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Introduction
The article examines the views of government authorities on heating in historic churches in Sweden from 1918 to 1975. In this period heating was introduced in most Swedish churches. Authorities basically had to navigate three interests that potentially could cause conflict: heating for comfort, spatial organization of the indoor environment, and the conservation of art objects. These interests have been observed by previous research and serve to generate questions to be answered in the article. The use of churches in the Church of Sweden underwent considerable change during this period. Many churches were used more frequently for baptisms, concerts, and other events as liturgical tradition was modernized and secularization changed the use of parish churches.

By studying the historical development of the custody of churches a more realist understanding of the complexity of the issue can be developed. If we can identify and explain the conflicting interests influencing decisions on heating and indoor climate in historically valuable churches, decision making in this field has the potential to become more reflective and well grounded. How did Swedish authorities relate to the growing demand of comfort in these buildings? Except for changes in use and expectations on comfort there was also a scientific development internationally regarding the understanding of how organic materials react to changes in temperature and humidity. To what extent did conservation officials try to strike a balance between heating for comfort and the protection of the building and its inventories?

Many churches in Sweden contain inventories of a number of materials (wood, metals, textiles, paper, leather, paints), which represent significant values. What is an appropriate climate for preservation differ between the materials kept in churches. The Church of Sweden manages today more than 3000 churches of which around 1380 are of medieval origins. Historically buildings and inventories of the Swedish church have been protected by the Church Code (Kyrkolagen), stating that it is the responsibility of the parish to keep the church and its inventory in good condition.

Many rural churches are today running a risk of becoming redundant due to secularization and urbanization. In coming years there will probably be less heating in many churches because of a decrease in use and increasing energy rates, whereas other churches will be heated more because of a more intense use. This change of use will of
course also directly affect the preservation of the inventories, which in almost all cases are supposed to be kept in the churches.

**Organization and legal protection (1918–1975)**

The responsibility of the church to maintain its buildings has in most cases primarily rested on the parish itself. Cathedrals are exceptions to this rule and are not considered here but have previously been investigated by Legnér & Geijer. Supervision of the historical values of state churches was carried out already in the nineteenth century, but with much less consistency than was the case post-1918. Before 1918 Överintendentsämbetet (Board of Public Works and Buildings, ÖIÄ) was the government authority responsible for the design, construction, and management of state-owned buildings. In time ÖIÄ became an outdated organization for the quickly growing building stock of the government, resulting in its annulment and the birth of a completely new government agency, Kungl. Byggnadsstyrelsen (Board of Building and Planning, KBS). In order for the new agency to be able to handle issues concerning the stock of historical buildings (including state churches), one of the sections of KBS called Kulturhistoriska Byrån (K-Byrån) was given this specific task. The task of this section was regulated in a royal decree from 1920 stating that interventions in churches of the Church of Sweden should be approved by KBS. Formally churches had been protected in law already before 1920, but the regulation had not been efficiently upheld or even been known by all priests. Proposals for modifications on churches were to be subjected to the scrutiny of KBS. The decree said that a building owned by the public or by an institution (such as the Swedish church) was to be cared for in a way that did not damage the building or its inventory. Furthermore, the decree specifically stated that the building and its interiors should be protected from damaging humidity and fire hazards, indicating that these risks were seen as the main threats against any historical building of the time. In this context it is especially interesting to see that humidity – and implicitly its possible consequences such as mold, rot, vermin, and corrosion – was identified as one of the main threats to the indoor environment of the church. Heating could of course be one way of solving problems of excess humidity.

Despite several re-organizations of KBS in the following decades, K-Byrån would continue its work following identical instructions until 1975. By then it had been moved to Riksantikvarieämbetet (National Heritage Board, RAÄ), and in 1975 it ceased to exist due to a complete reorganization of RAÄ.

Today the issues of approving proposals for modifications of old churches are handled by regional authorities.

