism, art nouveau, neoclassicism to functionalism. Power plant buildings were constructed using reinforced concrete, steel and glass.

A catalogue of existing buildings and structures considered to be attributes of the property's value is included in the nomination dossier.

History and development

Telemark is a traditional farming area and the development of the Rjukan-Notodden hydroelectric scheme, saltpetre factories and towns required the purchase of farms on which to build. The area is also rich in mineral resources which have been mined in the past. The watercourses had been used in earlier centuries for waterwheels to generate power for mills and saws and floating timber from the forests to the saw mills. From the 18th century the mountains and waterfalls also attracted tourists. The existing conditions which enabled the establishment of Hydro's large factories for production of fertilizer were the canalised river system with locks connecting to the sea; the Tinfos power plant which could be used for the test factory, and the water drop of the Rjukanfossen waterfall which could be harnessed for the large amount of cheap energy required.

The establishment of the Norsk Hydro Company by engineer and industrialist Sam Eyde in 1905, the year of Norway's full independence opened the way for large-scale industrial development in Telemark. At the beginning of the 20th century the world's known natural sodium nitrate resources (saltpetre) in South America were greatly depleted and the search was on to find a synthetic replacement to increase crop yields in advance of the predicted food crisis. Development of the alternating current system of electricity in the late 19th century and its use at the first power plant at Niagara Falls paved the way for the use of hydroelectricity to power Birkeland's electric arc furnace which drew nitrogen from the air, producing 'Norway saltpetre'. Working with engineer and entrepreneur Sam Eyde, who had studied in Germany and had business and social connections both there and in Sweden, the two brought together expertise and financial capital from a wide range of sources. By 1912, Hydro was contributing 71,000 tonnes to the world's fertilizer market.

During WWI ammonia nitrate became more important as it could be used to make explosives and Hydro built an ammonia nitrate plant at Notodden. After the war the focus returned to agricultural fertilizer and by 1920 production of Norway saltpetre amounted to 135,000 tonnes, doubling every ten years until it became the largest nitrogen exporter in Europe by the 1950s. In the inter-war period Hydro changed to a production method based on electrolytic hydrogen and new facilities were built 1928-9, with ammonia production in Notodden and continued fertilizer production using the Haber-Bosch method in Rjukan. The stock market crash led to rationalisation of Hydro's activities during the 1930s. Germany took over Rjukan's facilities during WWII and built installations to produce heavy water shipped to Germany for use in controlling nuclear fission. Rjukan consequently became the focus of sabotage attacks by the Allies and at the end of the War the Norwegian State took over as the majority shareholder due to the strategic importance of the enterprise. Hydro subsequently moved its fertilizer business and activities to Herøya near Porsgrunn in the late 1960s.

Today Notodden Industrial Park is home to around 50 enterprises and the town continues as a centre for commerce, the service industry and education. Rjukan Industrial Park accommodates 30 different enterprises in an area of 21 ha containing 34 buildings. The town is regarded as a tourism centre for Tinn Municipality.

The East-Telemark watercourse continues to be used for hydroelectric power production and as a tourist waterway. The original Tinfos II, Vemork and Sâheim power stations are still intact and in operation. They have been supplemented by several new plants which have generally been constructed in rock caverns. The visible façade of the New Vemork power plant located in a rock cavern behind the old power plant is a Brutalist-style concrete structure. The old Vemork power plant now houses the Norwegian Industrial Workers Museum with its exhibition, offices, cafeteria and shop. The original generator sets still in place in the generator hall form part of the permanent exhibition of the museum. The old Tinfos I power plant remains as building shell. The New Tinfos I plant (1955) is a Functionalist-style building of painted concrete. The lakes and rivers are no longer used commercially except for tourist vessels.

3 Justification for inscription, integrity and authenticity

Comparative analysis

The State Party points out that the comparative analysis for this property needs to be seen in the light of the ICOMOS 'Filling the Gaps' report of 2005 which highlights typological, chronological-regional and thematic categories into which this property fits. Within Norway the property is compared with Odda and Tysedal on the Tentative List which represents the exploitation of the natural topography for use of hydroelectric power to produce artificial fertilizer by the carbide and cyanamide processes. The industrial process could be seen to complement that at Rjukan-Notodden but the overall establishment does not include transport infrastructure or a company town and is thus less representative of the overall enterprise. The property is also compared with Hydro's establishment at Herøya near Porsgrunn where the company established the world's biggest calcium nitrate factory in the 1920s with options for both sea and overland transport and to which it moved its activities from Rjukan-Notodden in the late 1960s. This represents the industrial phase that followed the pioneering plants at Rjukan-Notodden but is said not to demonstrate the same values at similar depth. Other industrial enterprises referred to in Norway are said to either represent a later phase of industrial development or do not reflect similar values.

The property is compared with World Heritage listed properties at Ironbridge Gorge, UK (1986, (i), (ii), (iv) & (vi)); Blaenavon Industrial Landscape, UK (2000, (iii) & (iv)); New Lanark, UK ((2001, (ii), (iv) & (vi)); Saltaire, UK (2001, (ii) & (iv)); Crespi d'Adda, Italy (1995, (iv) & (v)); Volklingen Iron Works, Germany (1994, (ii) & (iv));

Zollverein Coal Mine Industrial Complex in Essen, Germany (2001, (ii) & (iii)); and Salins-les-Bains & Royal Saltworks of Arc-et-Senans, France (1982, 2009, (i), (ii) & (iv)), none of which represent the same period and type of global industrial development. Humberstone & Santa Laura Saltpeter Works, Chile (2005, (ii), (iii) & (iv)) is similar in responding to the world-wide demand for fertilizer but not in terms of the combination of hydroelectricity and electro-chemical processes.

The property is also compared with properties on the Tentative List at Ivrea, Italy; Industrial complexes at Ostrava, Czech Republic; Kyushu and Yamaguchi, Japan; La Constancia Mexicana, Mexico; Pilgrim's Rest Reduction Works, South Africa and other relevant enterprises in UK, Germany, Sweden, France, Switzerland, Austria, and particularly Canada and the USA, where the Niagara Falls were the site of the beginnings of hydroelectric power and electro-metallurgic industry. The State Party argues that Rjukan-Notodden stands out as representative of the new form of global industrial economy based on electricity in the early 20th century by the way it was organised and financed in one overall project. The State Party suggests however that in relation to hydroelectric power generation reflecting the importance of electricity, a number of sites could be combined as a transnational series. ICOMOS considers that in fact the restriction of the tie-in of power production to the limited purpose of fertilizer production at Rjukan-Notodden meant that by comparison the Niagara plants in particular supplied greater capacity for more uses distributed over far greater areas. However ICOMOS concurs with the State Party's claim that the nominated property is clearly distinguished by its combination of industrial themes and assets which together make it an exceptional representation of early 20th century industrial development.

ICOMOS considers that the comparative analysis justifies consideration of this property for the World Heritage List.

Justification of Outstanding Universal Value

The nominated property is considered by the State Party to be of Outstanding Universal Value as a cultural property for the following reasons:

- Ground-breaking industrial development as electricity replaced coal as a source of energy
- Testament to social transformation in the Western world at the beginning of the 20th century
- Created to produce a product (synthetic fertilizer) considered essential for the future of civilisation
- Representative of the exchange of results from science and research across national borders
- A complete ensemble of the contributing elements of hydroelectric power, industrial production, transport system and company towns created as one project.

ICOMOS considers that the first point of this justification needs to consider that coal-fired and oil-fired electricity also powered new global industries in the early 20th century. It would be more appropriate to say "ground-breaking industrial development using electricity as a source of energy". ICOMOS considers that the other points are appropriate.

Integrity and authenticity

Integrity

In general all important remaining physical structures and objects that are testimony to the industrial pioneering period of the production of artificial fertilizer for agriculture in Norway in the early 20th century are within the boundaries of the nominated area. ICOMOS notes that the ruins of Svælgfos I power plant, the Lienfos Dam and the foundations of the nitrogen and the ammonia gasometers at Rjukan together with some other structures within the nominated property are not considered as attributes by the State Party because of their ruinous state, but are considered as "supporting values". ICOMOS considers that they are integral to the hydropower and fertilizer production and should be maintained as part of the nominated property. ICOMOS notes that the ruins of Svælgfos II power plant, transformer station, plant operations manager's residence, penstock foundations, a section of the Svælgfos-Tinfos timber flume, and Lienfos power station remains which are part of the Svælgfos and Lienfos cultural environments are not included within the property but are in the buffer zone, although said to be part of the pioneering period of significance of the site. According to the State Party this is because of their lack of integrity and authenticity. ICOMOS also notes that there are also nine other power stations which are specified neither as attributes, nor as "supporting values". Additional information provided by the State Party in response to ICOMOS' query on this states that these were all built many years later than those relating to the key period of the property and all except New Tinfos I power plant (built in 1955) are located in the buffer zone and not in visible vicinity of the older ones. While not considered an attribute of the nominated property, New Tinfos I is protected under the Cultural Heritage Act as of 20 June 2014. ICOMOS considers that the nominated property is of adequate size to ensure the complete representation of the features and processes which convey the property's significance. However ICOMOS considers that integrity would be improved by inclusion of the Svælgfos and Lienfos cultural environments within the property boundary. In response to ICOMOS' letter and subsequent telephone meeting the State Party has provided new maps showing that the boundaries now enclose these areas. The physical fabric of the property and its significant features are generally in a good condition. The property is not suffering from adverse effects of development or neglect.

Authenticity

ICOMOS considers that the overall authenticity of the nominated property and its setting is high.

Hydroelectric power production

Hydro's power plants in the Tinnelva River have mostly been demolished, but some ruins of Lienfos as well as of Svælgfos I and II are still in place. The Myrens Dam that supplied water to Tinfos I power station is now dry and its penstock has been removed. The old Møsvatn Dam and Skardfoss Dam have been replaced by new dams but are still in place beneath the higher water level.

Industrial facilities

Notodden

Since the 1950s new buildings unrelated to the fertilizer production have been added and some of the historic buildings had been demolished. However the remaining shells of the historic buildings and their positions relative to each other still convey the organisation of the electric arc production lines A (1906-1934), B (1911-1934) and the Haber-Bosch production line (1929-1968). The form and design as well as the construction material of the buildings have largely been preserved, but most of the buildings have had minor alterations (new doors, windows, colours and some extensions) and have been re-roofed, although the traditional type of roofing has been used.

Rjukan

The demolition of buildings including all but one tower since the 1950s has left large vacant spaces. The remaining Barrel Factory has had significant changes to its façade. However, the remaining buildings with their positions relative to each other still convey the functional stages of the Rjukan I and II electric arc processes and the Rjukan III Haber-Bosch process.

