

A BUILDING FAÇADE SYSTEM

Field of the Invention

The present invention relates to building façades and systems related to the capture of
5 solar energy to avoid problems associated with energy management for buildings.

Background

Hot climate regions like Singapore, are characterized by high insolation. For a typical
modern high-rise building, 'heat gain' of the building from solar radiation is transmitted
10 mainly through the façade walls. The solar radiation falling onto a building's walls or
façade is either reflected back to its surroundings or absorbed as thermal energy. This
can cause the surface temperature of building façade walls to rise to around 20°C above
the ambient temperature.

It follows that the thermal loading results in high energy bills for air-conditioning. To
15 minimise thermal loading into a building from solar radiation, façade systems made of
double glazed glass, aluminium cladding, low-emissivity glass etc., are often specified
for a building project. Although these systems are more aesthetically pleasing than
conventional brick walls, they cost more.

On the other hand, the large amount of thermal energy stored in building façades presents
20 a potential opportunity for harnessing for utility. Using Building Integrated Photovoltaic
(BIPV) façade panels to harness solar energy for utility is a very promising option, but
complex and costly.

A basic type of passive solar wall is the Trombe wall (TW). The Trombe wall is an indirect-gain passive solar wall with its thermal storage between the windows and the living spaces, usually with ventilator openings near both the floor and ceiling. It can provide a heating effect with the solar heat input and condition the air from the room adjacent to the Trombe wall.

A PV-Trombe Wall (PV-TW) system comprises a PV glass panel, a blackened wall acting as a thermal absorber, an air duct in between and two air vents for winter heating and two air vents for summer cooling. Although good heating performance for room in winter could be achieved with a significant indoor temperature increase, cooling performance by natural ventilation is difficult to be satisfying.

Summary of the Invention

In a first aspect the invention provides a building façade system comprising: a building façade comprising a plurality of water storage tanks, each of said tanks in fluid communication with at least one other water storage tank; said facade mountable so as to be supported by a building exterior; wherein the building façade system is arranged to selectively receive and store a quantity of water in said tanks and drain said tanks on reaching threshold criteria.

In a second aspect the invention provides a method for operating a building façade system comprising the steps of: providing a plurality of water storage tanks, each of said tanks in fluid communication with at least one other water storage tank; mounting said tanks to a

building exterior so as to form a building façade; receiving, storing and draining a quantity of water to and from said tanks based upon threshold criteria.

In general, the invention is directed to a water storage façade system for buildings so as to achieve a reduction in heat penetration as well as provide heat storage capability, and thus
5 effectively act as a heat sink. The ability to drain and fill the water storage tanks allows the façade system to maintain the cooling effect on the building as well as provide a regular supply of heated water.

Advantages resulting from the present invention may include energy savings for air-conditioning in buildings by using water as thermal insulation medium in building
10 façades, and harnessing the thermal energy absorbed and stored by water to reduce heat penetration due to the sun's solar radiation falling onto building façade walls.

Further, it may achieve energy savings by circulating warm water generated within the façade for usage to reduce the energy consumption in the building such as for heating water.

15 Water as thermal mass is an ideal thermal storage and insulation medium. A "water wall" can be designed for harnessing the Sun's energy and cooling indoor space due to its high specific heat capacity at a low cost. For the same thermal mass, the weight of water is much lower than that of brick or concrete. Also water is more dynamic and can gain heat in winter or shed heat in summer faster due to internal convection and circulation
20 characteristics. Water also is more flexible than phase change storage because they work for cooling as well as heating, and don't have a critical working temperature. By replacing

some thermal storage mass (e.g., concrete blocks) with water, various water wall systems can be achieved.

The fluid communication may be achieved by an arrangement of pipes or other conduits.

Each of the water storage tanks may be connected by such conduits. Alternatively, the

5 tanks may be divided into series, so as to allow for selective infill and draining of water.

This may be particularly useful where certain parts of the façade are more exposed to the

sun, and so require more frequent replacement of cool water than other areas. Also, parts

of the façade may require a higher degree of cooling than other areas, such as for the

computer rooms, compared with office space, stairwells etc.

10 The façade may be intended to replace a conventional building façade, and so have mountings to the building exterior. These may be in the form of brackets fixed to the building to which the tanks are mounted, corbels formed within the concrete fascia of the building upon which the tanks are placed and frames fixed to the building, with the tanks fitting within the frame.

