

Green Building Policy Proposal

Final Proposal from the Green Roofs Review Task Force

June 15th, 2018

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Overview

The Green Roof Review Task Force mission was to recommend modifications, clarifications, and improvements to the Green Roof Initiative through a collaborative, consensus-based process that honored the vote and the benefits that the ordinance would have achieved. The [Green Roofs Review Task Force](#) met nine times from January 19, 2018 through June 7, 2018. Members reached consensus in their final meeting on a proposal they believe takes the ordinance in the right direction for Denver. The recommendations do not reflect any one members' ideal policy; however, all agree the proposal is a compromise that all can accept because it strengthens the existing ordinance while improving flexibility, allowing each owner of an existing large building and each new builder to find the most cost-effective ways to achieve the benefits of the existing ordinance.

Options Today:	Options in Task Force Proposal:
<p>Green Roof Green Roof – Solar Combination Solar Panels on the Roof</p> <p>Pro’s:</p> <ul style="list-style-type: none"> • Urban Heat Island Reductions • Green Experience Improvements. • Water and Storm Water Management Benefits • Greenhouse Gas Emission Reductions <p>Con’s:</p> <ul style="list-style-type: none"> • Expensive • Prescriptive • Many existing buildings can’t structurally support a green roof and would, at a minimum have to pay for a structural engineering study to qualify for an exemption from that portion of the requirement. • Delays in roof replacement and in new construction projects. 	<p>Green Roof Green Space on the Ground or on Terraces Financial Contribution for Off-site Green Green Roof – Solar Combination Renewable Energy anywhere on-site Community Solar Energy Efficiency Cool Roofs – now required on all buildings</p> <p>Pro’s:</p> <ul style="list-style-type: none"> • Urban Heat Island Reductions: Greater benefit from cool roofs on all buildings instead of black roofs partially covered in green. • Green Experience Improvements: Up to 3.5 million more square feet of green space by 2050 and better accessibility since green spaces can be placed in more accessible locations, not only roofs. • Water and Storm Water Management Benefits: Improved outcomes through on the ground spaces. • Greenhouse Gas Emission Reductions: Equivalent to the solar that was required, but with more flexibility. • Flexibility. Multiple options to allow each building to choose what works best for them. • Lower cost. All compliance costs cut at least 20%, and many buildings will see only a small fraction of the original cost. New construction should see less than a 1% cost increase, and in many cases far less. Many options have a return on the investment. <p>Con’s:</p> <ul style="list-style-type: none"> • Complicated. With flexibility comes a more complicated proposal.

Current Requirement - Ordinance as on the Ballot

As a frame of reference by which to understand the task force proposal we summarize very briefly here what the current requirement is, i.e. what the ordinance is that was on the ballot November 7th, 2017. The following is a very brief summary. For all the details on the current requirement go to www.denvergov.org/greenroofs

New Buildings Current Requirement

Pick one of the following 3 options:

Compliance Options	Metric
Green roof	Green roof covering 10-60% of the roof, depending on building type and size. (See chart below)
Green and rooftop solar	Green area equivalent to at least 30% of the required area; AND onsite solar equivalent to up to 70% of required area
Rooftop solar	On-site solar covering 100% of roof area. (or 80% coverage in Industrial buildings)

Existing Buildings Current Requirement

Install a combination of a green roof and rooftop solar at the time of roof replacement.

Compliance Option	Metric
Green and rooftop solar	Green area equivalent to at least 30% of the required area; AND onsite solar equivalent to up to 70% of required area

Current Coverage Requirement

The following chart shows what required coverage is under the current requirement. These coverage requirements were disproportionately burdensome to large single story buildings. They also make the green roof solar combination options above confusing to understand since we are talking about a percent of a percent, for example 30% green roof and 70% solar over 20-60% of the coverage required, as applicable.

Size of Building (Gross Floor Area)	Required Area. Percent of Roof Space Required to be Covered under Ordinance that was on the ballot.
25,000 – 49,000 sq ft	20%
50,000 - 99,000 sq ft	30%
100,000 - 149,999 sq ft	40%
150,000 – 199,999 sq ft	50%
200,000 sq ft or greater	60%
New Industrial Building	10%

New Coverage Requirement Proposal

The task force proposes modifying the coverage requirements as follows. Any projects already under development following the old coverage requirements would be allowed to utilize those instead if they wish.

New Buildings Coverage

The new proposed amount of coverage required on a site will be 10% of the roof area times the number of floors (or Roof Area Ratio, RAR), up to a maximum required coverage of 60%. This formula will increase total coverage city-wide by an estimated 14.5% if every new building selected the green roof option in this proposal. This would result in an estimated additional 3.5 million square feet of green space, by 2050 while more equitably distributing coverage across buildings. The goal is to be simpler and more equitable.