**Materials and method**

This study is largely based on documentation of K-Byrån on matters regarding heating of churches from the time 1918 to 1975. There is an extensive amount of protocols, letters, and reports covering this matter in the office archive, which is publicly available to anyone and kept at the Antikvarisk-Topografiska Arkivet (ATA) in Stockholm. A large part of the K-Byrån archive is comprised by the F series, or »Documents organized by subject.« Within this series extensive documentation on interventions undertaken in churches and other protected buildings is found. The
archive materials primarily used here comprise nine boxes in a specific part of the F series. The nine boxes kept in the F series contain several hundred documents on issues of indoor climate in churches. This series apparently functioned as a reference for conservation officers of K-Byråns throughout the period examined. Cases of general interest when regarding heating and ventilation in churches were collected here in order to serve as future references. The series contains documents from the whole period and thus documents accumulated gradually in the course of more than 50 years. The large number of documents dealing with churches reflects both the increasing workload of K-Byråns and the importance that issues of heating and preventive conservation in churches were attributed by the section.

The lion part of the documents originate after 1945, but there are also relatively rich source materials from the 1910s and 1920s. Additional documents have been gathered outside of this archive to further enlighten some of the issues. For example, have documents also been accessed to some extent from Ämetsarkivet at RAÄ and the archive of Gotlands Museum (Visby). For practical purposes it has not been possible to refer to more than a small part of this vast amount of documents. The documents quoted here, however, are of key importance when it comes to understanding the basis for decisions on heating systems in churches.

There is one subseries called F3ca which contains 12 boxes of documentation on the use of electricity in churches (not just for heating but also for all kinds of electrical appliances). In this subseries especially one box, F3ca:9, has been used for this investigation since it contains extensive documentation of tests on using electricity for heating churches in Sweden carried out in 1915–1935. Another subseries, F3a, deals with technical issues in churches and contains seven boxes. This article is largely based on documents found within the F3a subseries. The titles of two of the boxes explicitly deal with heating, including the results of a national survey carried out in the early 1950s which has been of great value to this article, but a closer inspection gives that all the boxes contain materials related to heating or insulation. Copies of articles in newspapers cited here have been found in the archive, confirming that officers at K-Byråns had actually read the articles.

By examining the archive of K-Byråns it becomes possible to observe, in a chronological order, and understand what kind of papers the coworkers of the office read, how they responded to issues brought forward by actors outside of the office, and to which extent these responses resulted in policies and other decisions, as expressed in promemorias or decisions.

**Heating – a challenge to fire safety**

One important reason for creating the section K-Byråns within KBS was to better manage restorations of churches, which in the last decades had been subjected to highly criticized stylistic restorations. A second, and related issue which the section was immediately engaged in was the need for increasing fire safety in churches. Legnér has pointed out that iron ovens were installed in many churches, schools, and other public buildings. These local heat sources were used to raise the level of comfort for a low operating cost, and not primarily for conserving the church. Some of these were installed or used in ways which sooner or later caused a fire in the
building. After 1918 fire prevention measures were taken more seriously by the government, partly due to an increase in the number of church fires. On an average, three churches burned every year. Of 80 fires in churches between 1880 and 1916, it was estimated that 64 were caused by the faulty installation of an oven or due to incorrect operation.\(^9\) As a result of an increase in fire preventive measures, KBS first issued instructions on the operation of fireplaces in churches in 1928.\(^10\) This was a brief manual on how to properly handle a fireplace and informed about the most common fire hazards in churches. The issue was not so much how heating could damage the church or its inventory, but that the church should be heated without endangering the building.

Another fire preventive measure taken around this time by KBS was to analyze how different kinds of asbestos-based paste could be used to insulate vaults.\(^11\) The vaults of churches were generally not insulated in the 1920s, since churches around this time were still heated just for sermons. If one wanted to heat a church more than just occasionally, there was of course also of interest to explore the possibilities of insulation, which at this time were limited. None the less the development in insulation technology was developing. Consequently, there was relatively little to gain in energy use from insulation in the 1920s, but with regard to fire safety there were substantial benefits to make. It was believed that a thin layer of asbestos could stop a fire inside the church from spreading to the attic. This was probably not used in many churches, since it was difficult to apply this kind of insulation to the top of vaults. When the issue was brought up again by parishes, K-Byråns produced a promemoria (1948) explaining that the primary aim of insulation in churches should be to decrease heating costs, rather than to prevent fires.\(^12\) As fires became more scarce from the 1940s on, focus shifted instead to abating energy costs. The aim was to provide some thermal comfort to visitors while keeping energy costs down.