Transport system

The whole transport system has been preserved, and its character and setting remain largely unchanged. Overhead line equipment is damaged and partly missing but still conveys electrification. Cranes have been removed from Rjukan Quay at Tinnoset harbour but the foundations and railway tracks remain. The lighthouses along Tinnstjøen Lake remain intact.

Rjukan and Notodden company towns

Notodden

Houses in the Grønnebyen area underwent some modernisation in the 1950s, but their general character, form, design and materials are well preserved apart from the replacement of the original outhouses by uniformly designed garages. The Villamoen area has changed to a greater degree due to new houses built by others than Norsk Hydro, but the overall 'villa' character of the settlement is retained.

Rjukan

The town plan and structure with its different housing areas and town square as well as the individual type-

houses, administrative, social and infrastructure buildings remain nearly unchanged from the 1920s. Individual buildings have had inappropriate architectural alterations (windows, doors, cladding, décor and extensions) since the time Norsk Hydro pulled out, but this has not affected the area as a whole and guidelines are being prepared for improvements and restoration.

In conclusion, ICOMOS considers that the conditions of integrity and authenticity have now been met.

Criteria under which inscription is proposed

The property is nominated on the basis of cultural criteria (ii) and (iv).

Criterion (ii): *exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;*

This criterion is justified by the State Party on the grounds that the results of science and research from Europe and North America were brought together in the artificial fertilizer production enterprise at Rjukan-Notodden where the natural topography enabled generation of hydroelectricity in the large amounts required for the process. Together with social innovations in workforce provision which brought together international planning ideas and innovative transport solutions, these themes combined to enable production of a new, globally significant product for the world-wide market.

ICOMOS considers that the property manifests an exceptional combination of industrial themes and assets tied to the landscape, which exhibit an important exchange on technological development in the early 20th century.

ICOMOS considers that this criterion has been justified.

Criterion (iv): *be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;*

This criterion is justified by the State Party on the grounds that the dams, tunnels and pipes to take water to the power plants; power lines to the factories; the factory areas and equipment; the company towns with workers' housing and social institutions; and the railway lines and ferry service necessary to take the product to a world market, all created within the powerful natural environment that enabled hydroelectric power production, combine as an outstanding technological and architectural ensemble illustrating new global industry in the early 20th century.

ICOMOS considers that the sites all combine as an outstanding technological and architectural complex in a natural landscape harnessed for industrial purposes.

ICOMOS considers that this criterion has been justified.

ICOMOS considers that the nominated property meets criteria (ii) & (iv) and conditions of authenticity and integrity.

Description of the attributes

The attributes are the buildings, structures and objects that relate to the pioneering period of the production of hydroelectric power and artificial fertilizer for agriculture in Norway in the early 20th century as set out in the nomination dossier. These include the Tinfos, Svælgfos, Vemork and Såheim power plants with their specified related buildings and structures; regulating dams and power transmission structures; the Hydro Industrial Parks in Notodden and Rjukan with their specified associated buildings, structures and production equipment; the Transport System including the Tinnoset and Rjukan Lines with their specified associated buildings, structures, rolling stock and ferries; Notodden and Rjukan company towns to the extent of the specified housing areas, buildings, structures and parks together with the waterways and landscape setting.

4 Factors affecting the property

The town of Rjukan has not been subject to development pressure due to its relatively remote location. Notodden is subject to greater development pressure and the proposal to upgrade the highway between Eastern and Western Norway to cross the nominated property either through or slightly north of Notodden's town centre may exacerbate this. Municipal plans have capacity to deal with increased residential density. Development pressure is significant along the valley between Møsvatn and Tinnsjøen lakes on the periphery of the buffer zone due to demand for holiday homes and tourism related activities particularly skiing. However view lines are currently affected primarily by vegetation growth. The estimated number of residents in the nominated property is 300 in Notodden and 850 in the Rjukan area.

Modifications of power plants to meet safety requirements and upgrades for increased production are considered the biggest development factors in relation to the hydroelectric power components.

The Notodden Industrial Park is subject to development pressure from new and upgraded enterprises currently controlled by zoning plans. Industrial production equipment stored in the open at these sites is subject to severe deterioration due to weather.

Notodden Railway Quay and Station will be subject to upgrade and change in the longer term due to use for new purposes subject to State and Municipal plans. The Rjukan Line is part of the Norwegian Industrial Workers' Museum but both it and the Tinnoset Line are subject to deterioration and the latter has suffered theft of overhead lines in uninhabited areas. Planned

electrification of the rebuilt section of the former Tinnoset Line which connects the Bratsberg Line to the new public transport terminal just west of the Notodden Old Railway Station will require some modification to the platform at the old station building. This will be subject to relevant legislative Heritage permits.

Climate change involving a higher rainfall in Norway is expected to increase erosion and vegetation overgrowth as well as the risk of floods, landslides and avalanches. The hydro-electric power facilities enable flood control; dam reinforcement guards against dam failure, and warning systems are in place to enable evacuation in the event of a major uncontrolled discharge. Seismic activity is considered minimal; municipal and county authorities deal with landslides and rock falls on a regular basis. Threats due to strong gusty winds and fire are countered by the Municipal 24 hour fire service. The industrial enterprises comply with Norway's fire safety legislation in relation to fire protection.

The nomination dossier records that risk zone maps have been prepared and indicate that emergency procedures could be improved in relation to securing buildings prior to flood; areas subject to landslide and avalanche and response times in areas at risk of fire.

Tourism numbers swell to equal the population of the municipality in Rjukan in winter, largely due to skiing but are negligible in Notodden. It is considered that both towns have adequate capacity to accommodate a further increase in visitors, as do the industrial parks and railway/ferry systems. The estimated number of visitors to Notodden Hydro Industrial Park is 2-3,000 annually.

ICOMOS considers that the main threats to the property are deterioration in exposed and unused areas and extreme weather impacts. View lines are vulnerable to development pressure.

5 Protection, conservation and management

Boundaries of the nominated property and buffer zone

The nominated property boundaries enclose the interlinked watercourses used by Hydro and Tinfos AS for power production around 1920 from Møsvatn Dam to Heddalsvatnet Lake. Where the water runs through tunnels and pipes the boundaries follow the outside of these installations. Where the railway runs along the watercourses its outer boundary forms the property boundary. Where the boundary crosses Tinnsjøen Lake it includes the ferry route and lighthouses, but excludes the northern part of the lake. The towns of Rjukan and Notodden are included to the extent they covered in 1930.

The buffer zone covers the landscape of valleys in which the watercourses run and includes Møsvatn Lake, the Vestfjorddalen Valley, Tinnsjøen basin and valley down to

Heddalsvatnet Lake. It is bounded by the horizon as seen from the valley floor, or from vessels on Tinnsjøen Lake and includes the immediate setting of the property with all additional objects of “supporting value” as well as all important view lines.

ICOMOS considers that the boundaries of the nominated property and of the buffer zone are adequate.

Ownership

All attributes within the nominated property are privately owned except for the production equipment which is owned by the Municipality and the two railway lines and parts of Rjukan Hydro Town which are owned by the State. The buffer zone is almost all in private ownership, exceptions being some properties owned by the Municipality and the National road which is State-owned.

Protection

Cultural Heritage protection in Norway is largely the responsibility of the Ministry of Climate and Environment, through its Directorate of Cultural Heritage, which administers the Cultural Heritage Act 1978, amended 2009. It is also the responsibility of the County Council which cooperates with the municipalities in preparing master plans and zoning plans to ensure protection of Cultural Heritage of national or regional value under the Planning and Building Act 2009, amended 2012.

A table in the nomination dossier shows which attributes and their component parts are protected by The Cultural Heritage Act 2013. These include both Industrial Parks in total, and the whole Transport System except for Mælsvingen with five houses which are protected under the Planning and Building Act 1985. Of the Power Plants; Tinfos I & II, parts of Vemork and Såheim are protected under the Cultural Heritage Act, and other parts are protected by the Planning and Building Act or other general legislation not Heritage related. Only a few specific buildings in Notodden and Rjukan towns are protected under the Cultural Heritage Act, the remainder are protected under the Planning & Building Act or other general legislation. In response to ICOMOS’ second letter and the telephone meeting, the State Party has provided a new timetable showing that all items will be protected by the Cultural Heritage Act or specific Heritage provisions of the Planning & Building Act by June 2015, together with supporting letters from the relevant authorities.

All objects with “supporting value” within the buffer zone are cultural Heritage sites and protected by the Cultural Heritage Act and/or the additional regulations of the Planning and Building Act. A further protective function is established by the zoning plans of the municipalities.

ICOMOS considers that the legal protection planned to be complete by June 2015 will be adequate. ICOMOS considers that the protective measures for the property are adequate.

Conservation

The thirteen nominated attributes of the property and their components have been inventoried in detail and their condition assessed according to the Norwegian Standard 3423 ‘Condition Survey of protected buildings and buildings with historical value’. Tables are provided in the nomination dossier, which show that conservation/maintenance works have been undertaken, are underway or are planned where required. ICOMOS considers that the conservation measures are appropriate to conserve the property’s values, integrity and authenticity.

ICOMOS considers that conservation is adequate.

Management

Management structures and processes, including traditional management processes

A ‘Declaration of Intent’ has been signed by the State Party and relevant county council and municipalities undertaking to protect the Outstanding Universal Value and the buffer zone. A provisional World Heritage Council comprising representatives from the Directorate for Cultural Heritage, the Telemark County Council, the three municipalities (Notodden, Tinn and Vinje) and the Norwegian Industrial Workers Museum has been set up to deliver a management structure for the property should it achieve World Heritage status. The Tinn and Notodden municipalities currently have one World Heritage coordinator each. If World Heritage status is achieved, a World Heritage Coordinator with responsibility for the whole area will be appointed. According to additional information provided by the State Party in response to ICOMOS’ letter, the partnership agreement between Telemark County and the municipalities as a basis for setting up the permanent World Heritage Council was approved in June 2014, with a World Heritage coordinator as Secretary. It is proposed that the World Heritage Council will meet annually with central stakeholders, including the owners of companies within the Industrial Parks who may also participate in its ordinary meetings.

Meanwhile the attributes are managed by the County Council and municipalities under the Ministry of Climate and Environment and its Directorate for Cultural Heritage with input from various ministries and government agencies. The Directorate’s staff includes specialists in relevant fields as does the staff of the County and Municipal authorities. Other expertise is provided by the Norwegian Institute for Cultural Heritage Research, three ship conservation centres and the Norwegian Industrial Workers’ Museum. Funding is provided through the annual allocation to the Directorate for Cultural Heritage for work on World Heritage sites. The total for 2013 was NOK 60 million. Various other sources of funds are available to private owners and businesses. ICOMOS notes that the Management Plan does not include further risk preparedness measures said in the nomination dossier to be required – see Factors affecting the property above. However in response to ICOMOS’

second letter the State Party has provided further details of the risk preparedness measures which will be included in the Management Plan.