New Proposed Coverage Requirement:

Number of Stories	Percent of Roof Space Required to be Covered under New Proposal
1 story	10%
2 stories	20%
3 stories	30%
4 stories	40%
5 stories	50%
6 stories and higher	60%

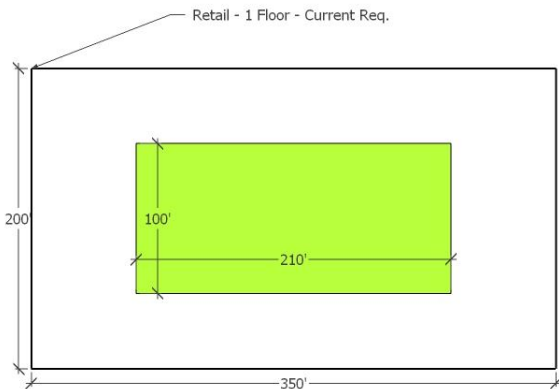
The following is an example of how this calculation would work for an 80,000 square foot building, with 2 floors, and an across the board percentage of 10%:

$$\text{Building Area/Roof Area (RAR)} = 80,000\text{sf}/40,000\text{sf} = 2$$

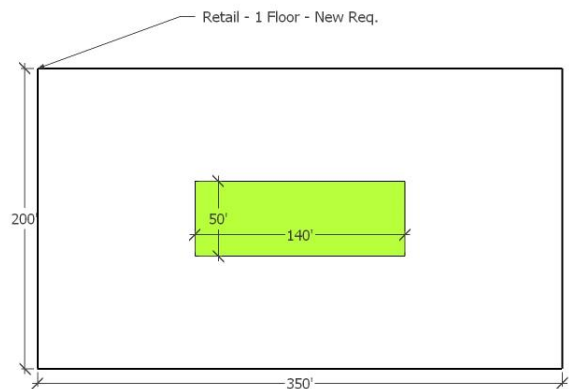
$$10\% \text{ (Across the Board Percentage)} \times 2 \text{ (RAR)} = 20\% \text{ of Roof}$$

$$40,000 \text{ sf Available Roof} \times 20\% = 8,000\text{sf Required Coverage}$$

The following image shows how the coverage requirement under the new proposal compares to the ordinance requirement for a new 70,000 sq ft single story retail building.

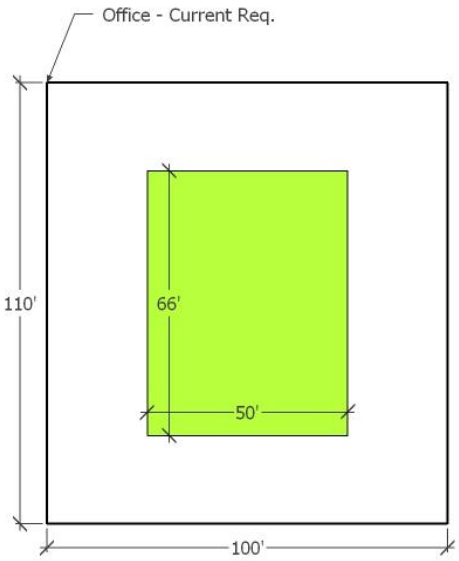


Existing Requirement

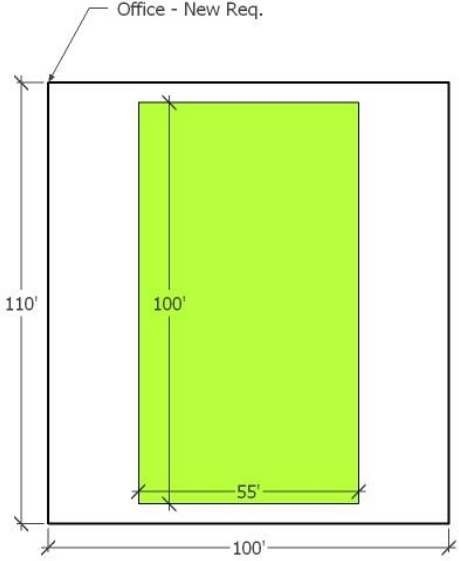


Proposed Requirement

The following image shows how the coverage requirement under the new proposal compares to the ordinance requirement for a new 55,000 five story office building.



Existing Requirement



Proposed Requirement

New Building Proposal

Summary

All new buildings above 25,000 sq ft, with the exception of single family homes, will have a cool roof unless the roof is a character defining architectural feature, regardless of roof angle. See the cool roof definition section at the end of this proposal for details. The proposal does not include major renovations unless they include a roof replacement, in which case they would be covered under the existing building section. If a new building that complies with the requirements for a new building, later has to do a roof replacement, they only have to put back up what was there originally.

All new buildings above 25,000 sq ft, with the exception of single family homes, will also pick one of the eight options shown here.