**The introduction of central heating in rural churches**

The restoration of a medieval or early modern church in Sweden in the 1920s or 1930s often meant that central heating was installed for the first time. It also meant that mural paintings which had been covered were revealed and conserved, as observed by Gustafsson.\(^13\) Wooden polychrome objects such as pulpit, altarpiece, paintings, and sculptures were returned to the church after having been stored away for some time. Restorations served not just to make these buildings more functional but also to enhance the sense of connectedness with the past. Consequently, the interiors of many old churches became more vulnerable since mural paintings needed to be cleaned and retouched once they had been soiled by air pollution. The return of painted wooden objects previously kept in humid and nonheated storages of museums to churches further increased risks related to heating.

For central heating in a rural church of this time low-pressure steam was often selected because it could quickly heat the church. In the 1920s the idea was that the church would be heated intermittently, mostly just for the Sunday sermon. A typical parish church, then, would be unheated for five or six days a week. Heating a church permanently was considered a waste of energy by parishes,
since the only purpose was to provide thermal comfort, not to decrease humidity or prevent condensation in the building. The parishes, which often were small and of limited means, wished to keep costs to a minimum. With low-pressure steam pipes and radiators the air volume could be heated relatively quickly. The disadvantages were that all of the air volume and also surfaces of interiors were heated, and that the loss of energy was considerable.

In the early 1920s it was generally believed in Sweden that the humidity of unheated historic buildings was a bigger problem than the risk of desiccation of wooden interiors. This was even pointed out in recent legislation.\textsuperscript{16} Extremely high levels of humidity made wood rot, textiles collect mold, metals corrode, and plaster crumble. Furthermore, small rural churches were not seen as representing high-cultural values. No evidence has been found in the archive that risks of desiccation were identified by K-Byrån in the 1920s regarding wooden objects stored in churches. As Legnér\textsuperscript{17} has observed, there were on the contrary advice being given to at least a few rural parishes with humidity problems in the church that they should install central heating in order to make the indoor environment drier, thus preventing rot and mold on wood.

**Electrical heating causing draughts and condensation**

For the purpose of heating intermittently for thermal comfort, parishes were encouraged to install electrical heaters, but still in the 1930s many rural parishes did not have access to the electrical grid. Even in cases where a church had access to low-voltage electricity, the rate was much too high to pose a realistic alternative to heating with cokes or firewood.\textsuperscript{18} There were also complaints that electrical heaters did not manage to provide enough comfort for churchgoers, or that the heat was distributed unevenly through the nave. Electrical heat was turned on shortly before a sermon, causing draughts.\textsuperscript{19} Parishes were therefore recommended to begin heating the church already the day before sermon. This meant that not only the air volume was heated but mainly the surfaces of walls and vaults but also furniture and objects. Cool walls would take up most of the heat before the air became warmer.

The main issue was then not how heat affected the building or its objects, but rather the costs of heating and how these could possibly be kept at a minimum but without losing the provision of thermal comfort. The consultant company Elektriska Prövningsanstalten\textsuperscript{20} provided K-Byrån with information on electricity consumption of churches connected to the grid. There were good reasons for KBS to encourage the use of electricity. In weekends there would be a surplus of electricity produced by the recently developed hydro power plants for industrial demand. The challenge was how to distribute power to churches scattered over the countryside, often without access to the grid. Electrical heating was considered a technically and aesthetically feasible way of heating a church, as compared to an oven or a central heating system using firewood, even if it was not ideal from the point of view of operation costs. The installations of lines and radiators would be less visible, and were easier to manage.\textsuperscript{21} Apparently electrical heaters were efficient in at least some churches.\textsuperscript{22} In 1934 around 200 churches seem to have used electricity for heating.\textsuperscript{23}
A more complete map of risks involved