Policy framework: management plans and arrangements, including visitor management and presentation

A number of national, regional, county and local plans cover the nominated property area. The future major road crossing the site is mentioned above. This will be subject to relevant legislative controls. The Regional Plan for Tourism and Experiences 2011-24 adopted by the County Council 15 June 2011 provides funds for tourism projects that promote the application for World Heritage status in the period 2013-2016. The strategy for culture and cultural Heritage in Telemark will contain objectives and measures related to World Heritage. Long term priorities include increasing knowledge of cultural Heritage in the county and craftsmen training. Notodden local plans include conservation guidelines relating to cultural Heritage protection and a municipal emergency response plan. Tinn local plans focus on developing business and services opportunities in parallel with supporting World Heritage status.

The Management Plan has been prepared and was approved by the parties to the 'Joint Declaration of Intent' in 2013. An Action Plan is provided for 2014-2019. This includes goals and actions for conservation, strengthening of Outstanding Universal Value, competence building and research, information & presentation, and visitor management and will be reviewed in 2020. ICOMOS notes that as well as omitting the risk preparedness strategy, the Action Plan does not mention reactivating the Railway Line/Ferry system for tourism purposes, although it appears to be intended.

Involvement of the local communities

It is proposed in the Management Plan that the World Heritage Council will hold meetings with stakeholders, representatives of business and industry and voluntary organisations at least once a year.

ICOMOS considers that the current management system is effective.

In conclusion, ICOMOS considers that the management system for the property is adequate. The Management Plan should be extended to include a risk preparedness strategy as proposed in the State Party's additional information.

6 Monitoring

An outline for monitoring activities is provided in the nomination dossier with the division of responsibilities still to be determined by The Directorate of Cultural Heritage and the County and Municipal authorities. ICOMOS notes that detailed indicators are also yet to be defined. In

response to ICOMOS' second letter the State Party has provided a more detailed outline of the monitoring programme to be included in the Management Plan. ICOMOS considers this needs to be further refined to relate to the inventory/data base of objects.

ICOMOS considers that the monitoring system will be adequate when it is further refined to relate to the inventory/data base.

7 Conclusions

ICOMOS considers that the comparative analysis justifies consideration of this property for the World Heritage List; that the nominated property meets criteria (ii) & (iv) and conditions of integrity and authenticity. The main threats to the property are deterioration in exposed and unused areas and extreme weather impacts. View lines are vulnerable to development pressure. The boundaries of the nominated property and of the buffer zone are adequate.

ICOMOS considers that the legal protection will be adequate when all proposed changes to the legislation are in place, which is expected to be by June 2015. ICOMOS considers that conservation is adequate and the management system for the property is adequate. The monitoring system needs to be further refined to relate to the inventory/data base.

8 Recommendations

Recommendations with respect to inscription

ICOMOS recommends that Rjukan-Notodden Industrial Heritage Site, Norway be inscribed on the World Heritage List on the basis of **criteria (ii) and (iv)**.

Recommended Statement of Outstanding Universal Value

Brief synthesis

Located in a dramatic landscape of mountains, waterfalls and river valleys, the Rjukan-Notodden Industrial Heritage Site comprises a cluster of pioneering hydro-electric power plants, transmission lines, factories, transport systems and towns. The complex was established by the Norsk-Hydro company which brought together results of science and research from Europe and North America to produce hydroelectricity and manufacture artificial fertilizer from nitrogen in the air in response to the Western world's demand for increased agricultural production in the early 20th century. Rjukan and Notodden company towns incorporated social innovations in workforce provision influenced by international planning ideas which together with innovative transport solutions enabled supply of a new, globally significant product for the world-wide market.

Criterion (ii): Rjukan-Notodden Industrial Heritage Site manifests an exceptional combination of industrial themes and assets tied to the landscape, which exhibit an important exchange on technological development in the early 20th century.

Criterion (iv): The technological ensemble of Rjukan-Notodden comprising dams, tunnels, pipes, power plants, power lines, factory areas and equipment, the company towns, railway lines and ferry service, located in a landscape where the natural topography enabled hydroelectricity to be generated in the necessary large amounts stands out as an example of new global industry in the early 20th century.

Integrity

In general all important remaining physical structures and objects that are testimony to the industrial pioneering period of the production of artificial fertilizer for agriculture in Norway in the early 20th century are within the boundaries of the nominated area which is of adequate size to ensure the complete representation of the features and processes which convey the property's significance. The physical fabric of the property and its significant features are generally in a good condition. The property is not suffering from adverse effects and neglect.

Authenticity

The property incorporates buildings, structures and remains which convey credibly and truthfully its Outstanding Universal Value as a pioneering industrial enterprise for the production of artificial fertilizer in the early 20th century.

Management and protection requirements

The property is protected under the Cultural Heritage Act 1978, amended 2009 and the Planning & Building Act 2009, amended 2012. All specified items will be protected by the Cultural Heritage Act or specific heritage provisions of the Planning & Building Act by June 2015. The buffer zone is protected under the Cultural Heritage Act and zoning controls pursuant to the Planning & Building Act.

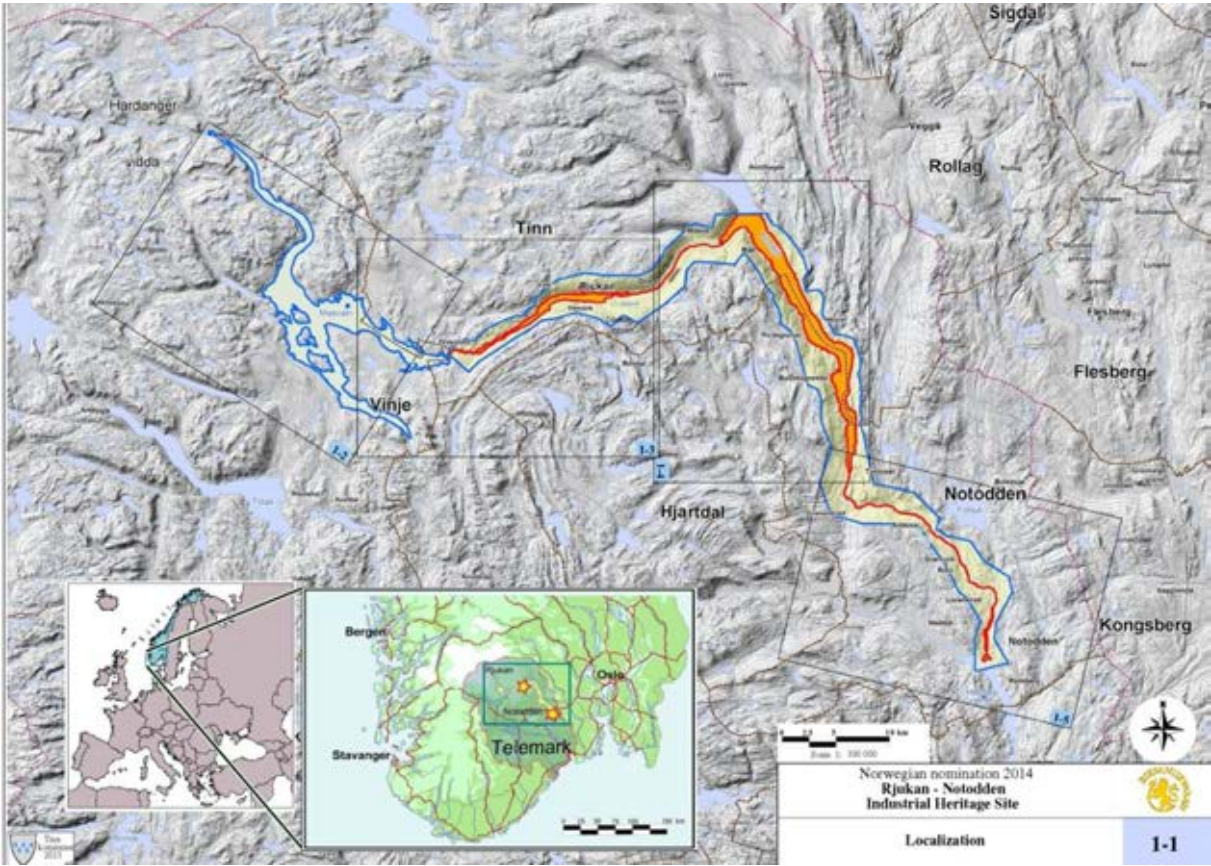
A 'Declaration of Intent' has been signed by the State Party and relevant county council and municipalities undertaking to protect the Outstanding Universal Value and the buffer zone. A provisional World Heritage Council comprising representatives from the Directorate for Cultural Heritage, the county authority, municipalities and the Norwegian Industrial Workers Museum has been set up to deliver a management structure for the property. A World Heritage Coordinator with responsibility for the whole area will be appointed. The Management Plan 2014-2019 includes an Action Plan with goals and actions for conservation, strengthening of Outstanding Universal Value, competence building and research, information & presentation, and visitor

management and will include a risk preparedness strategy.

Additional recommendations

ICOMOS recommends that the State Party give consideration to the following:

- Extending the Management Plan to include a risk preparedness strategy as proposed;
- Refining the Monitoring System to relate to the inventory/data base.



Revised map showing the boundaries of the property



Tinfos II Power Plant



Såheim Power Plant



Notodden, Hydro Industrial Park



Rjukan, Hydro Industrial Park

Rjukan-Notodden (Norvège) No 1486

Nom officiel du bien tel que proposé par l'État partie
Site du patrimoine industriel de Rjukan-Notodden

Lieu
Comté de Telemark

Brève description

Situé au sein d'un paysage spectaculaire de montagnes, de chutes d'eau et de vallées fluviales, le site du patrimoine industriel de Rjukan-Notodden comprend un ensemble novateur de centrales hydroélectriques, de lignes électriques, d'usines, de réseaux de transport et de villes. Ce complexe fut mis en place par la société Norsk Hydro pour produire des engrais chimiques à partir de l'azote présent dans l'air. Il s'agissait de répondre à la demande croissante du monde occidental en matière de production agricole au début du XXe siècle. Les villes ouvrières de Rjukan et de Notodden, distantes de 80 kilomètres, comprennent des logements ouvriers et des institutions sociales reliés à un réseau ferré et des services de ferrys vers les ports d'embarcation des engrais et d'autres produits. Trois des centrales électriques novatrices (Vemork, Sâheim et Tinfos II) construites entre 1905 et 1940 sont intactes et toujours utilisées.