	Compliance Option (Select One)	Location	Metric
Green	Green roof/green space only	Roof, terraces, podiums, green walls, or grade-level	Green area equivalent to 10% of roof area x no. of floors (max 60% of roof area required)
	Financial contribution for off-site green	Offsite	The task force prefers a rate of \$25/sf contribution for required green area (10% of roof area x no. of floors, max 60% of roof area) (Actual costs to be determined through a rate study.)
Green + Energy	Green and solar	Roof, terraces, podiums, grade-level, green walls, off-site	Green area equivalent to 3% of roof area x no. of floors (max 18% of roof area required); AND on-site solar (or other renewable energy) total system production equivalent to solar over 7% of roof area x no. of floors (max 42% of roof area required)
	Green and energy efficiency	Roof, terraces, podiums, grade-level, off-site (green); building (efficiency)	Green area equivalent to 3% of roof area x no. of floors (max 18% of roof area required) AND minimum 5% estimated energy cost savings above current City of Denver energy code at the time of permitting
Energy	Solar	Roof, building, site, community	On-site solar (or other renewable energy) for a total system production equivalent to solar panels covering 70% of roof area
	Energy efficiency	Building	Minimum 12% estimated energy cost savings above current City of Denver energy code at the time of permitting.
Certification	Certification	Building	Minimum equivalent to LEED Gold level certification
	Enterprise Green Communities certification	Building	Minimum certification

Details

Green Only

Modifications to increase benefits, add flexibility and reduce cost: The new proposed coverage requirement will increase total coverage city-wide by an estimated 14.5%, or 3.5 million square feet, if every new building selected this option. Green space could be on the roof, terrace, podium, or ground anywhere onsite. Or, the building could make a financial contribution towards off-site green.

Details on 'Green Roof/Green Space':

The new proposed amount of green roof/green space required on a site will be 10% of the roof area times the number of stories in the building (or RAR), up to a maximum required coverage of 60%. The green space will be included in the site plan. The site plan may be amended to remove the green space in the future as needed by making an equivalent financial contribution for off-site green space, or replacing the existing green space with adjacent green space on the current site.

Green roof /green space must be above-and-beyond the storm water required areas and above-and-beyond any green space currently required in zoning setback areas or open space. The green space will be included in the site plan.

The following are allowable strategies that could be implemented anywhere on the site to meet the Green roof/green space requirements:

- Green roof, including roofs at-grade
- Trees
- Green walls and hedges
- Groundcover and shrubs
- Ground-level food production
- Financial contribution for off-site green space at a recommended rate of \$25/sq ft. (Actual costs to be determined through a rate study.)

Green and Solar (OR) Green and Energy Efficiency

Modifications to increase benefits, add flexibility and reduce cost: Similar to the all green option above, the new proposed coverage requirement will increase total coverage city-wide under this option. The green space could be on the roof, terrace, podium, or ground anywhere on-site, or a financial contribution could be made towards off-site green. The solar energy part could be another equivalent renewable energy technology or some efficiency upgrades above code. The 70%/30% split between solar and green will remain. A higher portion green would be allowed if someone wanted to comply with, for example, 70% green and 30% solar. If so, the division of the 10% across the board percentage would adjust accordingly below.

Details on 'Green' in this option:

The amount of green space required on a site will be 3% of the roof area times the number of stories in the building, up to a maximum required coverage of 18%. The same strategies will be allowable as summarized in the green space section above. The green space will be included in the site plan. The site plan may be amended to remove the green space in the future as needed by making an equivalent financial contribution for off-site green space, or replacing the existing green space with adjacent green space on the current site.

Green roof /green space must be above-and-beyond the storm water required areas and above-and-beyond any green space currently required in zoning setback areas or open space. The green space will be included in the site plan.

PV over a green roof can add benefit to both systems, therefore the overlapping area is allowed to count twice,

Details for ‘Solar OR Energy Efficiency’ in this option:

- On-site solar total system area equivalent to 7% of roof area x no. of floors (max 42% of roof area required) Or, such lesser space as required to meet 100% of average estimated electricity used at the location. Solar panels must have a minimum efficiency of 16%. The minimum efficiency should be recommended to be updated by the Technical Advisory Group as the technology gets better over time
- Other on-site renewable options with similar generation capacity. Or other energy technologies that achieve equal to or greater additional, new greenhouse gas emission reductions.
- Community solar or Xcel Renewable*Connect in one of two ways.
 - With equivalent energy production to the on-site solar option and a minimum 2.5% estimated energy cost savings from energy efficiency above current City of Denver energy code.
 - With energy production equal to an estimated 100% of electricity the building will use. 10-year contract required. Contract renewal or equivalent other action will be required every 10 years, such that this option is equivalent to putting solar panels on the roof. Ongoing compliance will be verified through the existing building Energy Program.
- Minimum estimated 5% energy cost savings from energy efficiency above current City of Denver energy code
- Other equivalent certifications/programs may be added by CPD in the future (Denver Stretch Code)

Solar or Energy Efficiency

Modifications to increase benefits, add flexibility and reduce cost: Equivalent greenhouse gas emission reductions would be achieved. Solar or other renewable energy could be placed anywhere on-site, not only on rooftops. Community solar could be purchased. The building could achieve similar greenhouse gas emission reductions with deep energy efficiency above code.