15 Alternatively, the invention may be part of a larger building façade, within the tanks mounted to convention building façade panels, which in turn are mounted to the building.

In order for the tanks to receive and infill flow of water and then drain said water, a

standard arrangement of valves and pipework may be used. Said valves may be manually

operated when an operator is signaled that the threshold criteria/criterion have/has been

20 met. Alternatively, a control system may automatically fill and drain the tanks based on a closed loop feedback from sensors. In a further alternative, operation of the infill and

draining of water may be performed by a combination of automatic operation, with a fail safe or manual override available to the operator.

The criteria/criterion may be any one or a combination of water temperature, insolation level, time of day, time of year, ambient temperature, building temperature.

- 5 For instance, when the temperature in the tanks reaches a specified temperature, this may trigger the draining and replacement of the water. This may be to provide a regular supply of heated water, as well as to ensure that the building façade acts as a heat sink for insolation, and possibly internally generated heat.

- This may also be for specific series of tanks within the overall building façade to
10 selectively replace the water. In either case, temperature sensors located within the tanks may be required, either to provide an average temperature throughout all the tanks, or to provide temperature readings in specific series of tanks for selective draining of tanks.

- As mentioned, certain portions of the building may receive differing levels of solar radiation. Accordingly, the insolation received by the entire façade, or portions of the
15 façade may act as a trigger to replace the water.

- Insolation levels will also vary by time of day and time of year, and so the overall criteria may be varied accordingly to reflect such variation from the standard criteria. Such criteria may also be affected on a non-predictable basis, such as during rain storms, or overcast conditions. As such, ambient temperature and building temperature may also be
20 used to vary from the standard protocol used to determine the draining criteria.

In one embodiment, given the higher movable mass associated with a water based building façade, under earthquake conditions, having a high movable mass may impart adverse resonance conditions. Accordingly, there may be a further criterion that water is drained from the façade, should a resonance condition be met during an earthquake.

- 5 Similarly, the water based façade may also act as a damper, and so assist in dampening a resonance condition. Accordingly, the draining of the façade may be disabled during an earthquake. In a further alternative, the façade system may be partially drained to achieve a desired natural frequency of the building.

- 10 To maximize the exposure of the tanks to the sun, the tanks may be, on a sun receiving face, planar. That is, the tanks may have depth and breadth dimensions in excess of the thickness of the tanks, with the depth and breadth being the dimensions exposed to the sun and the thickness relating to a dimension directed towards the building.

- 15 Given the circumstances of individual applications, the tanks may also be other shapes so as to fit the desired purpose or design/space constraints, whilst still falling within the scope of the present invention. The orientation of the tanks may also be used to maximize exposure to the sun. For instance said tanks may be inclined upwards. Alternatively, the cross-section of the tanks may be a non-uniform quadrilateral, having the sun receiving face inclined upwards with the other faces of the tanks being vertical or horizontal.

- 20 Further, the water storage tanks may be elongate and so spanning all of most of the width of a building. As a non-limiting example, the tanks may be 1000mm wide and 50 mm thick and so rectangular and positioned horizontally across the building. In a further

alternative, and to aid in drainage, the water storage tanks may be arranged in a plurality of series, with each series corresponding to a vertical column.

Further, the tanks may be smaller units connected in series so as to provide fluid communication between adjacent tanks. To this end, and by way of illustration only, the
5 tanks may be 1000 mm by 1000 mm by 50mm thick.

A further useful alternative is to use the water within the tanks for drinking purposes. To this end, the water storage tanks may be made of material suitable for potable water, such as stainless steel or HDPE.

The building facade system may further include a reservoir into which water from the
10 water storage tanks drain. Said reservoir may be arranged to extract heat from the heated water, such as providing heat transfer fins within the reservoir

The building facade system may also include a supply tank for supplying water to said water storage tanks. For instance, water may be pumped to the supply tank from a distal water supply. On draining the tanks, the supply tank may be used to quickly replace the
15 water in the tanks. To this end, it may be useful to have said supply tank located hydraulic above said water storage tanks, and so allow gravity flow to fill the tanks.

To aid in the heating of the water in the tanks, a glass panel may be located adjacent to a sun receiving face of said tank, to reduce thermal energy losses from said tanks.
20 Alternatively, a photovoltaic panel may be located adjacent to the sun receiving face of said tank.