Catégorie de bien

En termes de catégories de biens culturels, telles qu'elles sont définies à l'article premier de la Convention du patrimoine mondial de 1972, il s'agit d'un *site*.

1 Identification

Inclus dans la liste indicative

26 novembre 2009

Assistance internationale au titre du Fonds du patrimoine mondial pour la préparation de la proposition d'inscription

Aucune

Date de réception par le Centre du patrimoine mondial

30 janvier 2014

Antécédents

Il s'agit d'une nouvelle proposition d'inscription.

Consultations

L'ICOMOS a consulté le TICCIH et plusieurs experts indépendants.

Mission d'évaluation technique

Une mission d'évaluation technique de l'ICOMOS s'est rendue sur le bien du 1er au 5 septembre 2014.

Information complémentaire reçue par l'ICOMOS

Une lettre a été adressée à l'État partie le 20 août 2014, demandant des informations complémentaires sur les processus industriels, ainsi que sur les délimitations, la protection et la gestion, et sur les projets de développement envisagés. Certaines informations ont été communiquées à la mission d'évaluation technique et reçues les 19 septembre et 6 octobre 2014, y compris le calendrier législatif et d'adoption du plan de gestion, des explications sur les changements législatifs, des informations au sujet d'éléments situés dans la zone tampon et les projets de développement envisagés. Une réponse à la lettre a été reçue le 6 novembre 2014. Une seconde lettre a été envoyée à l'État partie à la suite de la réunion de la Commission pour le patrimoine mondial de l'ICOMOS en décembre 2014, au sujet de l'extension de la délimitation du bien, de l'achèvement de la protection législative du bien, ainsi que de quelques questions concernant la gestion et le suivi. Une réunion téléphonique entre l'État partie et l'ICOMOS s'est déroulée le 15 janvier 2015, à la demande de l'État partie, pour clarifier certains points mentionnés dans la seconde lettre de l'ICOMOS. Une réponse a été reçue le 26 février 2015. Les informations fournies ont été intégrées ci-après.

Date d'approbation de l'évaluation par l'ICOMOS

12 mars 2015

2 Le bien

Description

Le bien proposé pour inscription comprend les cours d'eau interconnectés depuis le bassin de régulation de Møsvatn situé sur le plateau de la montagne Hardangervidda jusqu'au lac Heddalsvatnet, soit une étendue de 93 km couvrant une zone totale de 4 959,5 ha. Il inclut les éléments de quatre fonctions ou concepts étroitement liés : la production d'énergie hydroélectrique, l'industrie de transformation électrochimique, le système de transport et les deux villes ouvrières de Rjukan et de Notodden. La zone tampon du bien couvre 33 967,6 ha.

Production d'énergie hydroélectrique

Le système de génération d'énergie hydroélectrique fut développé par Norsk Hydro pour exploiter les chutes d'eau (plus de 700 m cumulés) du plateau supérieur engendrées par les chutes de Tinnfossen, de Svælgfos et de Rjukanfossen. Une électricité bon marché était nécessaire pour la fabrication d'engrais chimique azoté, qui s'appuyait sur le procédé électro-intensif et électrochimique Birkeland-Eyde. La première installation d'essai utilisa dès 1901 la centrale électrique Tinfos I, située aux abords de Notodden. Le bâtiment en brique enduit avec un toit à pignon est désaffecté et utilisé en

tant qu'atelier. Vint ensuite la centrale Hydro de Svælgfos (1907) qui, à l'époque, était la deuxième plus importante centrale électrique au monde après celle d'Ontario Power, sur le fleuve Niagara. Il n'en subsiste aujourd'hui que le bâtiment de pierre qui servait de parafoudre et d'atelier. Les principales centrales électriques novatrices d'Hydro situées le long des cours d'eau interconnectés comprennent Tinfos II (1912), dont la décoration intérieure et les aménagements d'origine sont largement préservés ; la centrale électrique de Vemork, à Rjukan (1911), construite en béton paré de pierres, alimentée par un système à haute pression composé d'une grande colonne d'eau et de tunnels creusés dans la roche et régulé par le barrage en béton de Møsvatn, et Sâheim (1915), un bâtiment en béton caractérisé par des tours coiffées de coupôles. Les autres éléments architecturaux comprennent l'ancien bâtiment en pierre servant à la prise d'eau et au contrôle des vannes à Vemork ; la salle des valves des conduites forcées de Vemork, toujours enchâssée dans le béton de protection coulé par les Allemands lors de la Seconde Guerre mondiale ; les bâtiments-ateliers de béton liés à Sâheim, la station du funiculaire, en béton (1915), le poste de transformation et de distribution (1915) et les vestiges de lignes électriques de distribution. Vemork était probablement la centrale électrique la plus importante au monde lors de sa mise en service, et Sâheim plus encore s'agissant de la production. Toutefois, sur le plan mondial, l'ICOMOS note que les avancées importantes dans le domaine de l'énergie hydroélectrique portaient davantage sur la capacité de distribution vers les villes et industries distantes que sur la production en kilowatts.

Installations industrielles

L'usine expérimentale de Norsk Hydro visant à produire de l'azote à partir de l'air afin d'élaborer de l'engrais synthétique fut créée à Notodden. Cette ville était déjà un centre d'activités et un site industriel car la société Tinfos AS, d'abord papetier, y développa ensuite la sidérurgie. Actuellement subsistent les vestiges de la structure de la tour A en béton (1907-1921) à Notodden, ainsi que d'autres bâtiments, incluant l'usine de nitrate de calcium en briques enduites et béton (1915-1916) qui a été très altérée, le four C (1907-1909), l'usine d'essai et l'atelier d'électricité (1909), le laboratoire et l'atelier (1915), l'usine d'hydrogène (1927), l'usine d'eau ammoniacquée (1914-1916) et le minaret, une tour de béton s'élevant à 63 m de hauteur utilisée comme prise d'air pour générer de l'azote gazeux lors du processus de production d'ammoniaque.

Les installations de Rjukan furent édifiées par Hydro pour une production à grande échelle et étaient beaucoup plus imposantes. Le four et la tour étaient les éléments primordiaux d'une chaîne de production qui s'appuyait sur le procédé d'arc électrique. Les bâtiments subsistants à Rjukan incluent le four I (1910-1911), composé de cinq halls à toit en pignon, avec une charpente en acier et revêtus de briques, la chaufferie construite en briques (1911), le laboratoire (1911), l'usine d'azote (1928), le

compresseur (1928), une tour d'absorption complète séparée, seul vestige des 32 tours d'origine de la tour 1 (maintenant démolie). Il s'agit d'une tour de granit qui contenait un agrégat de quartz calcaire à travers lequel l'eau percolait pour absorber les gaz azotés et produire ainsi de l'acide nitrique, une étape dans la production de nitrate. Dans les deux sites, la production industrielle perdue dans les bâtiments d'Hydro qui ont été aménagés pour des entreprises historiquement liées à Hydro.

Système de transport

Un système de transport interconnecté constitué de deux lignes de chemin de fer et de deux traversées par ferry à vapeur reliait les installations de Rjukan à Notodden afin d'assurer le transport du salpêtre vers les marchés mondiaux par le canal du Telemark. La voie ferrée fut électrifiée en 1911 et demeure largement intacte ; elle comprend les constructions ferroviaires, les quais des ferrys et deux ferrys visibles au Musée norvégien des travailleurs de l'industrie de Vemork. Les tunnels et les ponts constituent des structures importantes, dont le pont en treillis d'acier riveté de Gaupesprang (1909) ; l'ancienne gare ferroviaire pittoresque de Notodden (1908-1909) ; le quai de Rjukan (1909 – le quai ferroviaire) ; les bâtiments de la gare ferroviaire de Tinnoset (1909) ; le quai des ferrys de Tinnoset et ses bâtiments (1909) ; 10 des 11 phares d'origine situés au bord du lac Tinnnsjøen (1908/1939/1962) ; le quai des ferrys de Mæl (1909) ; la gare ferroviaire de Mæl (1909/1917) ; les maisons de Mælsvingen (vers 1914) ; la gare ferroviaire d'Ingølsland ; la gare ferroviaire de Rjukan ; la remise à locomotives de Sâheim ; ainsi que la voie ferrée, les équipements de signalisation et la ligne aérienne de contact. La ligne fut fermée en 1991 ; sa propriété, ainsi que celle des quais des ferrys, des cales, des phares, des véhicules ferroviaires, des voies et des bâtiments ferroviaires fut transférée à la Fondation de la ligne de Rjukan en 1997. En 2012, la propriété fut transférée au musée de Vemork.

Villes ouvrières de Rjukan et de Notodden

Notodden

Tinfos AS et Hydro ont construit les logements ouvriers de Notodden, étendant ainsi l'emplacement d'origine de la communauté paysanne environnante. Les zones d'habitation d'Hydro de Grønnebyen (1906) et de Villamoen (1908) sont situées sur des terre-pleins dominant l'usine et le lac, avec des maisons individuelles (1910-1914) et Tinnebyen (1917-1920) à l'est. Les logements d'Hydro sont également situés à Svælgfos (dès 1905) et à Lienfos (dès 1909), au nord du centre-ville. On attribue à Hydro la conception du centre commercial et la construction d'une école primaire, d'un théâtre et de bains municipaux – maintenant tous détruits –, d'un hôpital toujours existant et d'un bâtiment administratif. La conception des logements reflète l'idéal de la cité-jardin et l'architecture de cette période.

Rjukan

Il s'agit d'un modèle autonome de cité ouvrière créé par Hydro qui s'appuyait sur les idées venues de Suède et d'Allemagne et fut mis en œuvre sur les deux rives de la

Mana. Les logements étaient principalement situés sur la rive nord afin de favoriser l'ensoleillement ; ils s'étagaient selon l'ordre social, les logements ouvriers étant situés au plus bas. Plus de 140 types de maisons furent conçus, souvent par des architectes formés en Allemagne, utilisant le bois et la brique et appliquant les idées modernes en matière de lumière et de ventilation. Des salles de bains avec eau chaude, des toilettes à chasse d'eau et l'éclairage électrique dans chaque appartement visaient à attirer les ouvriers, qui se verraient offrir l'opportunité d'acquérir leur maison individuelle. La ville atteignit un pic d'environ 12 000 habitants en 1920. Elle était alors la ville industrielle la plus importante de Norvège. Les écoles, les maternelles, les parcs, l'hôpital, la bibliothèque, le bureau de poste, les terrains de sport et gymnases furent tous construits par Hydro, tout comme les infrastructures nécessaires, reflétant une fois encore l'idéal de la cité-jardin. Les bâtiments prestigieux étaient conçus par des architectes réputés aux styles variés – historicisme, Art nouveau, néoclassicisme et fonctionnalisme. La construction des bâtiments des centrales électriques faisait appel au béton armé, à l'acier et au verre.