Details:

The following are strategies that a building owner could implement to meet the ‘Solar or Energy Efficiency’ Option:

- On-site solar total system area equivalent to 70% of roof area. Or, such lesser space as required to meet 100% of estimated average electricity used at the location. Solar panels must have a minimum efficiency of 16%. The minimum efficiency should be updated by the Technical Advisory Group as the technology gets better over time. The task force recommends the City look into a tax rebate for the personal property tax solar pays when installed on commercial property if that solar is being used to comply with the green roofs ordinance. The City shall look into this option starting in late 2018 with the goal of making a decision that could be reflected in the 2019 budget.
- Other on-site renewable options with similar generation capacity.
- Community solar or Xcel Renewable*Connect in one of two ways.
 - With equivalent energy production to the on-site solar option and a minimum 6% estimated energy cost savings from energy efficiency above current City of Denver energy code.
 - With energy production equal to an estimated 100% of electricity the building will use.

10-year contract required. Contract renewal or equivalent other action will be required every 10 years, such that this option is equivalent to putting solar panels on the roof. Ongoing compliance will be verified through the existing building Energy Program. Off-site solar must be located in Public Service Company of Colorado territory.

- Minimum 12% estimated energy cost savings above current City of Denver energy code

Green Building Certification

Modifications to increase benefits, add flexibility and reduce cost: The building could meet LEED Gold, Enterprise Green Communities or other equivalent certifications/programs. Other equivalent programs may be added by the City in the future such as a Denver Stretch Code.

Details: For buildings pursuing compliance via LEED certification, the LEED design package must be submitted at the time of permitting the building to pursue this option. To get the certificate of occupancy, the building must be pre-certified or submit the LEED design review with a plan for how any requested changes will be made. Proof of green certification would need to be submitted 18 months after the certificate of occupancy is given. After 18 months there would be a 6-month grace period. If the LEED certification isn't submitted a citation will be issued equivalent to the financial contribution for off-site green that could have been paid for the 'green' compliance option initially. (\$25 / sq. ft. x 10% x number of floors (to a maximum of 60%) (Actual costs to be determined through a rate study).) Equivalent parameters would apply to Enterprise Green Communities certification. Other equivalent certifications/programs may be added by CPD in the future.

Additions

Any addition that adds new space 50,000 sq ft or larger shall comply with the new building provisions listed here in the new space being added.

Any addition that adds new space 25,000-50,000 sq ft shall comply with the level of effort required of existing buildings in the new space being added. They would pick one option summarized here:

- Green roof/green space/off-site green: 2% of roof space x number of floors up to maximum coverage of 18%
- Solar panels covering 5% of the roof x the number of floors up to a maximum coverage of 42%
- 4% estimated energy cost savings from energy efficiency above current City of Denver energy code at the time of permitting.
- Minimum LEED Silver or Enterprise Green Communities or equivalent certification.

Small additions are proposed to have an easier pathway than other new buildings since they often face challenges of tying into existing HVAC systems and existing grid connection points, giving them somewhat less flexibility in options available to comply.

Exemptions

- Residential buildings five stories or fewer, or less than 62.5 feet and less than 25,000 would only need to comply with the cool roof portion of the requirements.
- Parking areas, temporary structures, air supported structures, and greenhouses.
- If Available Roof Space is less than the coverage required for any strategy above then the building may comply with the lesser of the two values – ie a building is only required to comply on roof space that is available. Available Roof Space means the total roof area of a building or building addition excluding:
 - Private terraces no greater in area than the floor of the abutting residential unit at the roof level;