Brief Description of Drawings

It will be convenient to further describe the present invention with respect to the

5 accompanying drawings that illustrate possible arrangements of the invention. Other arrangements of the invention are possible and consequently, the particularity of the accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

10 Figure 1 illustrates a cross-sectional view of a building façade system according to one embodiment of the present invention;

Figure 2 illustrates a cross-sectional view of a building façade system according to further embodiment of the present invention;

15 Figure 3 illustrates a cross-sectional view of a building façade system according to still further embodiment of the present invention;

Figures 4A and 4B illustrate cross-sectional views of a water storage tank for a building façade system according to one embodiment of the present invention;

Figures 5A and 5B illustrate cross-sectional views of water storage tank for a building façade system according to further embodiment of the present invention;

20 Figure 6A and 6B illustrate cross-sectional views of water storage tank for a building façade system according to one embodiment of the present invention;

Figure 7 illustrate cross-sectional view of a portion of a building façade system according to a further embodiment of the present invention;

Figure 8A, 8B and 8C illustrate cross-sectional views of water storage tank for a building façade system according to a further embodiment of the present invention;

Figure 9A and 9B illustrate cross-sectional views of water storage tank for a building façade system according to a further embodiment of the present invention;

5 Figure 10A, 10B and 10C illustrate cross-sectional views of water storage tank for a building façade system according to a further embodiment of the present invention;

Figure 11A and 11B illustrate cross-sectional views of water storage tank for a building façade system according to a further embodiment of the present invention, and;

Figure 12A and 12B illustrate cross-sectional views of water storage tank for a building
10 façade system according to a further embodiment of the present invention.

Detailed Description

Referring to Figures 1 through 3 there is shown three embodiments of a building façade system according to the present invention. These embodiments include centralised
15 warm water storage tank 16 system by forced circulation with pump 18, centralised warm water storage tank 16 system by natural circulation without pump and direct warm water supply system without centralised warm water storage tank 16. For each storey of building, the inlet pipe and the outlet pipe of water storage façade tank 15 are positioned at opposite ends to make flowing water heated up gradually along said water storage
20 façade tank 15. For example, the inlet pipe is positioned on the left of water storage façade tank 15 and the outlet pipe on the right.

According to the embodiments shown in Figure 1 and Figure 2, a centralised warm water tank 16 can be used to store the heat energy which is not immediately required, which can channel the water in the building façades to be stored for possible daily usages.

Figure 1 illustrates a cross-sectional view of a water circulation system with pumps
5 in said water storage façade system as an embodiment of the present invention.

In this embodiment of said water circulation system with a centralised warm water tank 16, pumps 18 are used to move water through said water circulation system with water pipes 17 and valves connections, from said cold water supply tank 14 to said water storage façade tank 15, then to said centralized warm water tank 16, finally to the point of
10 use.

Said cold water supply tank 14 for cold water supply is in an elevated level position such as the top of building. The cold water flows out of said cold water supply tank through pipes 17 into said water storage façade tanks 15 by pumps 18, or natural convection, or house pressure. As the cold water is flowing in said water storage façade
15 tank 15 on each storey from the one side to the other side of building, the sunshine strikes directly on said water storage façade tank structure 8. The absorbed thermal energy in said outer façade skin is transmitted to water adjacent to said outer façade skin by conduction, then water contained in said water storage façade tank 15 is heated up gradually by convection currents, so original cold flowing water become warm water
20 when it flow out of said water storage façade tank 15. The heated water passes pipes 17 and enters said centralised warm water tank 16, which can store the heat energy which is not immediately required. In the case of the centralised warm water tank 16 not being

located at an elevated position, a pump is used for the stored warm water to be driven out of said centralised warm water tank 16 for daily warm water usages of end-users 19 through valves and pipes 17.

Figure 2 illustrates a cross-sectional view of a more energy efficient water circulation system without pump in said water storage façade system as an embodiment of the present invention.