Un catalogue des bâtiments et structures existants considérés comme étant des attributs de la valeur du bien est inclus dans le dossier de proposition d'inscription.

Histoire et développement

Le Telemark étant une zone traditionnellement agricole, le développement du complexe hydroélectrique de Rjukan-Notodden, des usines de salpêtre et des villes nécessita l'acquisition de terres agricoles pour construire les équipements nécessaires. La zone est également riche en ressources minérales qui ont été exploitées par le passé. L'utilisation des roues à aubes sur les cours d'eau lors des siècles précédents a servi à produire l'énergie nécessaire aux moulins et aux scieries, et le flottage du bois était assuré des forêts aux scieries. À partir du XVIII^e siècle, les montagnes et les chutes d'eau ont aussi attiré les touristes. Les conditions ayant permis l'établissement des usines importantes d'Hydro pour la production d'engrais étaient : le système fluvial canalisé dont les écluses menaient à la mer ; la centrale électrique de Tinfos, qui pouvait servir d'usine d'essai ; et la chute d'eau de Rjukanfossen, qui pouvait être exploitée afin de produire la quantité importante nécessaire d'énergie bon marché.

La création de la société Norsk Hydro par l'ingénieur et industriel Sam Eyde en 1905, année de l'indépendance de la Norvège, marqua le début d'un développement industriel à grande échelle dans le Telemark. Au début du XX^e siècle, les ressources mondiales de nitrate de sodium (salpêtre) connues en Amérique du Sud étaient en voie d'épuisement ; la recherche d'un produit de substitution de synthèse avait commencé afin d'augmenter le rendement des cultures, en prévision de la crise alimentaire annoncée. Le développement du système de courant alternatif de l'électricité à la fin du XIX^e siècle et son utilisation dans la première centrale électrique aux chutes du Niagara ouvrirent la voie à l'utilisation de l'hydroélectricité pour alimenter le four à arc

électrique de Birkeland, permettant d'extraire l'azote de l'air et de produire le « salpêtre norvégien ». Kristian Birkeland collabora avec l'ingénieur et entrepreneur Sam Eyde, qui avait étudié en Allemagne, où il entretenait des relations sociales et d'affaires, tout comme en Suède, et les deux hommes réunirent expertise et fonds de financement de sources très diverses. En 1912, Hydro alimentait le marché mondial des engrais à hauteur de 71 000 tonnes.

Pendant la Première Guerre mondiale, le nitrate d'ammonium prit de l'importance car il pouvait servir à la fabrication d'explosifs. Hydro construisit une usine de production de nitrate d'ammonium à Notodden. Après la guerre, la production se concentra de nouveau sur les engrais agricoles. En 1920, la production de salpêtre norvégien s'élevait à 135 000 tonnes, doublant tous les dix ans jusqu'à ce que la Norvège devienne le plus grand exportateur d'azote d'Europe dans les années 1950. Pendant la période de l'entre-deux-guerres, Hydro adopta une méthode de production utilisant l'hydrogène électrolytique, et de nouveaux équipements furent construits en 1928-1929, assurant la production d'ammoniaque à Notodden et la poursuite de la production d'engrais selon la méthode Haber-Bosch à Rjukan. Le krach boursier conduisit à la rationalisation des activités d'Hydro pendant les années 1930. L'Allemagne reprit les équipements de Rjukan pendant la Seconde Guerre mondiale et construisit des installations de production d'eau lourde. Celle-ci était expédiée en Allemagne et utilisée en vue de maîtriser la fission nucléaire. Rjukan devint par conséquent la cible d'attaques de sabotage de la part des Alliés. À la fin de la guerre, l'État norvégien devint actionnaire majoritaire d'Hydro en raison de l'importance stratégique de l'entreprise. Hydro déplaça ensuite ses activités de production d'engrais à Herøya, près de Porsgrunn, à la fin des années 1960.

Le parc industriel de Notodden accueille actuellement 50 entreprises environ et la ville est toujours un pôle commercial, de services et d'éducation. Le parc industriel de Rjukan héberge 30 entreprises différentes dans une zone de 21 ha qui contient 34 bâtiments. La ville est considérée comme le centre touristique de la municipalité de Tinn.

Le cours d'eau oriental du Telemark continue d'être utilisé à des fins de production d'énergie hydroélectrique et en tant que voie d'eau touristique. Les centrales électriques d'origine Tinfos II, Vemork et Sâheim sont toujours intactes et opérationnelles. On y a adjoint plusieurs nouvelles centrales qui ont généralement été construites dans des grottes. La façade visible de la nouvelle centrale électrique de Vemork, située dans une grotte derrière l'ancienne centrale électrique, est une structure en béton de style brutaliste. L'ancienne centrale électrique de Vemork abrite maintenant le Musée norvégien des travailleurs de l'industrie – expositions, bureaux, cafétéria et boutique. Les groupes électrogènes d'origine, toujours en place dans la salle des générateurs, constituent une partie de l'exposition permanente du musée.

L'enveloppe du bâtiment de l'ancienne centrale électrique Tinfos I demeure. La nouvelle centrale Tinfos I (1955) est un édifice de style fonctionnaliste en béton peint. Les lacs et rivières ne sont plus utilisés à des fins commerciales, à l'exception de la navigation touristique.

3 Justification de l'inscription, intégrité et authenticité

Analyse comparative

L'État partie indique que l'analyse comparative de ce bien doit être considérée à la lumière du rapport de l'ICOMOS « Comblant les lacunes » (2005), qui souligne les catégories typologiques, chronologiques-régionales et thématiques correspondant à ce bien. Le bien est comparé en Norvège à Odda et Tyssedal, sur la liste indicative, témoignage de l'exploitation de la topographie naturelle pour produire de l'énergie hydroélectrique servant à la production d'engrais chimiques selon les procédés carbure et cyanamide. Le procédé industriel peut être considéré comme étant complémentaire de celui de Rjukan-Notodden, mais l'ensemble de l'établissement n'inclut pas d'infrastructures de transport ni de cité ouvrière ; il est donc moins représentatif de l'entreprise entière. Le bien est aussi comparé à l'établissement d'Hydro d'Herøya, près de Porsgrunn, où la société a établi l'usine de nitrate de calcium la plus importante au monde dans les années 1920 ; le transport par voie maritime ou terrestre était possible et les activités de Rjukan-Notodden y furent déplacées à la fin des années 1960. Cet établissement représente la phase industrielle qui a succédé aux usines pionnières de Rjukan-Notodden mais ne témoigne pas des mêmes valeurs de manière aussi complète. D'autres entreprises industrielles norvégiennes auxquelles il est fait référence représenteraient une phase ultérieure de développement industriel ou ne reflèteraient pas des valeurs similaires.

Le bien est comparé aux biens suivants inscrits au patrimoine mondial : Gorge d'Ironbridge, R-U (1986, (i), (ii), (iv) et (vi)) ; Paysage industriel de Blaenavon, R-U (2000, (iii) et (iv)) ; New Lanark, R-U ((2001, (ii), (iv) et (vi)) ; Saltaire, R-U (2001, (ii) et (iv)) ; Crespi d'Adda, Italie (1995, (iv) et (v)) ; Usine sidérurgique de Völklingen, Allemagne (1994, (ii) et (iv)) ; Complexe industriel de la mine de charbon de Zollverein à Essen, Allemagne (2001, (ii) et (iii)) ; Salins-les-Bains et saline royale d'Arc-et-Senans, France (1982, 2009, (i), (ii) et (iv)). Aucun de ces biens n'est représentatif de la même période ou du même type de développement industriel mondial. Les usines de salpêtre de Humberstone et de Santa Laura, Chili (2005, (ii), (iii) et (iv)) sont similaires en ce qu'elles répondent à la demande mondiale d'engrais, mais sont dissemblables sur le plan de l'association de procédés hydroélectriques et électrochimiques.

Le bien est également comparé avec les biens suivants des listes indicatives : Ivrea, Italie ; complexes industriels d'Ostrava, République tchèque ; Kyushu et Yamaguchi, Japon ; La Constancia Mexicana, Mexique ;

Pilgrim's Rest Reduction Works, Afrique du Sud, et d'autres sociétés correspondantes au Royaume-Uni, en Allemagne, en Suède, en France, en Suisse, en Autriche, et particulièrement au Canada et aux États-Unis d'Amérique, où les chutes du Niagara furent le site des débuts de l'énergie hydroélectrique et de l'industrie électrométallurgique. L'État partie avance l'idée que le site de Rjukan-Notodden est singulier et représentatif de la nouvelle forme d'économie industrielle mondiale qui s'appuie sur l'électricité au début du XXe siècle en ce qu'il était organisé et financé sous la forme d'un projet global. L'État partie suggère toutefois qu'au regard de la production d'énergie hydroélectrique, témoin de l'importance de l'électricité, divers sites pourraient être associés pour former une série transnationale. L'ICOMOS considère que le fait de restreindre l'association de la production d'énergie à l'objectif limité de production d'engrais à Rjukan-Notodden montre, par comparaison, que les centrales du Niagara en particulier fournissaient une capacité plus importante destinée à des usages plus diversifiés et distribuée dans des zones bien plus étendues. Toutefois, l'ICOMOS approuve le postulat de l'État partie selon lequel le bien proposé pour inscription se distingue clairement par l'association d'équipements et de concepts industriels qui en fait une représentation exceptionnelle du développement industriel au début du XXe siècle.

L'ICOMOS considère que l'analyse comparative justifie d'envisager l'inscription de ce bien sur la Liste du patrimoine mondial.

Justification de la valeur universelle exceptionnelle

Le bien proposé pour inscription est considéré par l'État partie comme ayant une valeur universelle exceptionnelle en tant que bien culturel pour les raisons suivantes :

- Développement industriel révolutionnaire contemporain du remplacement du charbon par l'électricité en tant que source d'énergie,
- Témoignage des transformations sociales dans le monde occidental au début du XXe siècle,
- Mise au point d'un produit (engrais synthétique) considéré comme essentiel pour l'avenir de l'humanité,
- Représentatif des échanges transnationaux sur les avancées de la science et de la recherche,
- Un ensemble complet des éléments constitutifs suivants d'un même projet : énergie hydroélectrique, production industrielle, système de transport et villes ouvrières.