After 1945 low-pressure steam was considered technically obsolete but was still used in many rural churches. In years to come many of these systems were converted to low-pressure hot water systems fuelled with oil instead of cokes or firewood. One problem identified by K-Byrån was the intense heat rising from the large radiators mounted on walls, causing dust particles to stick to the surface of walls. Central heating systems were increasingly identified with the problem of blackening which damaged mural paintings. Blackening was perceived as an aesthetical problem in the way that it had a detrimental effect on the appearance of the interiors, more than a loss of historical values. Another problem was desiccation of wooden objects since radiators were often concealed next to or behind furniture. A third issue was the need for digging out a boiler room below the church, which K-Byrån ceased to recommend since it meant disturbing human remains. According to Legnér, digging a large pit next to, and sometimes even beneath the church also meant risking structural collapse.

There was a genuine belief that electric heating would abate costs for heating, and that it would also be a cleaner way of heating. Fig. 1 describes not only the rise of heating installations in churches between 1920 and 1953, but also a shift from ovens and central heating to electric heating. The figure is based on an inventory of final and approved proposals for heating systems in churches performed by KBS in 1952–1953. Unfortunately the survey did not continue in the years following 1953. The figure shows that in the 1920s and 1930s electric heaters constituted a

![Fig. 1. Final proposals for heating systems in Swedish state churches approved by KBS, 1920-1953, divided between electric heating and other heating systems. Source: ATA, compilation of vol. F3a:6.](image-url)
small portion of the installations proposed, even though they increased in number over time. Starting in 1944, however, there was a sudden and sharp increase in proposals for installing electric heating. Between 1945 and 1953 just a few central heating systems were proposed. The situation in 1953, then, was that most of the c. 2700 churches of the Church of Sweden were heated in some way, and that roughly 1200 of them should have been heated with electricity. In other words, there had been a sharp increase in proposals for electric heating from 1934 to 1953. Nearly 1000 churches used some kind of central heating, and then there was a number (unknown) which still used ovens.

It was not just within the issue of church heating that the workload of KBS grew substantially after 1945. There was a general increase in proposals for restoration work or other modifications. In the early 1950s K-Byrån handled roughly 900 proposals every year with a staff of five persons. The staff was dependent on regional conservation officers for inspecting the churches before and during restoration work was carried out. Much of the increase of the work load was allegedly based on matters of taste and did not emanate from practical needs. The office responded to this restoration frenzy by explaining to the dioceasans that practical needs could be a legitimate reason for restoration, but not just aesthetical considerations. Instead more attention should be paid to careful maintenance of the buildings. Taste was thus not a legitimate argument for restoring a church, but changed use was. It is quite possible that proposals for interventions in churches were officially motivated by change of use, when the actual aim was to make an aesthetical improvement.

KBS was not well prepared to handle this increase in proposals and could not possibly grasp all the consequences for the buildings and the inventories that mass introduction of electric heating and other new installations meant. Instead K-Byrån became dependent on the support of regional museums that would make on-site inspections before and during restoration.

**The challenge of air heaters and infraheaters (post-1949)**

Evidently parishes were quick to accept the promises of heating. One reason should have been that manufacturers’ marketing of new heating devices was aggressive (Fig. 2). Some of the promotional materials which were disseminated to parishes were collected in the K-Byrån archive.