In this embodiment of said water circulation system with a centralised warm water tank 16, no pump is used to move water in said water circulation system. Said cold water supply tank for cold water supply is in an elevated level position such as the top of building. The cold water flows out of said cold water supply tank through water pipes 17 into said water storage façade tanks 15. As the cold water is flowing in, said water storage façade tank 15 which spans from one side to the other side of building, the sunshine strikes directly on a sun receiving face of the water storage tanks of the building façade system. The absorbed thermal energy in said outer façade skin is transmitted to water adjacent to said outer façade skin by conduction, then water 1 in said water storage façade tank 15 is heated up by convection currents, so original cold flowing water become warm water when it flow out of said water storage façade tank 15. The heated water passes pipes 17 and enters said centralised warm water tank 16, which can store the heat energy which is not immediately required. As there is no pump in said water circulation system, the installation position of said centralised warm tank has to be determined at a suitable height to ensure movement of warm water into said centralised warm tank and reach the point of warm water usage by natural convection or household water pressure. The

efficient solar energy absorption of said water storage façade tank 15 can be achieved by optimizing the water flow rate.

Figure 3 illustrates a cross-sectional view of a water circulation system with direct supply to end-users 19 in said water storage façade system as an embodiment of the
5 present invention.

In this embodiment, no pump is used to move water to flow through said water circulation system and no said centralised warm water tank 16 is needed to store the heat energy, which is not immediately required, for end-users 19 warm water usages. A circulation system with direct warm water supply from façade to the end-users 19 can
10 channel the water reach the point of use by natural convection or household water pressure. Said cold water supply tank for cold water supply is in an elevated level position such as the top of building. The cold water flows out of said cold water supply tank through pipes 17 into said water storage façade tanks 15 by pumps 18, or natural
convection, or house pressure. As the cold water is flowing in said water storage façade
15 tank 15 on each storey from the one side to the other side of building, the sunshine strikes directly on water storage façade tank structures, said outer façade skin with dark coating absorbs solar radiation. It will be appreciated that a dark coating on the façade skin for all the applicable embodiments and variants, falling within the invention, may provide a beneficial result.

20 The absorbed thermal energy in said outer façade skin is transmitted to water adjacent to said outer façade skin by conduction, then water 1 in said water storage façade tank 15 is heated up by convection currents, so original cold flowing water become warm

water when it flow out of said water storage façade tank 15. The heated water passes pipes 17 and directly reaches the point of end-users 19 for daily warm water usages. The optimized tank skin thickness and tank width are helpful to produce efficient solar energy absorption for said direct warm water supply system.

5 In the three embodiments of said water circulation system described above, water storage façade tanks 15 are used to reduce heat penetration into indoor rooms due to water as an ideal thermal insulation medium with high specific heat capacity. And the absorbed thermal energy can be taken away by using warm water due to the dynamic characteristic of water in order to further reduce heat penetration and reduce the required heat energy to
10 preheat or further heat up the warm water to the desired usage temperature. Therefore said water storage façade system not only minimises thermal loading into a building from solar radiation but also harness and utilise the abundant solar energy absorbed on building facade productively at a low cost.

15 The embodiments of said water storage façade tank structures 8 shown in Figure 4 through 7 will be described below.

Figure 4A illustrates a cross-sectional view of a water storage facade tank structure without thermal insulation layer 4 as simplest embodiment of the present invention. Figure 4B illustrates a cross-sectional view of a water storage facade tank structure as another embodiment of the present invention. A specific thermal insulation layer 4 is
20 positioned behind back surface 21 of said water storage façade tank 15 to minimise heat penetration into the interior of the building.

Figure 5A illustrates a cross-sectional view of a water storage facade tank structure with a transparent covering layer 5 separated from water storage tank by air gap 6. Said transparent covering layer 5 is exposed to the outer environment, as the outer façade skin, made of transparent materials such as glass. Sunlight strikes directly on said transparent covering layer 5 and penetrates through said transparent covering layer 5 on front wall 2 of said water storage façade tank 15. Said transparent covering layer 5 covers the said water storage façade and is separated by an air gap 6 from the water storage façade tank 15 in order to reduce heat losses for higher energy efficiency. The wall of said water storage façade tank 15 can be colored to enhance the absorption of sunlight for effective heating the water and the aesthetic appearance. Figure 5B illustrates a cross-sectional view of a water storage facade tank structure with a thermal insulation layer 4 based on Figure 5A

Figure 6A illustrates a cross-sectional view of a water storage facade tank structure with photovoltaic components attached to front surface 20 of said water storage façade tank 15. PV panels 7 can be cooled by running water in said water storage tank behind the back surface of PV panels 7. When a part of the solar radiation fallen on the PV panels 7 is directly converted to useful thermal and electric power. PV components achieve higher electrical energy conversion efficiency in lower operating temperature due to transmitting thermal energy to water. And water 1 in said water storage façade tank 15 achieves more thermal energy due to operating PV components. Figure 6B illustrates a cross-sectional view of a water storage facade tank structure with a thermal insulation layer 4 based on Figure 6A.