L'ICOMOS considère que le premier point de cette justification doit envisager le fait que l'électricité tirée de la combustion de charbon ou de produits pétroliers alimentait également de nouvelles industries mondiales au début du XXe siècle. Il serait plus juste d'indiquer : « Développement industriel révolutionnaire utilisant l'électricité en tant que source d'énergie ». L'ICOMOS considère que les autres points sont appropriés.

Intégrité et authenticité

Intégrité

De manière générale, tous les objets et structures physiques importants subsistants qui témoignent de la période industrielle novatrice de production d'engrais chimique destiné à l'agriculture en Norvège au début du XXe siècle sont contenus au sein des délimitations de la zone proposée pour inscription. L'ICOMOS note que les ruines de la centrale électrique Svælgfos I, le barrage de Lienfos et les fondations des gazomètres à azote et à ammoniac de Rjukan, ainsi que d'autres structures situées au sein du bien proposé pour inscription, ne sont pas considérés comme étant des attributs par l'État partie en raison de leur état délabré, mais comme des « valeurs complémentaires ». L'ICOMOS considère que ces structures font partie intégrante de la production d'hydroélectricité et d'engrais et devraient être intégrées dans le bien proposé pour inscription. L'ICOMOS note que les ruines de la centrale électrique Svælgfos II, le poste de transformation, la résidence du directeur opérationnel de l'usine, les fondations des conduites forcées, une section du canal de flottage de Svælgfos-Tinfos, ainsi que les vestiges de la centrale électrique de Lienfos, qui font partie de l'environnement culturel de Svælgfos et Lienfos, ne sont pas inclus dans le bien mais se trouvent dans la zone tampon, malgré le rôle important qu'ils sont supposés avoir joué pendant la période d'innovation du site. Selon l'État partie, cela s'explique par leur manque d'intégrité et d'authenticité. L'ICOMOS note également que neuf autres centrales électriques ne sont pas considérées comme des attributs ni comme des « valeurs complémentaires ». Les informations complémentaires fournies par l'État partie en réponse à la demande de l'ICOMOS sur le sujet indiquent que ces structures ont toutes été édifiées plusieurs années après celles qui se rapportent à la période principale du bien et que toutes, excepté la nouvelle centrale électrique Tinfos I (construite en 1955), sont situées dans la zone tampon et non dans le champ de visibilité des plus anciennes. Bien que n'étant pas considérée comme un attribut du bien proposé pour inscription, la nouvelle centrale électrique Tinfos I est protégée par la loi sur le patrimoine culturel du 20 juin 2014. L'ICOMOS considère que la superficie du bien proposé pour inscription est appropriée pour représenter de manière complète les éléments et processus qui traduisent l'importance du bien. Toutefois, l'ICOMOS considère que l'intégrité serait renforcée en intégrant les environnements culturels de Svælgfos et Lienfos au sein de la délimitation du bien. Suite à la lettre de l'ICOMOS et à la réunion téléphonique qui s'en est suivie, l'État partie a communiqué de nouvelles cartes montrant que les délimitations englobent maintenant ces zones. Le tissu physique du bien et ses éléments significatifs sont généralement en bon état. Le bien ne subit pas d'effets négatifs liés au développement ou au manque d'entretien.

Authenticité

L'ICOMOS considère que l'authenticité globale du bien proposé pour inscription et de son environnement est élevée.

Production d'énergie hydroélectrique

Les centrales électriques d'Hydro situées sur la Tinnelva ont pour la plupart été démolies, mais il subsiste cependant des ruines de Lienfos ainsi que de Svælgfos I et II. Le barrage de Myrens, qui alimentait la centrale électrique Tinfos I en eau, est maintenant asséché et ses conduites forcées ont été retirées. Les anciens barrages de Møsvatn et de Skardfoss ont été remplacés par de nouveaux barrages mais subsistent toujours sous le niveau d'eau le plus élevé.

Installations industrielles

Notodden

Depuis les années 1950, de nouveaux bâtiments sans lien avec la production d'engrais ont été édifiés, et quelques bâtiments historiques ont été démolis. Toutefois, les enveloppes subsistantes des bâtiments historiques et leur position relative entre eux traduisent toujours l'organisation des chaînes de production à arc électrique A (1906-1934), B (1911-1934), et la chaîne de production Haber-Bosch (1929-1968). La forme et la conception ainsi que les matériaux de construction des bâtiments ont été largement préservés en dépit d'altérations mineures sur la plupart d'entre eux (nouvelles portes, fenêtres, couleurs, et quelques extensions) et de réfections de toitures, même si le type traditionnel de couverture a été utilisé.

Rjukan

La démolition des bâtiments, notamment de toutes les tours à l'exception d'une seule, depuis les années 1950, a laissé de larges espaces vides. La façade de la fabrique de barils qui subsiste a fait l'objet de changements importants. Toutefois, les bâtiments subsistants et leur position relative entre eux traduisent toujours les étapes fonctionnelles du procédé à arc électrique de Rjukan I et II et du procédé Haber-Bosch de Rjukan III.

Système de transport

L'intégrité du système de transport a été préservée, ses caractéristiques et son environnement demeurant largement inchangés. Les équipements de la ligne aérienne de contact sont endommagés et partiellement manquants mais assurent toujours l'électrification. Dans le port de Tinnoset, les grues du quai de Rjukan ont été retirées mais les fondations et les voies ferrées demeurent. Les phares situés au bord du lac Tinnsjøen sont intacts.

Villes ouvrières de Rjukan et de Notodden

Notodden

Les maisons de la zone de Grønnebyen ont fait l'objet de modernisations dans les années 1950, mais leur caractère général, leur forme, leur conception et leurs matériaux ont été bien préservés, à part le

remplacement des remises d'origine par des garages à la conception uniforme. La zone de Villamoen a connu des modifications plus importantes en raison de la construction de nouvelles maisons non assurée par Norsk Hydro, mais le caractère global de « villa » des maisons de ce lotissement est conservé.

Rjukan

Le plan et la structure urbaine, avec les différentes zones de logements, la place publique ainsi que les maisons individuelles et les bâtiments administratifs, publics et d'infrastructure sont presque inchangés depuis les années 1920. Des constructions individuelles ont fait l'objet d'altérations architecturales inadaptées (fenêtres, portes, enduits, décoration et extensions) depuis le retrait de Norsk Hydro, mais cela n'a pas affecté l'intégrité de la zone ; des orientations sont en cours de préparation sur ce sujet de la rénovation et de la restauration.

En conclusion, l'ICOMOS considère que les conditions d'intégrité et d'authenticité sont à présent remplies.

Critères selon lesquels l'inscription est proposée

Le bien est proposé pour inscription sur la base des critères culturels (ii) et (iv).

Critère (ii) : *témoigner d'un échange d'influences considérable pendant une période donnée ou dans une aire culturelle déterminée, sur le développement de l'architecture ou de la technologie, des arts monumentaux, de la planification des villes ou de la création de paysages ;*

Ce critère est justifié par l'État partie au motif que les avancées de la science et de la recherche en Europe et en Amérique du Nord furent réunies dans l'entreprise de production d'engrais chimiques de Rjukan-Notodden, où la topographie naturelle permettait la production abondante d'hydroélectricité nécessaire au procédé. Associées aux innovations sociales en matière d'apport de main-d'œuvre, qui faisaient appel à la fois aux concepts de planification internationaux et à des solutions de transport novatrices, ces avancées ont permis l'élaboration d'un produit nouveau et important pour le marché mondial.

L'ICOMOS considère que le bien manifeste une association exceptionnelle d'équipements et de concepts industriels liés au paysage, qui témoigne d'échanges importants sur le plan du développement technologique au début du XXe siècle.

L'ICOMOS considère que ce critère a été justifié.

Critère (iv) : *offrir un exemple éminent d'un type de construction ou d'ensemble architectural ou technologique ou de paysage illustrant une période ou des périodes significative(s) de l'histoire humaine ;*

Ce critère est justifié par l'État partie au motif que les barrages, tunnels et conduites servant à acheminer l'eau

vers les centrales électriques ; lignes électriques des usines ; zones et équipements industriels ; villes ouvrières avec leurs logements et leurs institutions sociales ; et les lignes de chemin de fer et service de ferrys nécessaires à l'acheminement du produit sur le marché mondial, tous mis en place dans un environnement naturel propice qui a permis la production d'énergie hydroélectrique, s'associent pour former un ensemble technologique et architectural exceptionnel illustrant la nouvelle industrie mondiale au début du XXe siècle.

L'ICOMOS considère que les sites s'associent tous pour former un complexe technologique et architectural exceptionnel dans un paysage naturel exploité à des fins industrielles.

L'ICOMOS considère que ce critère a été justifié.

L'ICOMOS considère que le bien proposé pour inscription remplit les conditions d'intégrité et d'authenticité et répond aux critères (ii) et (iv).

Description des attributs de la valeur universelle exceptionnelle

Les attributs sont les bâtiments, structures et objets qui se rapportent à la période novatrice de production d'énergie hydroélectrique et d'engrais chimique pour l'agriculture en Norvège, au début du XXe siècle, comme indiqué dans le dossier de proposition d'inscription. Ces attributs comprennent les centrales électriques de Tinfos, Svælgfos, Vemork et Sâheim ainsi que les bâtiments et structures mentionnés s'y rapportant ; les barrages de régulation et les structures de transport d'énergie ; les parcs industriels d'Hydro à Notodden et Rjukan ainsi que leurs bâtiments associés, les structures et les équipements de production évoqués ; le système de transport, comprenant les lignes de Tinnoset et de Rjukan ainsi que les bâtiments associés, les structures, le matériel roulant et les ferrys mentionnés ; les villes ouvrières de Notodden et de Rjukan jusqu'au périmètre des zones de logements, des bâtiments, structures et parcs décrits, ainsi que l'environnement composé par les voies d'eau et le paysage.

4 Facteurs affectant le bien

La ville de Rjukan n'a pas subi de pressions dues au développement en raison de sa situation relativement isolée. Notodden fait davantage l'objet de pressions dues au développement, qui pourraient être exacerbées par la proposition d'élargissement de la route qui relie l'est et l'ouest de la Norvège. Cette route traverserait le bien proposé pour inscription au niveau du centre-ville de Notodden ou légèrement au nord de celui-ci. Les plans municipaux sont en mesure de traiter la densification résidentielle. Les pressions dues au développement sont importantes dans la vallée, entre les lacs de Møsvatn et Tinnstjøen, à la périphérie de la zone tampon, en raison de la demande pour des maisons de vacances et des

activités touristiques, particulièrement le ski. Toutefois, les lignes de vue sont à l'heure actuelle principalement affectées par la croissance de la végétation. Le nombre d'habitants estimé du bien proposé pour inscription est de 300 à Notodden et de 850 dans la zone de Rjukan.