In the 1940s the electric grid had improved in rural areas, making electricity more feasible than before, provided that intermittent heating was used and only in weekends. With electric heaters it was believed that the temperature of the air inside the church could be raised quickly without affecting the temperature of surfaces. The assumption was made that wooden surfaces would not react to the heat before it was turned off again. In recent years the assumption has been proven not to be completely true: the surfaces of wooden objects react quickly to changes in the surrounding environment. The idea was that a minimum of energy should be spent on heating the structure and the interiors, using it instead to improve the comfort of the churchgoers. The main goal was still to minimize the use of expensive energy, but a few years into the 1950s another goal would be added, namely to protect wooden inventories in the churches.
Fan driven air heaters was another kind of heating system adopted in many churches, apparently often without approval from KBS since they required very little or no adaptation of the building. Air heaters could easily be installed in a church connected to the electric grid. These heaters could raise the indoor temperature quicker than any previous heating installation. In the middle of the 1950s RAÄ reacted against the permanent use of such air heaters in churches with medieval wooden art. More specifically, the use of an air heater called Thermobloc (Fig. 3) was criticized by conservators for causing severe desiccation of wood in churches. It had been on the market since 1949 and by the late 1950s this kind of heater was used in several hundred churches that were heated intermittently. The RAÄ conservator Arne Strömberg, commenting the use of this kind of air heater, argued that wooden objects benefitted most from no heating. This heating device was used in many countries all over the world for a variety of buildings. The manufacturer argued that it was energy efficient and easy to handle, quickly raising air temperature within a confined space. One drawback, however, was that it was all too easy to misuse the heater in a church (for example by letting it heat the church to comfort temperature permanently), causing desiccation, warping, and paint flaking on wooden surfaces.

As a consequence of this increased attention to damages, more refined technical solutions began to be considered. IR heaters...
would then be placed on the walls, heating the bodies of churchgoers from above and causing cool draughts. Radiant infrared heating in churches was discussed in Sweden already in 1954, but at that time the conclusion was that the technology could not provide enough thermal comfort in itself and only work as a supplement to other heaters.\textsuperscript{34} None the less, IR technology developed continuously in the years to come.

In the 1960s recently observed drawbacks of central heating systems served to promote

Fig. 3. The AB Bahco Thermobloc air heater was fuelled with oil and blew hot air into the nave of the church. Many of these heaters do not seem to have used any kind of air cleaning. Source: ATA, vol. F3a:6.
electrical heating even more. A lot of parishes had had their furnaces converted from solid fuels to heating oil. Typically a low-pressure steam furnace would be converted to low-pressure water heated with an automatized oil burner. Heating became automatized which meant that much the church was looked after much less frequently. The oil burner could be switched on, the thermostat set on a fixed temperature and then be left to do the work without the supervision of a caretaker. Decreasing fuel rates contributed to this rise of permanent heating. Damages such as desiccation, paint flaking, mold, rot, or soiling could potentially accumulate over winter without anyone noticing them. It was also easy to begin heating the church permanently day and night. In 1964 the discovery was made by an engineer consulted by KBS, Ingmar Holmström, and the painting restorer Erik Olsson that permanent heating caused as much damage to the building (soiling of walls and vaults) as it did to the wooden objects inside. During the 1960s Holmström became an expert in Sweden on the building physics of masonry structures.

Holmström, now working for Statens institut för byggnadsforskning (National Institute for Building Research), began studying how old wood reacted on variations in relative humidity. He also examined damages on old chimneys and vaults due to heating with oil. One conclusion was that churches which were not heated should be allowed to remain cold. The exhaust fumes of burned oil were of much less temperature than the ones of firewood, causing condensation on the inside of chimneys. This condensation, coupled with pollutants (mainly sulfuric acid and tar), penetrated the chimney from the inside and caused saline precipitation on vaults inside the church. The results were large black spots appearing in the plastered ceilings of Gotland churches.

Condensation of these pollutants led to the destruction of mural paintings and of masonry attacked by these chemicals. In 1966 this problem was widespread among the 92 medieval churches which were still in use on Gotland. In many churches original chimneys from the beginning of the twentieth century were still in use. By this time coal or firewood fuelled furnaces had been converted to ones fuelled with oil. Only in 9 out of 39 cases had the chimney been constructed in a way that prevented damage due to condensation. As a consequence KBS recommended that churches either be heated with electricity, or with central heating using a separate boiler house. This was only a recommendation, not a binding measure, since converting the heating system of a church was a costly affair and parishes could not be forced against their will.