Figure 7 shows a modular arrangement 31 of the water storage tanks 33 according to a further embodiment. The building façade system may orient the water storage tanks on a “per storey” basis, having a horizontal arrangement of the tanks, as shown in Figures 1 to 3. Alternatively, as shown in Figure 7 a modular arrangement 31 may be used, whereby
5 water supply enters 32 at one end, and follows a vertical and horizontal path, with individual tanks 33 variously connected 34 to form a non-linear path within the same storey. Such an arrangement may be useful to accommodate a non-uniform design of the building, perhaps for sloping ground or voids within the structure etc., and so it is necessary to accommodate a non-linear storey. Such a modular arrangement 31 can then
10 be used and still fall within the scope of the present invention.

In the embodiments of the invention integrated into houses or buildings as a portion of buildings, said water storage façade tank structures 8 can be attached to existing wall 13 or be used as structured water storage facades for new houses or buildings. The integrated schemes will now be described with reference to Figure 8 and Figure 9.

15 Figure 8 and Figure 9 illustrate cross-sectional views of water storage façade tank structures (underneath passive window 9) integrated into houses as embodiments of the present invention;

In this kind of embodiment, the water storage façade tank 15 is under the passive window 9. And the top part of said water storage façade tank 15 is insulated with a
20 thermal insulation layer 10 between window frame and said water storage façade tank 15 interface to prevent heat transfer. The height of said water storage façade tank 15 is the distance from the ground to the window lower frame.

Figure 8 shows three embodiments of a structured water storage façade. According to the embodiment shown in Figure 8A, said water storage façade tank structures 8 in Figure 4 through 7 are used directly as building wall by being supported with load-bearing structures such as columns. According to the embodiment shown in Figure 8B, said water storage façade tank structures 8 in Figures 4 through 7 are integrated into building by covering back surface 21 of said water storage façade tank structures 8 with construction panels 11 such as Vacuum Insulation Panel (VIP) layer, gypsum board and so on exposed to indoor air. According to the embodiment shown in Figure 8C, said water storage façade tank structures 8 in Figure 4 through 7 is separated from construction panels 11 by an air gap 12 based on the embodiment shown in Figure 8B.

Figure 9 shows two embodiments of a water storage tank structure attached to existing building outer walls. Said water storage façade tank structures 8 in Figure 4 through 7 are attached to civil structures such as concrete wall, brick wall and so on without air gap 12 in Figure 9A and with air gap 12 in Figure 9B. Some construction panels 11 can be positioned adjacent to civil structures.

Figure 10 and Figure 11 illustrate cross-sectional views of panel water tank wall structures without passive window 9 as embodiments of the present invention;

In the embodiments, water storage façade tank structures 8 become a panel water tank wall without passive window 9 in full height from the ground to the roof of indoor room. The components of panel water tank wall structures are arranged in the same order as Figure 8 and Figure 9 in horizontal direction.

Figures 12A and B illustrate cross-sectional views of heat transfer mechanism of water storage façade tank 26, 29 as the simplest embodiments of the present invention;

In the embodiment shown in Figure 12A, front wall 28 of said water storage façade tank 26, made of suitable material such as metals, opaque, is exposed to the outer
5 environment, the sunlight 25 strikes directly on front wall 28 of said water storage façade tank 26. Front wall 28 of said water storage façade tank 26 absorbs solar radiation and the absorbed thermal energy in front wall 28 of said water storage façade tank 26 is transmitted to water in said water storage façade tank 26 by conduction and elevates water temperature. In said water storage façade tank 26, the water with higher
10 temperature moves upward due to lighter weight and the water with lower temperature moves downward due to heavier weight. Water in said water storage façade tank 26 is heated up by convection currents. The heat stored in water can be taken away when water flows in said water storage façade tank 26 from one side to the other side of building façade for daily usage.

15 Back surface 27 of said water storage façade tank 26 receives heat from warm water through back wall 27 of said water storage façade tank 26 by conduction. The heat transfer from back surface 27 of said water storage façade tank 26 to indoor room must be minimized in order for absorption efficiency of said water storage façade tank 26, which can be achieved by optimizing the water flow rate for said water circulation system
20 without pump, and by optimizing the skin thickness and width of said water storage tank for said direct supply water circulation system. In addition, said specific thermal insulation layer and air gap are helpful for preventing heat penetration into the interior of the building.