Les modifications des centrales électriques pour répondre aux exigences de sécurité et les améliorations visant une production accrue sont considérées comme les facteurs de développement les plus importants se rapportant aux éléments de la production d'énergie hydroélectrique.

La zone industrielle de Notodden est soumise à des pressions dues au développement d'entreprises nouvelles et modernisées qui sont actuellement contrôlées dans le cadre des plans de zonage. Les équipements de production industrielle stockés à l'air libre dans ces sites sont exposés à des dommages importants en raison des conditions climatiques.

La gare et le quai de la voie ferrée de Notodden feront l'objet d'agrandissement et de modifications à long terme en fonction des nouveaux usages prévus par les plans nationaux et municipaux. La ligne de Rjukan fait partie du Musée norvégien des travailleurs de l'industrie mais elle se détériore, tout comme la ligne de Tinnoset. Cette dernière a subi des vols de lignes aériennes de contact dans des zones inhabitées. S'agissant de la section remise en état de l'ancienne ligne de Tinnoset, qui relie la ligne de Bratsberg au nouveau terminal de transports publics situé à l'ouest de l'ancienne gare ferroviaire de Notodden, son électrification requiert des modifications du quai de l'ancienne gare. Cela fera l'objet d'autorisations légales en matière de patrimoine.

Le changement climatique, à l'origine de précipitations plus importantes en Norvège, devrait accentuer l'érosion et la croissance de la végétation, ainsi que le risque d'inondations, de glissements de terrain et d'avalanches. Les équipements d'énergie hydroélectrique permettent de maîtriser les crues ; le renforcement des barrages prévient tout accident, et des systèmes d'alerte sont opérationnels pour permettre une évacuation en cas de déversement non maîtrisé important. L'activité sismique est considérée comme minimale ; les autorités municipales et du comté sont régulièrement confrontées à des glissements de terrain et à des chutes de pierres. Les services municipaux de lutte anti-incendie, mobilisables 24 h/24, parent aux dangers engendrés par les fortes rafales de vent et les incendies. Les entreprises industrielles appliquent la législation norvégienne de sécurité incendie en matière de protection anti-incendie.

Le dossier de proposition d'inscription indique que des cartes des zones à risque ont été préparées et que les procédures d'urgence pourraient être améliorées en matière de sécurisation des bâtiments s'agissant de la prévention des inondations ; des zones sujettes aux glissements de terrain et aux avalanches et du temps d'intervention dans les zones exposées à un risque d'incendie.

En hiver, le nombre de touristes égale celui de la population dans la municipalité de Rjukan, principalement pour pratiquer le ski, alors qu'il est négligeable à Notodden. Les deux localités sont censées disposer d'une capacité suffisante pour absorber une augmentation potentielle du nombre de visiteurs, à l'instar des zones industrielles et des réseaux de transport – chemin de fer et ferry. Le nombre estimé de visiteurs du parc industriel Hydro de Notodden est de 2 000 à 3 000 par an.

L'ICOMOS considère que les principales menaces pesant sur le bien sont la détérioration dans les zones exposées et non utilisées, et les conséquences de conditions météorologiques extrêmes. Les lignes de vue sont vulnérables aux pressions dues au développement.

5 Protection, conservation et gestion

Délimitations du bien proposé pour inscription et de la zone tampon

Les délimitations du bien proposé pour inscription contiennent les cours d'eau interconnectés du barrage de Møsvatn au lac de Heddalsvatnet et utilisés par Hydro et Tinfos AS pour produire de l'électricité dans les années 1920. Les délimitations suivent le bord extérieur des installations servant à l'écoulement de l'eau – tunnels et conduites. La limite extérieure de la voie ferrée, quand elle suit un cours d'eau, détermine la délimitation du bien. Là où la délimitation traverse le lac Tinnnsjøen, elle inclut le trajet du ferry et les phares, mais exclut la partie nord du lac. Les villes de Rjukan et de Notodden sont incluses, dans la limite de leur extension de 1930.

La zone tampon recouvre le paysage des vallées où s'écoulent les cours d'eau et comprend le lac de Møsvatn, la vallée de Vestfjorddalen, le bassin de Tinnnsjøen et la vallée menant au lac de Heddalsvatnet. Elle est limitée par la ligne d'horizon telle qu'aperçue du fond de la vallée ou des embarcations du lac de Tinnnsjøen et comprend l'environnement immédiat du bien et tous les autres éléments de « valeur complémentaire », ainsi que toutes les lignes de vue importantes.

L'ICOMOS considère que les délimitations du bien proposé pour inscription et de la zone tampon sont appropriées.

Droit de propriété

Tous les attributs présents au sein du bien proposé pour inscription sont propriété privée, sauf les équipements de production, propriété de la municipalité, les deux lignes de chemin de fer et des parties de la ville Hydro de Rjukan, propriété de l'État. La zone tampon est presque entièrement sous propriété privée, à l'exception de quelques biens de la municipalité et de la route nationale, propriété de l'État.

Protection

La protection du patrimoine culturel en Norvège relève largement de la responsabilité du ministère du Climat et

de l'Environnement, via sa Direction du patrimoine culturel, qui applique la loi sur le patrimoine culturel de 1978, amendée en 2009. Le Conseil du comté est également responsable, et coopère avec les municipalités pour préparer des plans directeurs et des plans de zonage afin de garantir la protection du patrimoine culturel national ou régional en vertu de la loi sur l'aménagement du territoire et la construction de 2009, amendée en 2012.

Un tableau du dossier de proposition d'inscription énumère les attributs et leurs parties constitutives qui sont protégés par la loi sur le patrimoine culturel de 2013. Ces attributs comprennent la totalité des deux zones industrielles et l'ensemble du système de transport sauf à Mælsvingen, avec cinq maisons qui sont protégées par la loi sur l'aménagement du territoire et la construction de 1985. Quant aux centrales électriques, Tinfos I et II, des parties de Vemork et Sâheim sont protégées par la loi sur le patrimoine culturel, et d'autres parties sont protégées par la loi sur l'aménagement du territoire et la construction ou d'autres dispositions légales non liées au patrimoine. Seuls quelques bâtiments spécifiques dans les localités de Notodden et de Rjukan sont protégés par la loi sur le patrimoine culturel, le reste étant protégé la loi sur l'aménagement du territoire et la construction ou d'autres dispositions légales. Suite à la seconde lettre de l'ICOMOS et à la réunion téléphonique, l'État partie a transmis un nouveau calendrier, qui montre que tous les éléments seront protégés par la loi sur le patrimoine culturel ou d'autres dispositions spécifiques visant le patrimoine de la loi sur l'aménagement du territoire et la construction dès juin 2015, ainsi que des lettres de confirmation émanant des autorités concernées.

Tous les éléments de « valeur complémentaire » présents au sein de la zone tampon sont des sites du patrimoine culturel protégés par la loi sur le patrimoine culturel et/ou les réglementations supplémentaires de la loi sur l'aménagement du territoire et la construction. Une fonction de protection est également établie par les plans de zonage des municipalités.

L'ICOMOS considère que la protection légale devant entrer en vigueur en juin 2015 sera appropriée. L'ICOMOS considère que les mesures de protection du bien sont appropriées.

Conservation

Les 13 attributs proposés pour inscription du bien et leurs éléments ont fait l'objet d'un inventaire détaillé ; leur condition a été évaluée en conformité avec la norme norvégienne 3423 « Étude de l'état des bâtiments protégés et des bâtiments ayant une valeur historique ». Les tableaux figurant dans le dossier de proposition d'inscription montrent que des travaux de conservation/entretien ont été entrepris, sont en cours ou sont planifiés là où cela est nécessaire. L'ICOMOS considère que les mesures de conservation sont adaptées à la protection de la valeur, de l'intégrité et de l'authenticité du bien.

L'ICOMOS considère que la conservation est appropriée.

Gestion

Structures et processus de gestion, y compris les processus de gestion traditionnels

Une « déclaration d'intention » a été signée par l'État partie, le Conseil du comté et les municipalités concernés, marquant l'engagement en faveur de la protection de la valeur universelle exceptionnelle et de la zone tampon. Un Conseil du patrimoine mondial provisoire a été mis en place, et comprend des représentants de la Direction du patrimoine culturel, du Conseil du comté de Telemark, des trois municipalités (Notodden, Tinn et Vinje) et du Musée norvégien des travailleurs de l'industrie, afin d'élaborer une structure de gestion du bien si ce dernier accédait au statut de patrimoine mondial. Les municipalités de Tinn et de Notodden disposent actuellement chacune d'un coordinateur du patrimoine mondial. Si le statut de patrimoine mondial est obtenu, un coordinateur du patrimoine mondial responsable de la zone entière sera nommé. Selon les informations complémentaires fournies par l'État partie en réponse à la lettre de l'ICOMOS, l'accord de partenariat entre le comté de Telemark et les municipalités servant de base à la mise en place du Conseil du patrimoine mondial permanent a été approuvé en juin 2014, son secrétaire étant coordinateur du patrimoine mondial. Il est proposé que le Conseil du patrimoine mondial se réunisse annuellement avec les principales parties prenantes, dont les propriétaires d'entreprises présentes au sein des zones industrielles, qui pourraient également participer à ses réunions ordinaires.

Parallèlement, les attributs sont gérés par le Conseil du comté et les municipalités sous l'égide du ministère du Climat et de l'Environnement via sa Direction du patrimoine culturel, avec la participation de plusieurs ministères et agences gouvernementales. Le personnel de la Direction du patrimoine culturel comprend des spécialistes dans les domaines concernés, tout comme le personnel du comté et des autorités municipales. Une expertise supplémentaire est fournie par l'Institut norvégien pour la recherche sur le patrimoine culturel, trois centres de conservation des constructions navales et le Musée norvégien des travailleurs de l'industrie. Le financement des travaux sur les sites du patrimoine mondial est assuré par une subvention annuelle accordée à la Direction du patrimoine culturel. Cette subvention a atteint le montant de 60 millions de couronnes norvégiennes en 2013. Diverses autres sources de financement sont disponibles pour les propriétaires et entreprises privés. L'ICOMOS note que le plan de gestion ne comprend pas les nouvelles mesures de préparation aux risques qualifiées de nécessaires dans le dossier de proposition d'inscription – voir Facteurs affectant le bien ci-avant. Toutefois, en réponse à la seconde lettre de l'ICOMOS, l'État partie a fourni des précisions supplémentaires quant aux

mesures de préparation aux risques qui seront comprises dans le plan de gestion.