Several years after the discovery of these damages K-Byrån finally issued its recommendations for using oil to heat old churches. In these guidelines the danger of causing desiccation due to permanent heating was mentioned. To what extent these guidelines were actually implemented is not known. Damages caused by faulty use of oil burners seemed to encourage the use of electric heating even more. As Fig. 1 shows, electric heating was proposed in a lot of churches in the late 1940s and early 1950s, and it is probable that the triumph of this heating technology continued also later, especially considering the decrease in rates of electricity in the 1950s and 60s.

At this time K-Byrån seems to have taken a more cautionary stance toward heating. This cautious approach could be related to the organizational move of K-Byrån to RAÄ in
1967, where the skills of the conservators of polychrome wooden art could be tapped. As mentioned above, RAÄ conservators had previously articulated concerns about the effects of heating on paint and wooden materials. Due to changes in the management of government-owned buildings it was considered less appropriate for KBS to continue to have the responsibility of supervising and approving changes to churches and other historic buildings. In the 1960s KBS was increasingly viewed as a provider of rational and functional premises for a number of users within national government. The task of managing a historic building stock was played down. This should be the most important reason for why K-Byrån was moved to RAÄ, which was already involved in the management of churches since it supervised the conservation of church inventories.

A more cautious approach is evidently visible in the way proposals for pew heaters were analyzed in the late 1960s. Pew heaters would heat the bodies of visitors from below without heating the air very much. However, they could damage pews carrying historical values. In 1969 K-Byrån called attention to the risk that heaters positioned directly beneath the seats could cause dehydration to the valuable wooden interior of a church. The honeymoon of electric heating had come to an end and damage risks associated with pew heaters were observed. Hesitance toward heating were expressed also by other government agencies. A conclusion drawn by the National Institute of Building Research was that stone churches which were not heated, should remain so, but there were not many churches left (less than 10% of the total stock) unheated in 1967.

Simultaneously radiant heating technology was now considered applicable in churches despite its previous shortcomings. IR heating appeared promising in churches not just because it seemed to be an economically feasible alternative, but also because it was based on the idea that just the bodies of churchgoers would be heated and not the surfaces of the interior. Toward the late 1960s radiant heating technology had developed further and was tried out in pews, potentially making traditional electric pew heaters less attractive to parishes.

In the late 1960s Holmström worked on trying out different radiant heating devices in churches. In 1966 he had proposed a system of wall-mounted IR heaters in Fröjel church on Gotland, which was rejected by the parish, but a similar system was installed in Garde church three years later. He produced a report on the matter commissioned by KBS. Four different types of damages caused by heating were identified: desiccation of wood, damage on walls and vaults, salt precipitation on masonry, blackening, and condensation on chimneys. Holmström suggested two possible ways to proceed. One was to use infrared radiant heating in the pews only to provide thermal comfort and keep the rest of the church cool. He conducted experiments on an IR system in a room in the Royal Palace of Stockholm in which air exchange rate, temperature, and relative humidity could be controlled. Military conscripts were used as subjects for measuring the level of comfort. An old wooden pew was moved to the room
to make it resemble a church. One conclusion from the experiment was that the level of comfort could be kept but soiling of the walls be reduced if the pews kept some distance to the walls. This would also decrease the experience of draughts coming from the walls.

The option was to humidify the air, but this was more risky since humidification would put strain on the building envelope. This would not solve the issue of blackening since central heating or electrical heaters would still be in use. Holmström was convinced that Gotland churches would do better without any heating at all, but in order to satisfy the parishioners’ demand for comfort heating he was willing to accept a minimum of radiant heating directed toward the pews, thereby not affecting the rest of the nave.