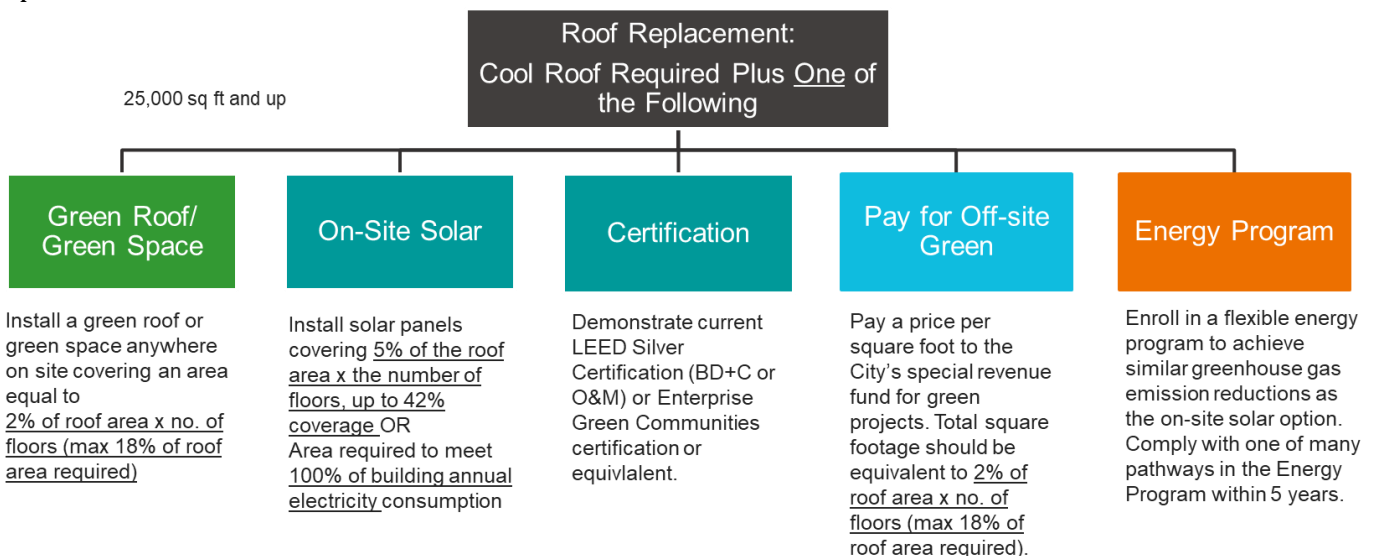
- In the case of a residential building or a building addition to a residential building, the outdoor amenity space;
- In the case of a non-residential building or a building addition to a non-residential building, the amount of area that is intended for recreational or social use by the occupants of the building;
- Areas where there exists rooftop mechanical, electrical or other equipment, including cell towers or other equipment leasing space on the roof, and the code required clearance area;
- Areas covered by skylights
- Areas consisting of a glass covered atrium; and
- Areas covered with glazing (windows).
- Areas designated for renewable energy devices.
- No cool roof required if the roof is a character defining architectural feature. See the definition in the cool roof section below.

Existing Building Proposal

Summary

Under the current requirement existing buildings over 25,000 sq ft have to do a green roof solar combination. Given that many existing buildings are unable to support the load of the green roof, the task force decided to give building owners the option to choose to install either the green roof or the solar (not both) at time of roof replacement. They also provided some other options with similar benefits for a building to pick from at the time of roof replacement. These options are illustrated and discussed below.

Any building with multiple roof structures or a building replacing only part of a roof would only have to comply for that portion of the roof that is being replaced. Any building that previously complied with this law as a new building when it was constructed would not need to comply again at the time of roof replacement.



Details

Green Roof/Green Space

The new proposed amount of green roof/green space required on a site will be 2% of the roof area times the number of stories in the building (or RAR), up to a maximum required coverage of 18%. For any existing building providing on-the ground green space, a site development plan will be required. This site development plan must show that the required parking is not being lost, and document the location of any new on-the ground green space. This new green space must exist outside required setback areas, and be new green space that was not previously provided. The site plan may be amended to remove the green space in the future as needed by making an equivalent financial contribution for off-site green space, or replacing the existing green space with adjacent green space on the current site.

The following are allowable strategies that could be implemented anywhere on the site to meet the Green roof/green space requirements:

- Green roof, including roofs at-grade
- Trees
- Green walls and hedges
- Groundcover and shrubs
- Ground-level food production

On-Site Solar

On-site solar energy covering 5% of the roof area x the number of floors, up to 42% coverage, or such lesser space as required to meet 100% of the average electricity used at the location. Solar panels must have a minimum efficiency of 16%. The minimum efficiency should be updated by the Technical Advisory Group as the technology gets better over time. The task force recommends the City look into a tax rebate for the personal property tax solar pays when installed on commercial property if that solar is being used to comply with the green roofs ordinance. The City shall look into this option starting in late 2018 with the goal of making a decision that could be reflected in the 2019 budget.

Certification

Demonstrate current LEED Silver Certification (BD+C or O&M) or Enterprise Green Communities certification or equivalent other certification approved by Community Planning and Development.

Pay for Off-Site Green

Pay a price per square foot to the City's special revenue fund for green projects. Total square footage should be equivalent to 2% of roof area x no. of floors (max 18% of roof area required). The task force prefers a rate of \$17/sf contribution for required green area on existing buildings.

Energy Program

When buildings enroll in the Energy Program they will then have 5 years to comply via one of the options listed below. The Energy Program is designed to achieve similar cumulative emission reductions as the solar energy required at time of roof replacement on the ballot. Credit will be given for energy actions taken as far back as 2013 until 2023, after which time credit will always be given for energy actions taken as far back as 2018. Compliance options that rely on operational efficiency will be reviewed on an appropriate timeline to ensure ongoing savings equivalent to the timeline of putting solar panels on the roof.