Cadre de référence : plans et mesures de gestion, y compris la gestion des visiteurs et la présentation

Divers plans locaux, du comté, régionaux et nationaux couvrent la zone du bien proposé pour inscription. La future route principale devant traverser le site est mentionnée ci-avant. Elle sera soumise au contrôle législatif assorti. Le Plan régional pour le tourisme 2011-2024 adopté par le Conseil du comté le 15 juin 2011 finance les projets touristiques qui promeuvent la candidature au statut de patrimoine mondial durant la période 2013-2016. La stratégie pour la culture et le patrimoine culturel du Telemark inclura des objectifs et des mesures liées au patrimoine mondial. Les priorités à long terme comprennent la connaissance accrue du patrimoine culturel dans le comté et la formation d'artisans. Les plans locaux de Notodden incluent des orientations de conservation se rapportant à la protection du patrimoine culturel et un plan municipal d'intervention d'urgence. Les plans locaux de Tinn se concentrent sur le développement de l'économie et des services tout en soutenant la candidature au statut de patrimoine mondial.

Le plan de gestion a été élaboré et approuvé par les parties signataires de la « déclaration d'intention commune » en 2013. Un plan d'action 2014-2019 est défini. Il comprend des objectifs et des actions pour la conservation, le renforcement de la valeur universelle exceptionnelle, celui des compétences et de la recherche, de l'information et de la présentation et la gestion des visiteurs. Il sera revu en 2020. L'ICOMOS note que le plan d'action n'évoque pas la stratégie de prévention des risques, pas plus qu'il ne mentionne la réactivation du système ligne ferroviaire/ferry à des fins touristiques, alors qu'elle semble être prévue.

Implication des communautés locales

Le plan de gestion indique que le Conseil du patrimoine mondial se réunira avec les parties prenantes, les représentants économiques et industriels et les organisations bénévoles au moins une fois par an.

L'ICOMOS considère que le système de gestion actuel est efficace.

En conclusion, l'ICOMOS considère que le système de gestion du bien est approprié. Le plan de gestion devrait être étoffé pour comprendre une stratégie de préparation aux risques, comme le proposent les informations complémentaires de l'État partie.

6 Suivi

Le dossier de proposition d'inscription contient un résumé des activités de gestion, la répartition des responsabilités étant toujours à déterminer par la Direction du patrimoine culturel et les autorités du comté et municipales.

L'ICOMOS note que des indicateurs précis restent aussi encore à définir. En réponse à la seconde lettre de l'ICOMOS, l'État partie a fourni une ébauche plus détaillée du programme de suivi devant faire partie du plan de gestion. L'ICOMOS considère que cette ébauche doit encore être affinée afin d'être corrélée à l'inventaire/base de données des objets.

L'ICOMOS considère que le système de suivi sera approprié quand il sera affiné afin d'être corrélé à l'inventaire/base de données.

7 Conclusions

L'ICOMOS considère que l'analyse comparative justifie d'envisager l'inscription de ce bien sur la Liste du patrimoine mondial ; que le bien proposé pour inscription répond aux critères (ii) et (iv) et remplit les conditions d'intégrité et d'authenticité. Les principales menaces pesant sur le bien sont la détérioration dans les zones exposées et non utilisées ainsi que les conséquences de conditions météorologiques extrêmes. Les lignes de vue sont vulnérables aux pressions dues au développement. Les délimitations du bien proposé pour inscription et de la zone tampon sont appropriées.

L'ICOMOS considère que la protection légale sera appropriée quand tous les changements législatifs proposés seront en vigueur, ce qui est prévu dès juin 2015. L'ICOMOS considère que la conservation est appropriée et que le système de gestion du bien est approprié. Le système de suivi devrait être affiné afin d'être corrélé à l'inventaire/base de données.

8 Recommandations

Recommandations concernant l'inscription

L'ICOMOS recommande que le site du patrimoine industriel de Rjukan-Notodden, Norvège, soit inscrit sur la Liste du patrimoine mondial sur la base des **critères (ii) et (iv)**.

Déclaration de valeur universelle exceptionnelle recommandée

Brève synthèse

Situé au sein d'un paysage spectaculaire de montagnes, de chutes d'eau et de vallées fluviales, le site du patrimoine industriel de Rjukan-Notodden comprend un ensemble novateur de centrales hydroélectriques, de lignes électriques, d'usines, de réseaux de transport et de villes. Ce complexe fut mis en place par la société Norsk Hydro, qui tira parti des avancées de la recherche scientifique européenne et nord-américaine pour produire de l'hydroélectricité et fabriquer des engrais chimiques à partir de l'azote présent dans l'air. Il s'agissait de répondre à la demande croissante du monde occidental en matière de production agricole au début du XXe siècle. Les villes ouvrières de Rjukan et

Notodden adoptèrent les innovations sociales en matière d'apport de main-d'œuvre, influencées par des concepts de planification internationaux qui, associés à des solutions de transport novatrices, permirent l'élaboration d'un produit nouveau et important pour le marché mondial.

Critère (ii) : Le site du patrimoine industriel de Rjukan-Notodden manifeste une association exceptionnelle d'équipements et de concepts industriels liés au paysage, qui témoigne d'un échange important en matière de développement technologique au début du XXe siècle.

Critère (iv) : L'ensemble technologique de Rjukan-Notodden constitué par les barrages, les tunnels, les conduites, les centrales électriques, les lignes électriques, les aires et les équipements industriels, les villes ouvrières, les lignes ferroviaires et service de ferrys, situé dans un paysage dont la topographie naturelle a permis de générer les grandes quantités d'hydroélectricité nécessaires, offre un exemple éminent de nouvelle industrie mondiale au début du XXe siècle.

Intégrité

De manière générale, tous les objets et structures physiques importants subsistants qui témoignent de la période industrielle novatrice de production d'engrais chimique destinés à l'agriculture en Norvège au début du XXe siècle sont contenus au sein des délimitations de la zone proposée pour inscription. La superficie de cette dernière est appropriée pour assurer la représentation complète des éléments et processus qui traduisent l'importance du bien. Le tissu physique du bien et ses éléments significatifs sont généralement en bon état. Le bien ne subit pas d'effets négatifs liés au développement ou au manque d'entretien.

Authenticité

Le bien comprend des édifices, des structures et des vestiges qui traduisent de manière crédible et fidèle sa valeur universelle exceptionnelle en tant qu'entreprise industrielle innovante dans la production d'engrais chimiques au début du XXe siècle.

Mesures de gestion et de protection

Le bien est protégé par la loi sur le patrimoine culturel de 1978, amendée en 2009, et la loi sur l'aménagement du territoire et la construction de 2009, amendée en 2012. Tous les éléments spécifiés seront protégés par la loi sur le patrimoine culturel ou des dispositions spécifiques visant le patrimoine de la loi sur l'aménagement du territoire et la construction dès juin 2015. La zone tampon est protégée par la loi sur le patrimoine culturel et des contrôles de zonage, en application de la loi sur l'aménagement du territoire et la construction.

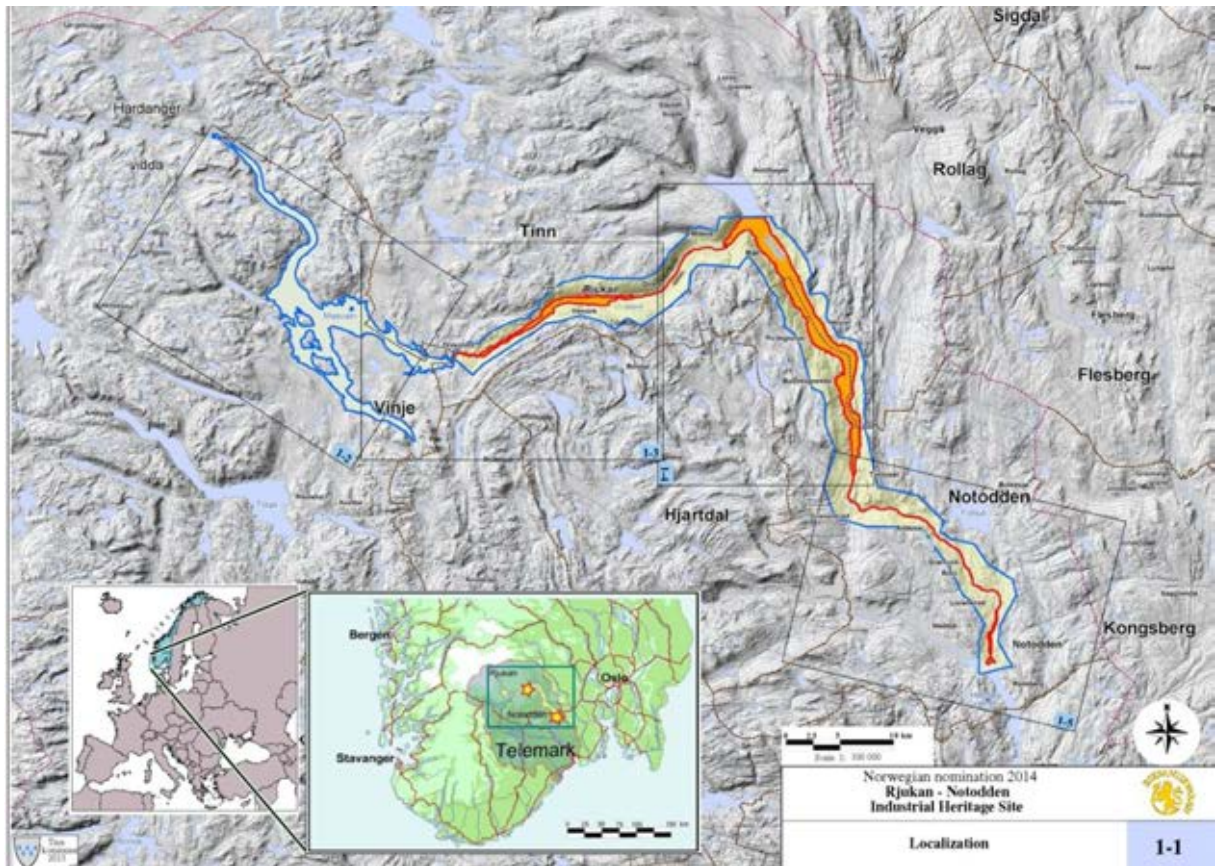
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Recommandations complémentaires

L'ICOMOS recommande que l'État partie prenne en considération les points suivants :

- étendre le plan de gestion afin qu'il inclue une stratégie de préparation aux risques, comme proposé ;
- affiner le système de suivi afin qu'il soit corrélé à l'inventaire/base de données.



Plan révisé indiquant les délimitations du bien proposé pour inscription



Centrale électrique Tinfos II



Centrale électrique Sâheim



Parc hydro-industriel de Notodden



Parc hydro-industriel de Rjukan