Creating a comfortable environment with IR heating in winter time proved to be difficult in the cold and dry Swedish climate. This kind of heating technology could only prolong a seasonal use of a church and not all year around. Parishes installing IR heating, however, seem to have believed that they would provide sufficient heat even in winter time, and were quickly disillusioned about the promises of the new technology. Thus the parishioners abandoned the church in winter and had mass in the parish house instead. There was also an aesthetical issue with IR heaters in that they were only tolerated by K-Byrán in concealed spaces, such as beneath or inside pews, and not in visible positions on walls or columns. This meant that IR heating around 1970 could not entirely replace central heating or electrical heating, and thus it was discredited and abandoned by many parishes. Much like in the case of electric heating, which at an early stage was discredited by parishes but later was more accepted, IR heating was rejected for not providing enough heat. Bylund Melin & Legnér has shown that electric or central heating increasingly was used for mixed-mode operation (i.e. comfort heating just before and during sermons and less heating during rest of the week) for low power, continuous heating during the weekdays and at full power in the weekends.

Around 1970, then, a range of different heating technologies were used in Swedish churches. Air heaters were still one of them despite previous warnings. In 1970 paint flaking was observed in Skokloster church, which for several years had been heated with a Thermobloc device and which contained polychrome art that was very sensitive to dry air. Swedish architects visiting Denmark at this time paid attention to air heaters used in churches there, supporting an argument for mixed-mode heating practiced with care. In a report to K-Byrán, they described their skeptical attitude toward the widespread use of air heaters in Danish churches. Sharp fluctuations in relative humidity (RH) and condensation on walls and objects were to be avoided by having a more even supply of heat.

The global energy crisis of the 1970s certainly influenced the first recommendations for church heating in Sweden. A low level of heating was advised, not just for keeping energy use down but also for preserving the church. However, recommendations published around this time implied that intermittent heating, which used much less energy than background heating did, had become an exception in many churches despite rising energy rates. Around the mid-1970s both RAÄ and other agents engaged in conservation stressed the importance of heating with care and only intermittently.
Another manual issued by RAÄ giving advice on energy conservation in churches also emphasized that heating should be intermittent, not exceeding temperatures of 16–18 degrees Celsius wintertime during sermons. Between sermons the church would be allowed to cool off. This was the first time a temperature interval was recommended. There was still no mentioning of within which interval RH should stay. »The church will not suffer from being unheated« was the tentative conclusion drawn by the authors.52

In a 1982 report RH interval was mentioned for the first time, saying that RH in churches should not drop below 40%. There was no criticism of heating strategies53 used, only the advice that churches could be left unheated without taking damage.

Conclusions

The number of unheated churches will probably grow in a near future because of a need to decrease costs for energy use. Other churches will be heated more than today due to a more intensive use. Beginning in the 1920s, the strategy has been to use as many churches as possible and also to heat them in order to keep them attractive to churchgoers. A conflict of interest gradually arose between parishes requesting comfort and government agencies stressing protective legislation and the need to use heating responsibly. The purpose was to keep costs down and to prevent damage from overheating. In the 1920s, 1930s, and 1940s the conflict was not very articulate, since heating seemed to be the solution for both providing comfort and preserving the church. High fuel rates served to keep heating to a minimum. K-Byrå argued for a safe provision of heat, which at this time meant that local fireplaces such as ovens should be replaced with central heating. Improved fire safety was a major concern for KBS in the 1920s. Only intermittent heating was used in the period 1920–1950, keeping energy use at a comparatively low level.

As heating technology became more efficient, fuel rates decreased and demands for comfort heating increased, damages became more evident. A conflict of interests between preservation, comfort needs, and use of the church seemed to have developed. After 1945 there was a sharp and continual increase in the number of annual proposals for restorations or renovations of churches. The means of K-Byrå influencing parishes were limited since the section mostly issued recommendations and not binding decisions. Even if parishes followed recommendations, K-Byrå had no means of controlling how heating systems were used in practice. The risk was evident that installations were used more intensely (i.e. not intermittently) than proposed. In order to efficiently control heating in churches it would have been necessary for K-Byrå not just to scrutinize proposals but also to make regular inspections to see how churches actually were heated, but this was entirely left to the caretaker of the church.