The following are strategies that a building owner could implement in the Energy Program. The building owner could pick any one of these strategies.

- ENERGY STAR score of 85 or higher.
- LEED Silver Certification BD+C or O&M current certification or equivalent
- Enterprise Green Communities certification.
- Net Zero building
- Install on-site solar energy covering 5% of the roof area x the number of floors, up to 42% coverage, or such lesser space as required to meet 100% of average estimated electricity used at the location. Solar panels must have a minimum efficiency of 16%. The minimum efficiency should be recommended to be updated by the Technical Advisory Group as the technology gets better over time. Other on-site energy technologies that achieve equal to or greater additional, new greenhouse gas emission reductions are also allowed in the energy program.
- Off-site solar equivalent to 100% of electricity used in a building with a minimum of a 10-year contract. Contract renewal or equivalent other action will be required every 10 years, such that this option is equivalent to putting solar panels on the roof. Off-site solar must be located in Public Service Company of Colorado territory.
- 25,000-50,000 sq ft buildings could alternately pick one of the following options:
 - EUI 10% below baseline from 2017
 - 10% total estimated energy savings from any improvements to the building. Examples of improvements include:
 - Retrocommissioning
 - Lighting upgrades to LEDs
 - Mechanical system upgrades
 - Electric vehicle charging stations, would be credited with how far they move a building towards the 15% goal.
 - Off-site solar equivalent to 10% of energy used in the building with a minimum 10-year contract. Plus, a 5% reduction in EUI below the baseline from 2017, or 5% total estimated energy savings from any improvements to the building.
- 50,000+ buildings could alternately pick one of the following options:
 - EUI 15% below baseline from 2017
 - 15% total estimated energy savings from any improvements to the building. Examples of improvements include:
 - Retrocommissioning
 - Lighting upgrades to LEDs
 - Mechanical system upgrades
 - Electric vehicle charging stations, would be credited with how far they move a building towards the 15% goal.
 - Off-site solar equivalent to 15% of energy used in the building with a minimum 10-year contract). Plus, a 7.5% reduction in EUI below the baseline from 2017, or 7.5% total estimated energy savings from any improvements to the building.
- Affordable Housing would have the option to comply with the Energy Program with only a Retrocommissioning study and implementation of the no-cost recommendations in that study with no particular savings requirement.

Exemptions that Apply to the Roof Replacement Requirements

- Residential buildings five stories or fewer, or less than 62.5 feet, would only need to comply with the cool roof portion of the requirements if they are over 25,000 sq ft.
- Only a cool roof would be required under the following circumstances
 - A roof that must be replaced due to an emergency such as fire or wind.

- A roof that must be replaced due to hail, in the first year after the ordinance passes when the building owner can demonstrate a gap in insurance coverage. A gap would exist where the building has coverage that includes the cost of meeting any new code requirements, but had a cost limit on that coverage that is insufficient to meet the additional costs of this ordinance, and the policy has not yet come up for renewal, so the building owner has not yet had an opportunity to increase coverage.
- If Available Roof Space is less than the coverage required for any strategy above then the building may comply with the lesser of the two values – ie a building is only required to comply on roof space that is available. Available Roof Space means the total roof area of a building or building addition excluding:
 - Private terraces no greater in area than the floor of the abutting residential unit at the roof level;
 - In the case of a residential building or a building addition to a residential building, the outdoor amenity space;
 - In the case of a non-residential building or a building addition to a non-residential building, the amount of area that is intended for recreational or social use by the occupants of the building;
 - Areas where there exists rooftop mechanical, electrical or other equipment, including cell towers or other equipment leasing space on the roof, and the code required clearance area;
 - Areas covered by skylights
 - Areas consisting of a glass covered atrium; and
 - Areas covered with glazing (windows).
 - Areas designated for renewable energy devices.
- No cool roof would be required if the roof is a character defining architectural feature. See that definition in the cool roof section below.

Campuses

Campuses should have the option to comply at the campus level rather than building by building. The definition of a campus is one or multiple owners of contiguous property that consists of at least 10 acres (*10 acres is our current general development plan GDP threshold, but that may be revised down to 5 acres soon, this will remain consistent with the current GDP threshold*).

To do so, they would need to select any one of the new building or existing building compliance pathways and achieve equal amounts of additional green space or emission reductions to what would have been required across the whole campus. New campuses would select one of the new building options. Campuses of existing buildings would select one of the existing building options. A campus with a mix of existing buildings and plans for new buildings could select a combination of new building options for their new buildings and existing building options for their existing buildings.

Campuses will need to document compliance with the green roof initiative in the following ways.