In the embodiment shown in Figure 12B, front wall 30 of said water storage façade tank 29, made of transparent materials such as glasses, one portion of absorbed thermal energy in front wall 30 of said water storage façade tank 29 is transmitted to water in said water storage façade tank 29 by conduction and the other portion of absorbed thermal energy in
5 front wall 30 of said water storage façade tank 29 is transmitted to water in said water storage façade tank 29 by radiation.

In order to minimize heat transfer from water storage façade tank to indoor room, draining water storage façade tank and supplying it with cold water from cold water
10 supply tank located at the top of buildings is adopted in this invention, which is easier and cheaper to implement compared with existing complex methods. So the advantage of cooling down water storage façade tank is especially apparent. Alternatively, the water supply may be provided from the mains water supply.

15 Said water storage façade tank system is characterized by applicability for retrofitting and architectural adaptability. It may be retrofitted or installed into presently existing walls without making major structural changes to the building. Its implementation is limited to the outer shell of the house with the water tanks attached to. The influence of retrofitting on the normal life of residences in the rooms and existing walls is very small.
20 It also can be used as structured water facades for new houses or buildings with minor structural changes to the building.

Said water storage façade tank system can be integrated into the present water systems for possible daily usage in homes or buildings without disrupting them through a

circulation system. Besides drinking, water is widely used for daily activities like washing, laundry etc.

As an energy saving water wall system, it may reduce solar radiation penetrating, as well as allow harvesting and utilization of solar energy by using water as a thermal insulation medium and thermal storage mass, not only for low-rise but also for high-rise buildings. The water pressure in water storage façade tanks may be controlled with pressure and flow valves to meet design requirements of system and usage requirements of end-users.

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This kind of water façade may be used as the multi-functional facades of residential, commercial and other types of buildings or houses both for existing and new ones.

It may also be used as water tank roof with the similar multi-functions after making some structural changes based on the water façade mentioned above.

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CLAIMS:

1. A building façade system comprising
a building façade comprising a plurality of water storage tanks, each of said tanks
5 in fluid communication with at least one other water storage tank;
said facade mountable so as to be supported by a building exterior;
wherein the building façade system is arranged to selectively receive and store a
quantity of water in said tanks and drain said tanks on reaching threshold criteria.
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2. The building façade system according to claim 1, wherein said criteria includes
any one or a combination of: water temperature, insolation level, time of day, time
of year, ambient temperature, building temperature.
- 15 3. The building façade system according to claim 1 or 2, wherein the water storage
tanks are planar.
4. The building façade system according to any one of claims 1 to 3, wherein the
water storage tanks are elongate, rectangular in cross-section and positioned
20 horizontally across the building.
5. The building façade system according to any one of claims 1 to 4, wherein water
storage tanks are made of material suitable for potable water.

6. The building façade system according to any one of claims 1 to 5, wherein each water storage tank corresponds to a floor of said building.
7. The building façade system according to any one of claims 1 to 5, wherein the
5 water storage tanks are arranged in a plurality of series, with each series corresponding to a floor of said building.
8. The building façade system according to any one of claims 1 to 5, wherein the
10 water storage tanks are arranged in a plurality of series, with each series corresponding to a vertical column.
9. The building façade system according to any one of claims 1 to 8, further including a reservoir into which water from the water storage tanks drain.
- 15 10. The building façade system according to any one of claims 1 to 9, further including a supply tank for supplying water to said water storage tanks.
11. The building façade system according to claim 10, wherein said supply tank is located hydraulic above said water storage tanks.
- 20 12. The building façade system according to any one of claims 1 to 11, wherein each water storage tank includes a glass panel located adjacent to a sun receiving face of said tank.

13. The building façade system according to any one of claims 1 to 12, wherein at least one water storage tank includes a photovoltaic panel located adjacent to a sun receiving face of said tank.

5 14. The building façade system according to claim 12, wherein said glass panel is separated from the tank so as to provide an air gap.

15. The building façade system according to any one of claims 1 to 14, wherein the water storage tanks are insulated from the building exterior.

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16. The building façade system according to claim 15, wherein the insulation is provided by an air gap or an insulation layer.

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