A number of conclusions can be made. Firstly, thermal comfort quickly came to be perceived as an inevitable feature of a church. In the 1920s and 1930s and even later, heating promised not only the possibility of a more varied and frequent use of the church, but also a healthier and more comfortable indoor environment. Secondly, new heating technology which became available on the market in the 1940s and 1950s was introduced and used in churches before the consequences could be fully grasped. The case with the Thermobloc heater that was installed in many
churches showed that parishes made important decisions on heating and ventilation without approaching K-Byrå. A third conclusion is that K-Byrå did not attempt to discourage parishes from installing heating devices in churches. Instead K-Byrå argued that heating was acceptable if it was considered necessary by the parish, but that heating should only be used intermittently (as opposed to mixed-mode or permanent heating) and with caution. By the 1970s, in the wake of the global energy crisis, the first general instructions on heating in churches were issued. Efficient energy use was encouraged, and it was suggested that churches did not need heating for the purpose of preservation. Heating should be aimed for the bodies of visitors rather than for the air volume of the church.

A general conclusion from the study is that despite that heating systems were to be approved before they were installed, later use of these systems escaped central supervision, thus leaving the responsibility of preventing climate induced damages entirely to the individual parishes. The wish to heat churches is however still very strong today, and probably much stronger than before in Sweden. The development between 1918 and 1975 has shown that there was a cumulative and continual increase in the use of heating technology. Despite that there were evident risks associated with this increase, there were actually goals which were shared by the parishes and KBS, such as making energy use more efficient and preserving the building and its inventories. Even if there at times was a conflict between preservation aims and comfort needs, the notion of a conflict of interests should not be overstressed.

Finally, this study shows that the concept of local radiative heating which has been disseminated internationally in recent years has been consciously applied in Swedish churches for a long time. The position of ovens among or just next to pews in the early twentieth century was one way of achieving improved comfort without »wasting« energy on heating the surroundings. Early electric pew heaters was another and more refined application in this tradition, which was followed by attempts to use infrared heaters in the 1960s. Thus the idea of local radiative heating rests on an older tradition which for some time was almost abandoned and forgotten, but later was rediscovered and applied again.

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Endnotes


8. The archive catalog of K-Byrån is available from: http://www.visualarkiv.se/xtf/view?docId=SE/ATA/KBYR/1.ead. xmlquery=kulturhistoriska20byran;brand=arkivinfo.


22. ATA, K-byrån, vol F3a:6, »Betr. elektrisk uppvärmning av kyrkor«, pro memoria from Elektriska Prövningsanstalten to KBS 2 October 1926.


30. AB BAHCO, 10 år med BAHCO Thermobloc. [10 years with BAHCO Thermobloc.] AB BAHCO, 1959.


40. B. Linn, »Öljeeldning orsakar svåra skador i kyrkor«. [Heating with oil causes serious damage to churches.] Byggnads-Ingenjören, No. 1–2, 1969, pp. 24–27.
44. ATA, K-byrån, F3a:6, copy of article »Framtidens värme infraröd i kyrkor, skolor, fabriker«. Svenska Dagbladet 1953-02-03.
46. Gotlands Museum, Fröjel, parish council 14 April 1969 (about experiences with IR heating in Garde church).

**Summary**

The paper examines the views of government authorities on heating in historic churches in Sweden from 1918 to 1975, when a government office called Kulturhistoriska Byrån oversaw restorations and other modifications of public buildings with historic values. In this period heating was introduced in most Swedish churches in order to raise the level of comfort of the churchgoers. In the late 1970s there were alarming reports of excessive damages to polychrome wooden art in these churches, which were thought to have been caused by heating. The work of Kulturhistoriska Byrån is analyzed in order to better understand how heating technology in churches developed and was applied, and how the office analyzed the situation at different points in time. The general development gradually went from issues of thermal comfort, fire safety and insulation to more attention being paid to damages caused by heating. Despite that heating systems were to be approved before they were installed, later use of these systems escaped central supervision, thus leaving the responsibility of preventing climate induced damages entirely to the individual parishes.

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