1. If selecting an option that includes a green roof or green space then the campus would have to demonstrate campus wide provision of additional at-grade green spaces beyond what is required on that campus to meet revised green roof requirements. (Current requirements are 10% green space on a campus doing a GDP. The amount must also be in excess of water quality requirements for site.)
 - a. To meet the green roof initiative requirement of providing additional at-grade green space, a campus could include in their open space plan in an IMP/GDP/site development plan/similar effort, a document of this additional at-grade green space that is beyond any code requirement for open space.

- b. A development agreement or similar tool would be required to document when this additional green space will be required to be provided.
 - c. This would allow owners to move ahead with permitting new buildings and permitting roof replacement on existing buildings without providing other elements of green roof compliance.
 - d. At time of permitting individual new buildings, the open space committed to on that portion of the campus will need to be shown and permitted with the site development plan for the applicable building.
2. If selecting a compliance option that includes an energy component then a campus would need submit a campus wide energy plan documenting such things as on-site renewables (location and amount of generation), energy efficiency measures, and what building systems will be required as a result. The energy master plan could be submitted during an infrastructure master plan/general development plan or similar effort, at a time of their choosing, for existing buildings,
- a. DDPHE staff would review this component of the IMP/GDP/similar effort to determine if it will comply with the modified green roof initiative
 - b. A development agreement or similar tool would have to be entered into between the developer and city to document requirements for when this energy system would come online such that individual buildings or roof replacements could be permitted without otherwise showing compliance with the green roof initiative.
 - c. An energy plan could be submitted following IMP approval but prior to any building permitting, and could be treated as an amendment to that document

Cool Roof Definition

A cool roof would need to use roofing materials that have a Solar Reflectance Index (SRI) or Solar Reflectance (SR) equal to or greater than at least one of the values in the table shown here. This is modeled on the IECC, LEED V4, and the ENERGY STAR program requirements and shall be updated over time as those standards are updated.

	Slope	Initial SRI	3-year aged SRI	Initial SR	3-year aged SR
Low-Sloped Roof	< 2:12	82	64	0.65	0.50
Steep-sloped roof	>2:12	39	32	0.25	0.15

The following roofs will be allowed in addition to the requirements above:

- Ballasted roofs with light color rocks.
- Metal roofs with a Solar Reflectance higher than 0.50.
- Concrete, clay and ceramic tile with a Solar Reflectance higher than 0.10
- A roof that is either all or partially covered by glazing (windows) as long as one is replacing the glazing system with a glazing system.

Cool roofs will require a combination of vapor barrier (vapor retarder of 0.1 perms or less) at the roof deck, 2015 IECC insulation (either above-deck or below-deck), and proper interior ventilation to prevent condensation. Installation of additional layers of roofing on recovers will require the 2015 IECC insulation (R-30) above the roof deck or interior ventilation plus a vapor barrier at the roof deck if the 2015 IECC insulation requirement is met below the roof deck. Modifications to interior ventilation/insulation may be limited to a reasonable percentage of the roof replacement cost low SRI roofs would be allowed where modifications weren't feasible.

Additional details may be added and small adjustments may be made to these standards through the ordinance drafting process and the City gets further input from the roofing community. The City will work

on a draft and then get input on that draft from all roofers who want to review the draft. Email Katrina Managan by July 6th to request to review the draft, katrina.managan@denvergov.org.

No cool roof would be required if the roof is a character defining architectural feature. A character defining architectural feature as it relates to a building's roof, must be a roof structure that is visible from a person of average height in a public vantage point such as a city park, public street, campus grounds, or a private street with a public access easement. Character defining elements include the roof's relationship to the overall shape of the building, as well as the roof's distinctive materials, craftsmanship, and/or decorative details that is important to the overall visual character of the building. If the materials, color or shape of the roof were to change, it would impact the visual character of the building.

Financial Contribution to Off-site Green Space, or Fee-in-lieu

Financial contributions for off-site green space should be placed in a special revenue fund to be managed by the Denver Department of Public Health and Environment. In order to charge a fee-in-lieu for required green space on the ground, this fee must be rationally related to the overall cost of providing required green space on the ground. The City will conduct a rate study to determine this cost.

The task force recommends that new buildings pay a fee-in-lieu of \$25 per square foot, and existing buildings pay a fee-in-lieu of \$17 per square foot, while recognizing that adopted rates will need to be informed by a rate study. The task force's goal is to set the dollar amount so that this is a viable compliance option that achieves the benefits of the original ordinance. Any future increases should be done with a formula tying them to an index/value that is measured regularly – such as the price of land in Denver.

The fund must be spent on the following uses and purposes:

- Green space acquisition
- Green space improvement. Improvements may include ecosystem protection and restoration (items such as native plantings, invasive species control).
- Water quality improvements and green infrastructure
- Urban forest protection and expansion
- Creating green roofs in city in partnership with land owners/developers that are excited to utilize the technology
- Low-income and affordable housing customer solar adoption through rooftop or community solar.

The guiding principles on what projects should receive priority are:

- Low income areas that currently have less green space and trees
- Highest impact projects
- Green spaces located near the buildings that paid into the fund where feasible.

Funds will not be spent on administrative costs, but only projects as outlined above. Multiple City departments including, among others, Budget and Management, Public Works and Parks and Recreation staff, will form a selection committee to determine the projects that will utilize the moneis from the special revenue fund. A new citizen committee or board, including members who have paid the fee-in-lieu, will oversee how the funds are spent to the highest extent allowed by the law.

Green Space Trading Program

The City should look into developing a 'Green Space Trading Program'. The idea behind a Green Space Trading Program is that property owners or developers that install extra green space beyond these requirements could receive credits that can be sold for use by the property owner or developer on another project. Property owners or developers who can't meet the green requirements on site could meet the requirements for new or existing buildings through the purchase of green credits. Credits would be issued

and tracked by City staff and will be based on the amount a project exceeds the requirements of the green roof ordinance. The cost to purchase credits would be driven by market demands.

The Green Space Trading Program concept will be evaluated based on the following criteria:

- If the program would result in a significant increase in new green spaces in Denver over and above what the fee in lieu option alone could achieve.
- The costs of developing and running the program (including a plan for how the program would be run and staffing needs initially and over time) vs. the financial savings building owners would see and the non-financial benefits of additional green space for citizens of Denver.
- If there are any better alternative compliance assistance programs that might result in more significant installations of green space as buildings comply with the green building requirements.

Non-Controversial Proposed Changes

While the proposal makes significant changes to the green roofs ordinance that was on the ballot, some of the following tweaks to the green roof requirements in the ordinance will still be needed since green roofs are still one possible compliance pathway. The task force believes the following small tweaks are needed in addition to the more major changes above and that these should not be very controversial.

1. Ensure definitions in the ordinance are consistent with existing zoning and building code definitions. For example, modify the Gross Floor Area (GFA) calculation to not include open area in atriums above first floor (Webb Building example)
2. Remove water re-use/collect from anywhere the ordinance reads collect and reuse as it conflicts with state law.
3. Change Section 10-303 B.6 on 'Fire Safety' to require a vegetation free border zone that is 6 ft around roof penetrations, intersecting walls, parapets, upturns or mechanical equipment that are clad with combustible material. IFC 317.3 requires a 6 ft separation.
4. Remove Section 10-303 A3 because it implies a green roof project that meets the Green Roof Construction Standard would potentially not have to follow Denver Building Code as well. All projects need to follow Denver Building Code.
5. Green Roof Construction Standard Item 11 b – remove the word 'un-irrigated', as IFC requires irrigation.
6. At the request of Denver Fire the following section would be changed. 317.2.1 Rooftop garden or landscaped roof assembly material. Where buildings of Type V, III, IV or II-B construction rooftop gardens or landscaped roof or similar uses or locations shall be of Class A-rated roof system complying with ASTM E-108 or UL 790
7. Remove Planning Board from all items related to reporting out to City Council, recommending changes to green roof construction standard, and the cost per SF to base the fee on. These can be handled by the Technical Advisory Group and staff.
8. If variance applications are still needed then change Planning Board to Board of Appeals for variance requests.
 - a. The current proposal may have enough options that variances aren't needed.
 - b. If we still have variances, then we will need clear criteria for variance decisions – both at staff level and at Board of Appeals
9. Edit the green roof construction standard to allow new green roof technology that meets the water detention standards for the green roof compliance pathway.
10. Rename Green Roof Technical Advisory Group in Sec. 10-305 to the Green Building Technical Advisory Group. Make the group 13 seats instead of 10. Have staff call the meetings of the group, not the Planning Board.

Membership in the GBTA shall be representative of various sectors including the following:

(add) (g) Renewable energy industry sector being individuals working in the commercial solar industry.

(add) (h) Energy Efficiency industry sector being individuals working in the energy efficiency industry. [assuming committee recommends EE compliance measures]

(add) (i) Water quality / capture requirements expert

Staffing and Resource Needs for Successful Implementation

The task force recommends the City resources this program at a sufficient level to enable successful implementation and robust support for building owners and managers navigating the new law. The following are initial anticipated staffing and resource needs in each department for the City to successfully implement the proposal:

Community Planning and Development:

1 FTE Engineer/Architect Specialist – A green roof/green building expert

1 FTE Operations Assistant – To help staff the green roof technical advisory group

1 FTE Permit Review Technician – To review roofing permit applications.

1 FTE Project Manager I

Department of Public Health and Environment:

2 FTEs to implement the Energy Program, energy master plan review and to manage the new special revenue fund.

~\$60,000 in contractor support each year, to help building owners comply with the Energy Program.

Public Works :

1 limited staff position or consultant funding to study the Green Spaces Trading Program idea.